

audio research

H I G H D E F I N I T I O N[®]

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SP4, SP4A MANUAL
SP4, SP4A SCHEMATIC
AND PARTS LIST

August 1977

INTRODUCTION

Congratulations on your purchase. The SP-4 stereo preamplifier was conceived and designed for audio perfectionists. "Analog Module" circuitry provides unequalled performance under actual dynamic listening conditions.

In addition to the normal complement of features, the SP-4 has: provisions for an optional (*) low level head amp, alternate compensation of magnetic (mag 2) phono section, 1600 watt relay controlled power outlets, main output "turn-on" delay, high quality anodized aluminum panels, knobs, and handles, and a scuff-resistant chassis finish. Conservative design and extensive use of high quality industrial grade components insure many years of trouble-free performance.

WARRANTY

A limited 90-Day Warranty (from the date of purchase by the original purchaser) is provided by Audio Research Corporation. This warranty is subject to the conditions and limitations stated within the documents attached to the outer shipping carton.

LIMITED 3-YEAR WARRANTY

A 3-Year Limited Warranty Application is included with the documents attached to the outer shipping carton.

THIS LIMITED 3-YEAR WARRANTY WILL NOT BE ISSUED OR EFFECTIVE UNLESS WITHIN THIRTY DAYS AFTER THE DATE OF SALE THE PURCHASER MAILS TO AUDIO RESEARCH A LIMITED 3-YEAR WARRANTY APPLICATION FORM WHICH HAS BEEN COMPLETED, DATED AND SIGNED BY BOTH THE SELLING DEALER AND THE PURCHASER AND A COPY OF THE BILL OF SALE OR OTHER PROOF OF PURCHASE OF THE PRODUCT.

WARNING - FAILURE TO COMPLY WITH THE ABOVE CONDITIONS WILL RESULT IN THE WARRANTY BEING RESTRICTED TO THE LIMITED 90-DAY WARRANTY.

PACKAGING

Save All The Packaging - Your Audio Research component is a precision electronic instrument and should be properly cartoned any time shipment is made. You may never have occasion to return it to the factory for service, but if such should be necessary, or other occasion to ship it occurs, the original packaging may save your investment from unnecessary damage or delay.

ACCESSORIES

The following optional (*) accessories for your SP-4 preamplifier will be made available through your Audio Research dealer:

- * Walnut veneered oiled finish cabinet
- * Programable low level head amp electronics

LINE VOLTAGE CONVERSION

This equipment can be operated from either 120 Volts or 240 Volts A.C., 50/60 Hz. Check the position of the line voltage selector switch on the rear panel. If necessary, remove the switch safety cover and set the switch to the proper voltage as indicated below the switch. Secure the switch position with the safety cover and screws with the word "fuse" showing. Install the appropriate fuse as indicated below if the line voltage is different than that set for at the factory.

Voltage	Fuse
120	1/4 Amp. Type 3AG or MDL Slo-Blo
240	1/8 Amp. Type 3AG or MDL Slo-Blo

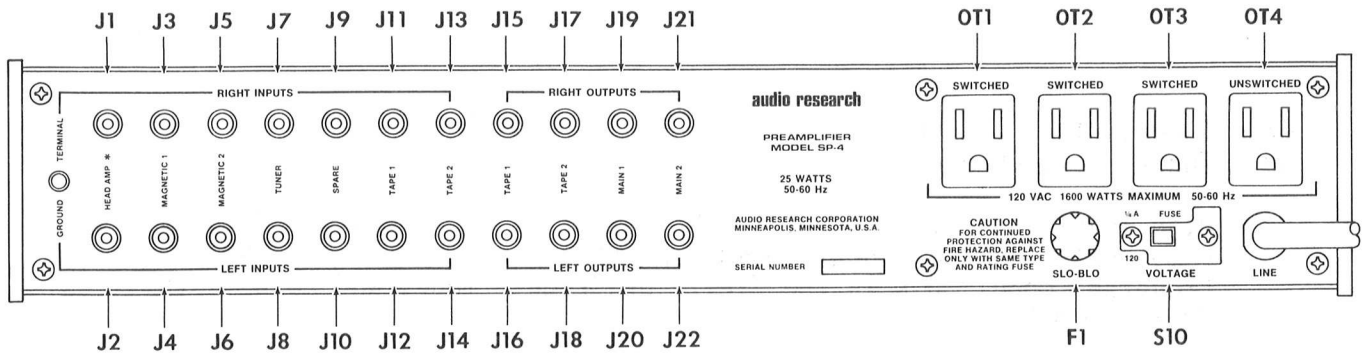
WARNING

To prevent fire or shock hazard, do not expose this equipment to rain or moisture.

This unit contains voltages which may be lethal. Do not operate this unit with covers removed. Refer servicing to qualified personnel.

CAUTION

For continued protection against fire hazard, replace only with same type and rating fuse.



REAR PANEL LAYOUT

REAR PANEL FUNCTIONS

Refer to the "Rear Panel Layout" diagram above.

Audio Inputs:

- J1 - Head Amp * (optional), Right Channel
- J2 - Head Amp * (optional), Left Channel

Provision for "optional" Head Amp electronics have been made within the SP-4 directly behind the Head Amp input connectors. These input and associated electronics will be required only for low output moving coil transducers. Consult your dealer for information and use of this special input feature. These inputs are not connected internally at the factory and are not used in systems employing moderate or high output moving coil magnetic cartridges.

- J3 - Magnetic 1, Right Channel
- J4 - Magnetic 1, Left Channel

Connect to tone arm/cartridge on record player. Nominal input impedance is 50 K ohms (200 PF shunt). Use with magnetic type cartridges requiring RIAA playback compensation. Note: Normally connect grounding wire from record player or arm to the "Ground Terminal" screw located next to and between J1 and J2. With certain systems this may add hum in which case no ground wire is required.

- J5 - Magnetic 2, Right Channel
- J6 - Magnetic 2, Left Channel

Same as above. Allows use of a second record player when selected from the front panel.

Note: The input characteristics and gain of the SP-4 have been factory set to accommodate most of the high quality magnetic phono cartridges on the market today. However, the SP-4 low level "mag" sections can be programmed by a technician for different gain, input resistance and capacitance. This feature allows "matching" of various cartridges to the magnetic preamp section for optimum performance. Consult your dealer for further information and use of this special input feature.

- J7 - Tuner, Right Channel
- J8 - Tuner, Left Channel

High level inputs. Connect to the output of an AM and/or FM tuner component. Nominal input impedance is 47 K in the "stereo" or "reverse" mode, 30 K in the "left" or "right" mode, and 20 K in the "mono" mode.

- J9 - Spare, Right Channel
- J10 - Spare, Left Channel

Provides high level inputs for any auxiliary system component. Nominal input impedance is the same as the "tuner" inputs J7 and J8 above.

- J11 - Tape 1, Right Channel
- J12 - Tape 1, Left Channel

High level inputs. Connect to tape recorder line outputs. Nominal input impedance is the same as for the tuner inputs above - shunted by any load(s) connected to the tape outputs when the front panel tape dubbing switch (S4) is in the "copy" position.

- J13 - Tape 2, Right Channel
- J14 - Tape 2, Left Channel

Same as above. Allows use of a second tape recorder when selected from the front panel.

Audio Outputs:

- J15 - Tape 1, Right Channel
- J16 - Tape 1, Left Channel

Connect to tape recorder line inputs. Provides a program source for tape recording. Output signal is independent of "volume" control setting and equal to the source input level, i.e. "tuner", "spare", "tape 1", "tape 2", or magnetic phono preamplifier output. Nominal output impedance is 50 ohms plus the output impedance of the selected source. In general, the load impedance should be greater than 20 K for optimum performance.

- J17 - Tape 2, Right Channel
- J18 - Tape 2, Left Channel

Connect to the line inputs of a second tape recorder when used. Function and characteristics are same as above.

- J19 - Main 1, Right Channel
- J20 - Main 1, Left Channel

Connect to power amplifier (or electronic crossover) inputs. Nominal output impedance is 50 ohms. In general, the load impedance should be greater than 10 K for optimum performance. The outputs are AC coupled through a 5 MF capacitor.

- J21 - Main 2, Right Channel
- J22 - Main 2, Left Channel

Same as (in parallel with) outputs above. Used to drive a second power amplifier. Combined load impedance of Main 1 and Main 2 should be 10 K minimum for optimum performance.

Power Circuits:

- OT1 - Switched AC Convenience Outlet
- OT2 - Switched AC Convenience Outlet
- OT3 - Switched AC Convenience Outlet

Connect to system components (power amplifier(s), tuner(s), electronic crossover, etc.) that are to be turned on by the front panel power switch (S1). Will accept 2 or 3 prong line plugs. Outlets are switched by an internal power relay. Capacity is 1600 watts total including the unswitched outlet (OT4). The outlets are not fuse protected.

Note: An internal .01 MF/1600 V capacitor is connected (for arc suppression) across the internal power relay contacts. If an Audio Research RPR-1 (Remote Power Receptacle) is used in the system to remotely turn on the power amplifier(s), the .01 MF capacitor must be removed. The small 60 Hz current passed by the capacitor is sufficient to turn-on the RPR-1 transmitter electronics continuously even with the SP-4 power switch (S1) off.

Since relay contact arcing is not a problem when using the RPR-1 (power amplifiers are instead connected to the RPR-1 outlets), this capacitor can be safely removed. To accomplish this, remove the SP-4 top cover and 8 holding screws. CAUTION: UNPLUG SP-4 POWER CORD BEFORE REMOVING TOP COVER AND CAPACITOR. Locate the .01 MF/1600 V capacitor nested between the power relay contacts - towards the rear panel next to the power transformer. Clip the leads off close to the solder joints, remove the capacitor, and replace the top cover. The SP-4 is now ready for use with an RPR-1.

OT4 - Unswitched AC Convenience Outlet

Connect to record player, turntable, or tape recorder where power should be controlled by the component on-off switch only. This ensures proper "cycling" and mechanism disengagement.

Note: The "grounding" type convenience outlets are provided to accommodate power amplifiers with 3 prong (grounded) line plugs. To avoid "system" ground loops, the ground circuits of the rear panel outlets are connected to the ground conductor of the SP-4 line cord only. The preamplifier chassis is not connected to the convenience outlet or line cord/plug ground circuit.

F1 - Preamplifier Line Fuse Receptacle

Provides protection for preamplifier electronics only. Refer to page 2 for fuse replacement information.

S10 - Line Voltage Selector Switch

Selects for 120 or 240 volt input power. Refer to page 2 for "Line Voltage Conversion" procedure.

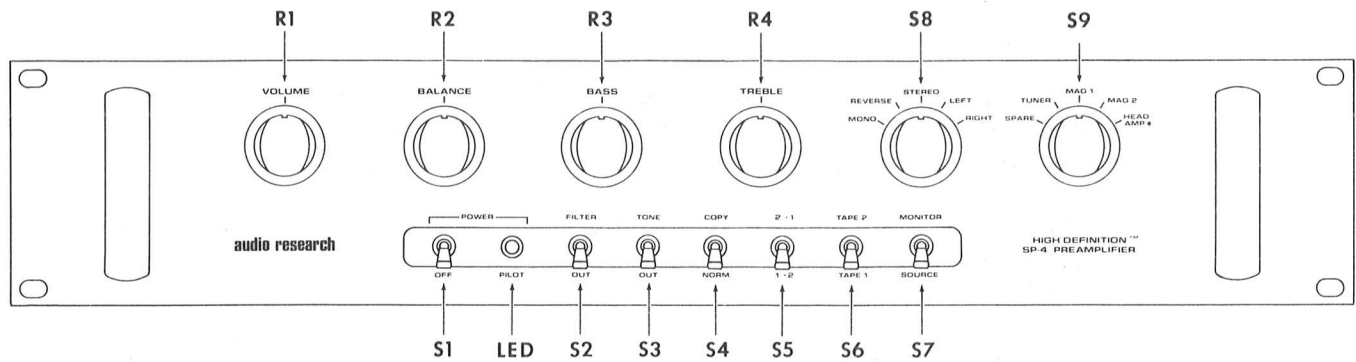
SYSTEM CONNECTION

Before connecting the SP-4 into your system, familiarize yourself with the rear panel functions by referring to the diagram and description of the rear panel in the previous section.

Use only high quality shielded phono cables when interconnecting the SP-4 with any signal sources, power amplifiers, or electronic crossovers. Avoid inexpensive cables which use "weak" or soft metal grounding shells as they may introduce hum and/or noise into the system. Keep audio cables neatly dressed and away from all power cords for minimum hum and noise interference.

When connecting to the magnetic and tape inputs, use the number "1" connectors if a single turntable and/or tape deck is employed. This will result in easier and more convenient front panel control switching.

It should be noted that the SP-4 line cord grounds the convenience outlet grounds only. The preamplifier chassis is not connected to the line cord ground in order to minimize system ground loops.



FRONT PANEL LAYOUT

FRONT PANEL FUNCTIONS

Refer to the "Front Panel Layout" diagram above.

Rotary Controls:

- Volume (R1) - Controls preamplifier "main output" level. Power amplifier or source gain controls (if available) should be set such that normal listening levels occur at approximately a 1 or 2 o'clock setting. This will provide ideal volume control "range".
- Balance (R2)- Controls the relative volume of each channel. Equal channel volume occurs when the control is centered at the indicator mark. Clockwise rotation from center position increases right channel "main output" level while decreasing left channel output. Counter-clockwise rotation increases left channel output and decreases right channel output.
- Bass (R3) - Bass tone control circuitry is activated when switch (S3) is moved to the "tone" position. Response is flat when control is centered at indicator mark. Clockwise rotation increases bass response while counter-clockwise rotation decreases response.
- Treble (R4) - Treble tone control circuitry is activated when switch (S3) is moved to the "tone" position. Response is flat when control is centered at indicator mark. Clockwise rotation increases treble response while counter-clockwise rotation decreases response.

Rotary Switches:

- Mode (S8) - Switch selects one of five "main output" modes:
 - "Mono" - Combines the left and right input channels internally to provide a monaural output (common output for both left and right main outputs).
 - "Reverse" - Provides stereophonic operation except channels are reversed, i.e. left input to right output, right input to left output.

"Stereo" - Provides normal stereophonic operation without channel reversal, i.e. left input to left output, right input to right output.

"Left" - Left channel input sources are coupled to both the left and right "main outputs" simultaneously. The "balance" control functions as normal.

"Right" - Same as above except right channel input sources are coupled to both the left and right "main outputs" simultaneously.

Note: The "tape outputs" are unaffected by the position of the "mode" switch.

Source (S9) - Switch selects one of five rear panel inputs (program sources) as marked. The selected source is also switched to the "tape outputs" when switch (S4) is in the "norm" position.

Note: The "Head Amp*" position is not normally used.

Provisions for optional (*) Head Amp electronics have been made within the SP-4 directly behind the Head Amp input connectors. These inputs and associated electronics will be required only for low output moving coil transducers. Consult your dealer for information and use of this special input feature. These inputs are not connected internally at the factory and are not used in systems employing moderate or high output moving coil magnetic cartridges.

Toggle Switches:

Power (S1) - Preamplifier on-off switch. Move handle up for power "on". Also turns on the "switched" rear panel outlets. Green indicator (LED) illuminates when preamplifier is on.

Filter (S2) - Active low frequency (subsonic) filter. Enabled when handle is moved to "filter" position. Switch is normally left in the full range "out" position for optimum response. Use only for removal of excessive low frequency noise (turntable rumble, etc.).

Tone (S3) - Moving handle to "tone" position activates bass and treble tone control circuitry. Unless needed, switch should be left in the "out" position for optimum performance and flat response.

Tape Copy & Monitor Switches (S4, S5, S6, S7)

- S4 - Controls output signal to "tape output" connectors (J15, J16, J17, J18). In the normal "norm" position, the signal source selected by the source switch (S9) is also switched to the tape outputs J15, J16, J17, J18. When two tape recorders are used in the system and tape copying or dubbing is desired, the switch is moved to the "copy" position. This allows you to tape from one deck to another and at the same time to listen to another program source as selected by (S9). When S4 is in the "copy" position, the "tape outputs" are connected to the "tape 1" or "tape 2" inputs as selected by (S5).
- S5 - Used in conjunction with (S4) above. Selects either "tape 1" or "tape 2" inputs and connects them to the tape outputs J15, J16, J17, and J18 when (S4) is in the "copy" position. Position (1→2) connects the outputs of tape recorder #1 to the inputs of tape recorder #2 and position (2→1) connects the outputs of tape recorder #2 to the inputs of tape recorder #1).
- S6 - Used in conjunction with monitor switch (S7) described below. Selects either "tape 1" or "tape 2" inputs for monitoring of tape recordings when (S7) is in the "monitor" position. This switch also functions as a program or tape input selector when using tapes as a program source.
- S7- Allows monitoring of tape recordings or selection of a program (tape) source when used in conjunction with (S6) above and in the "monitor" position. In the "source" position, selector switch (S9) controls the program source allowing selection of all "magnetic", "tuner", or "spare" inputs. Source switch (S9) is bypassed when S7 is in the "monitor" position.

Indicator:

- LED -Green light emitting diode. Illuminates when preamplifier power switch, S1, is "on".

GENERAL OPERATION

Before operating, familiarize yourself with the front panel control functions by referring to the diagram and control description in the previous section. To operate your music system proceed as follows:

1. Set "volume" control at minimum (full counter-clockwise).
2. Turn power switch "on" - green LED indicator should illuminate.

Note: A "main output" delay (5 second nominal) is initiated at power turn-on. This eliminates any warm-up pulses that would otherwise be heard through the speaker system.
3. Turn on desired source (record player, tuner, tape recorder, etc.).
4. Set "source" switch to program source desired, "mode" switch to "stereo"; "bass", "treble", and "balance" controls to a 12 o'clock position, and all six toggle switches to the right of the power switch in a down position.
5. Turn "volume" control up to desired listening level.
6. Push "filter" switch up to activate low frequency filter if needed. This attenuates any low frequency noises such as turntable "rumble", etc. Switch should be left in the "out" position for optimum wide range response.
7. Push "tone" switch up to activate "bass" and "treble" controls. Leave "tone" switch down for optimum performance and flattest response.
8. The tape copy and monitor switches (four right hand toggle switches) allow complete recording and playback control of one or two recorders. The normal position for all four switches is down when a tape recorder(s) is not in use.
9. Refer to the previous section for a detailed description and operation of the front panel controls.

SYSTEM DIAGNOSTICS

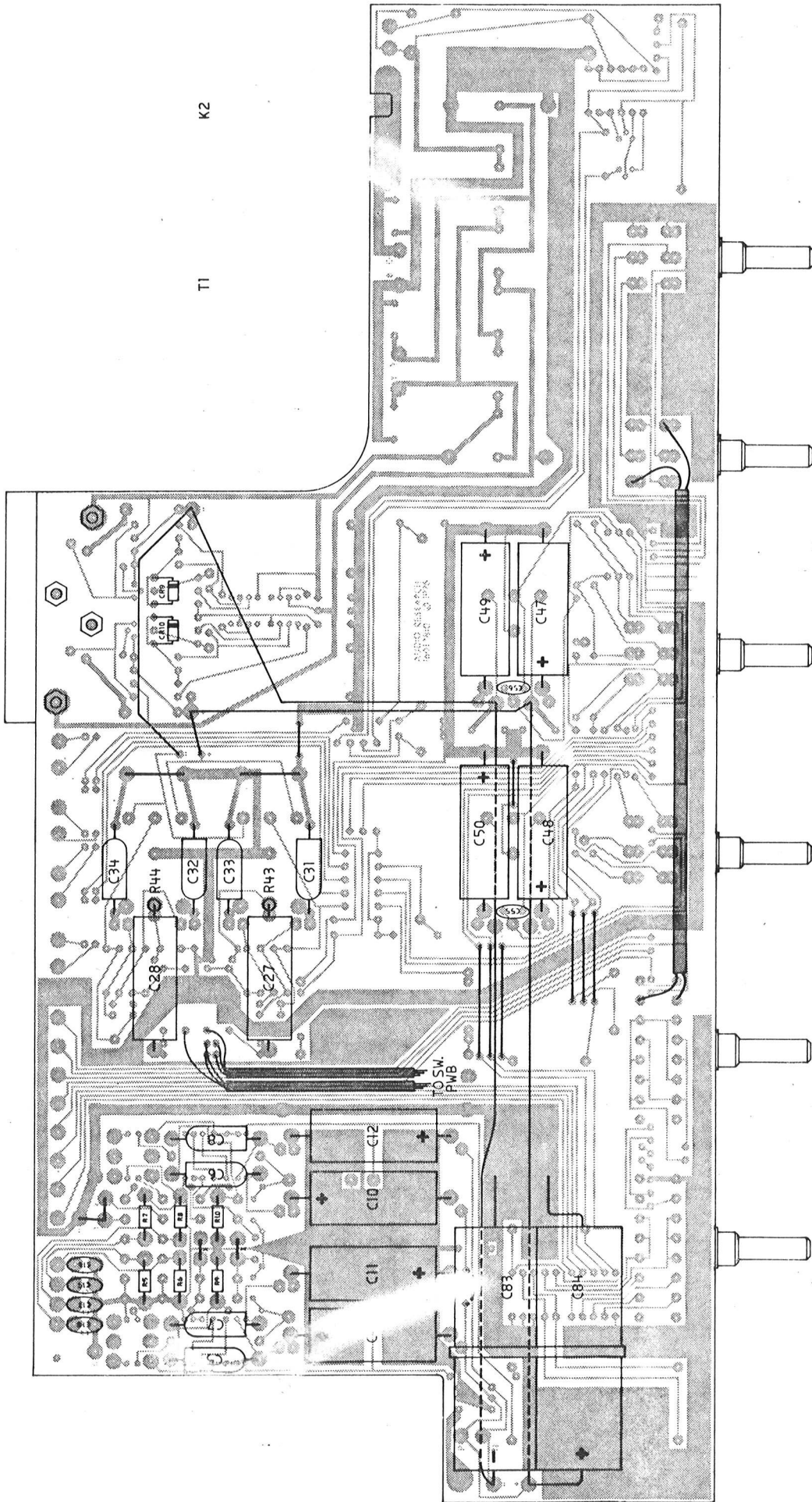
In case of difficulty after connecting the SP-4 into your system, a list of common system problems and possible causes is provided below to aid in troubleshooting:

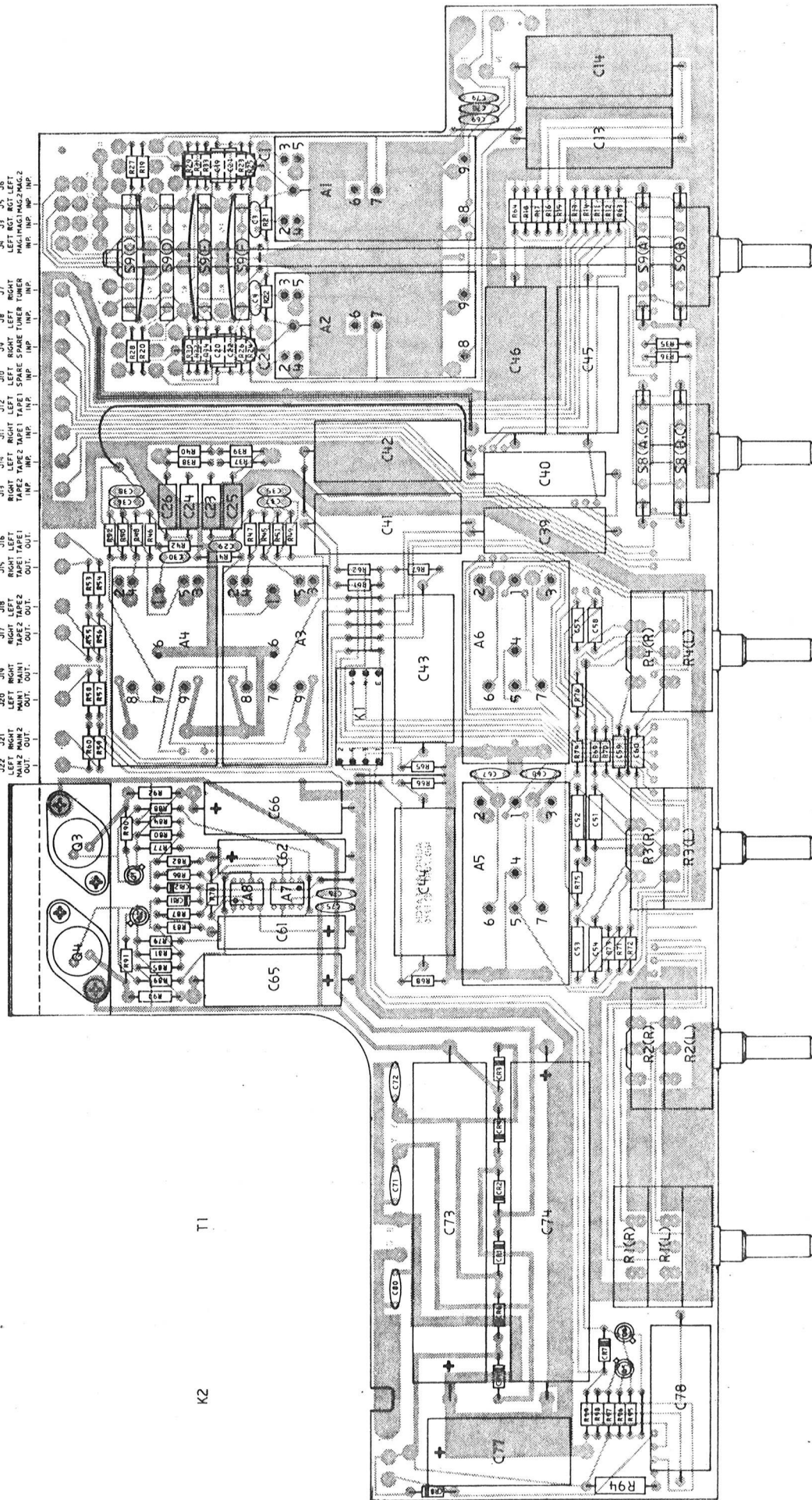
<u>Symptom</u>	<u>Possible Cause</u>
Both channels dead	<ul style="list-style-type: none">- Power amplifier off- Controls improperly set- Improper interconnect wiring- Defective signal source- Blown power amplifier fuse- Blown SP-4 fuse
One channel dead	<ul style="list-style-type: none">- Balance control not centered- Defective audio cable- Improper interconnect wiring- Defective signal source
Hum or noise	<ul style="list-style-type: none">- System ground loop- Turntable not grounded- Poor interconnect wiring- Defective audio cable- Excessive lead length- Defective signal source
High distortion	<ul style="list-style-type: none">- Low AC line voltage- Loudspeaker-Turntable mechanical feedback- Defective cartridge or source

FACTORY SERVICE

In the event that service becomes necessary, the SP-4 must be returned to the factory with return authorization. Please write or call Customer Service at Audio Research for return authorization. The original equipment packaging should be used any time shipment is made.

All shipments to the factory must be prepaid and insured for full value. All factory serviced equipment will be returned freight collect. In the event that chargeable repairs are required, you will be contacted prior to the return of your equipment.





- U22 U21 LEFT MAIN2 MAIN2 OUT. OUT.
- U20 U20 RIGHT MAIN1 MAIN1 OUT. OUT.
- U19 U19 RIGHT TARE2 TARE2 OUT. OUT.
- U18 U18 LEFT TARE1 TARE1 OUT. OUT.
- U17 U17 RIGHT TARE1 TARE1 OUT. OUT.
- U16 U16 LEFT TARE2 TARE2 OUT. OUT.
- U15 U15 RIGHT TARE2 TARE2 OUT. OUT.
- U14 U14 LEFT TARE1 TARE1 OUT. OUT.
- U13 U13 RIGHT TARE1 TARE1 OUT. OUT.
- U12 U12 LEFT TARE2 TARE2 OUT. OUT.
- U11 U11 RIGHT TARE2 TARE2 OUT. OUT.
- U10 U10 LEFT SPARE SPARE INP. INP.
- U9 U9 LEFT SPARE SPARE INP. INP.
- U8 U8 RIGHT SPARE SPARE INP. INP.
- U7 U7 LEFT SPARE SPARE INP. INP.
- U6 U6 RIGHT SPARE SPARE INP. INP.
- U5 U5 LEFT MAG/MAG2/MAG2 INP. INP.
- U4 U4 RIGHT MAG/MAG2/MAG2 INP. INP.

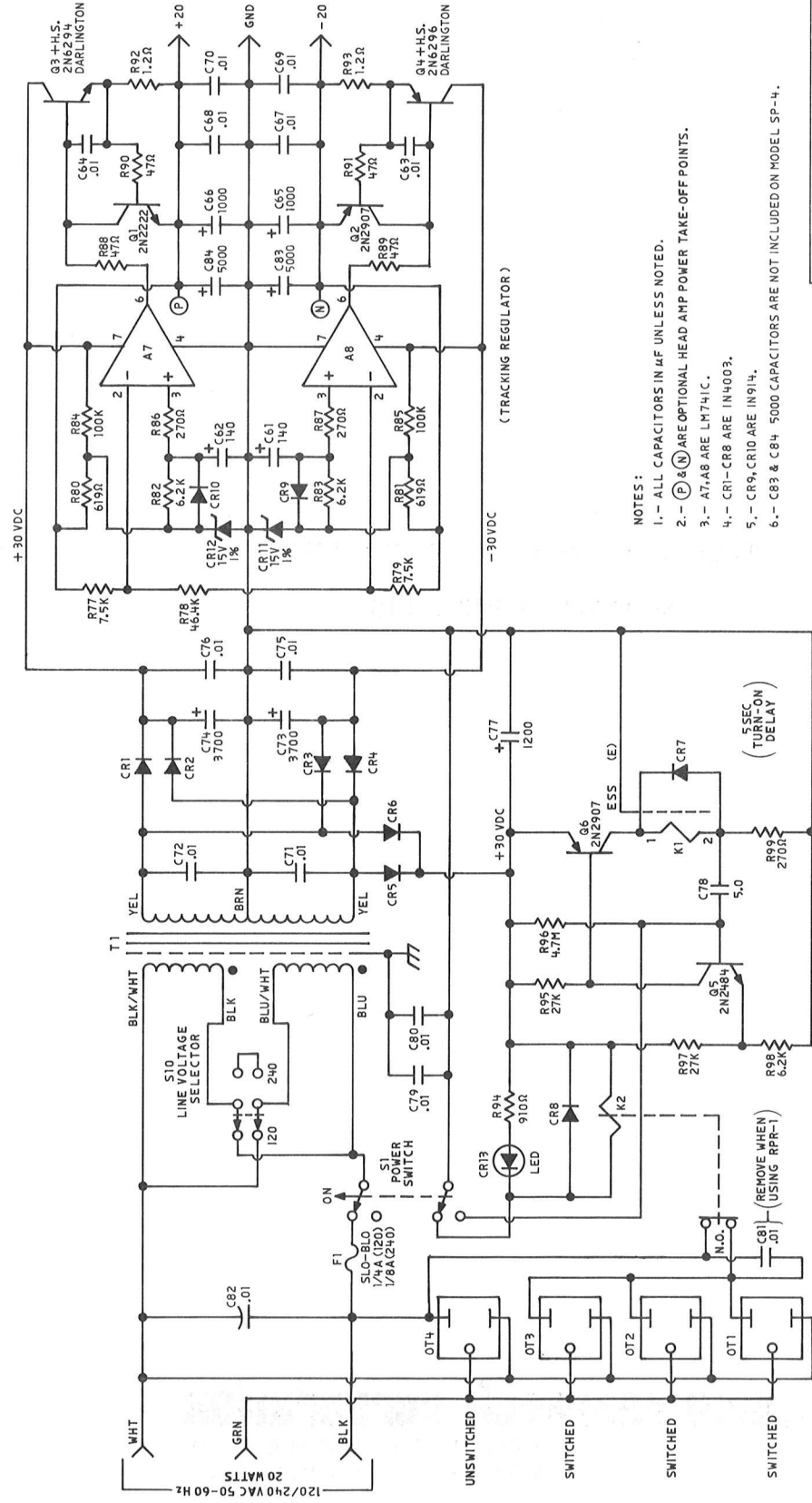
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NOTES

MODEL SP-4 AND SP-4A PREAMPLIFIER
SCHEMATIC & PARTS LIST

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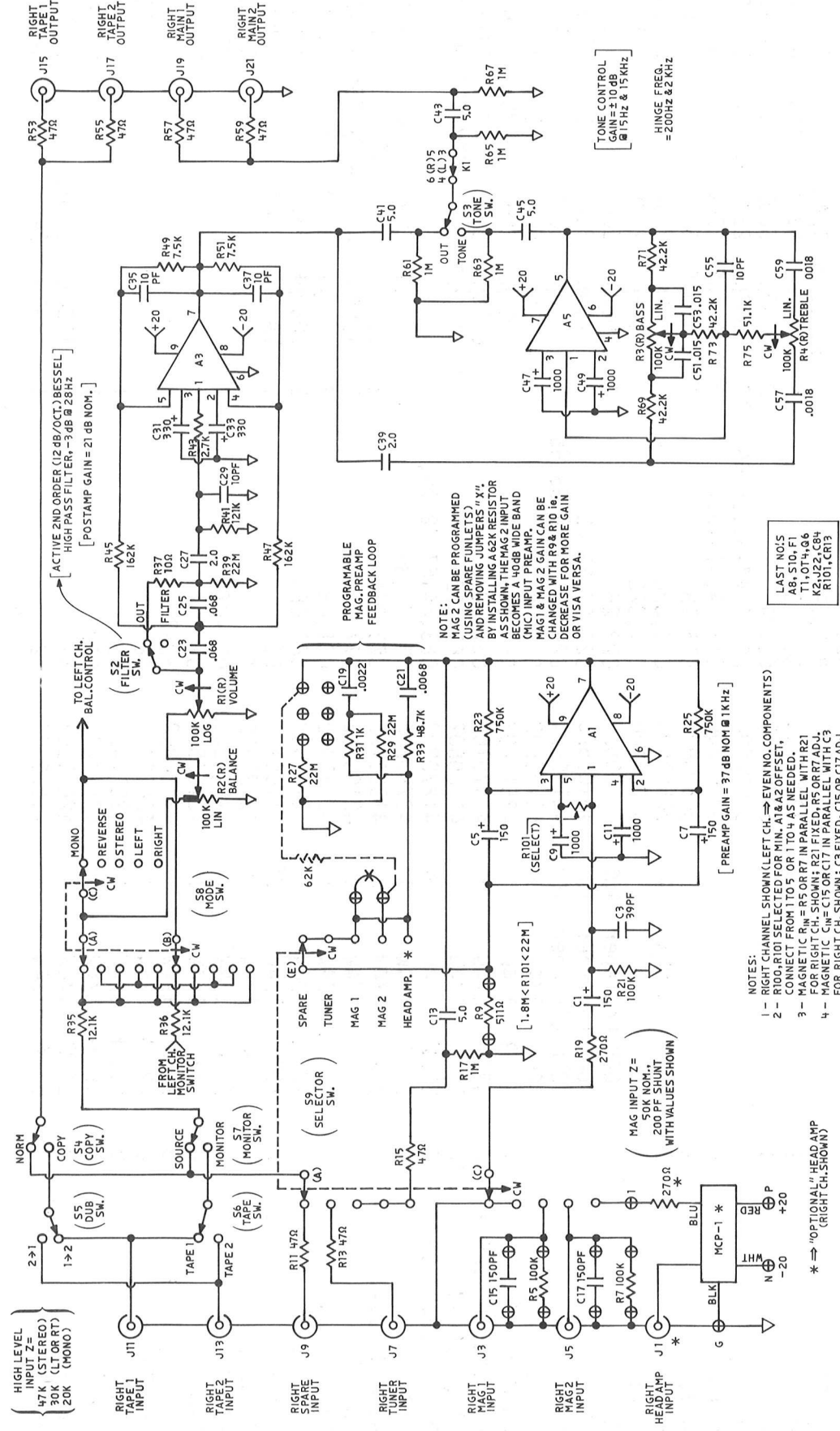
2843 TWENTY-SIXTH AVENUE SOUTH
MINNEAPOLIS, MINNESOTA 55406



- NOTES:
- 1.- ALL CAPACITORS IN μ F UNLESS NOTED.
 - 2.- (P) & (N) ARE OPTIONAL HEAD AMP POWER TAKE-OFF POINTS.
 - 3.- A7, A8 ARE LM741C.
 - 4.- CR1-CR8 ARE IN4003.
 - 5.- CR9, CR10 ARE IN514.
 - 6.- C83 & C84 5000 CAPACITORS ARE NOT INCLUDED ON MODEL SP-4.

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FRAGMENTAL	APPROVED BY
ANGULAR	TITLE SCHEMATIC SP-4 AND SP-4A POWER SUPPLY
	DATE 8-1-77 DRAWING NUMBER
	910040-10 A



NOTE:
 MAG 2 CAN BE PROGRAMMED
 (USING SPARE JUMPTERS "X"
 AND REMOVING JUMPTERS "Y"
 BY INSTALLING A 62K RESISTOR
 AS SHOWN, THE MAG 2 INPUT
 CMIC INPUT PREAMP. BAND
 MAG 1 & MAG 2 GAIN CAN BE
 CHANGED WITH R94 & R101b,
 DECREASE WITH MORE GAIN
 OR VISA VERSA.

- NOTES:
- 1 - RIGHT CHANNEL SHOWN LEFT CH. \Rightarrow EVEN NO. COMPONENTS)
 - 2 - R100, R101 SELECTED FOR MIN. A1 & A2 OFFSET.
 - 3 - CONNECT FROM 5 OR 110 \Rightarrow AS NEEDED.
 - 4 - MAG 2 INPUT CMIC INPUT PREAMP. BAND FOR RIGHT CH. SHOWN; R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, 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TOLERANCES (EXCEPT AS NOTED)	AUDIO RESEARCH CORPORATION MINNEAPOLIS, MINNESOTA
ORIGINAL	SCALE DRAWN BY S. C.
FRAGMENTAL	APPROVED BY
ANGULAR	TITLE SCHEMATIC SP-4 AND SP-4A CIRCUITRY
	DATE 8-1-77 DRAWING NUMBER
	910041-10 A

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SP4A PARTS LIST

COMPONENT	QUAN.	VALUE	RATING	TOL.	ARC PART NO.	COMPONENT	QUAN.	VALUE	RATING	TOL.	ARC PART NO.
A1,A2	2				AM-6	R84,R85	2	100K	1/4W	5%	41100502
A3,A4	2				AM-5	R92,R93	2	1.2 Ω	1/2W	5%	41120003
A5,A6	2				AM-4	R94	1	910 Ω	1W	5%	41910204
A7,A8	2				31000400	R95,R97	2	27K	1/4W	5%	41270402
Q1	1				30000700	R96	1	4.7M	1/4W	5%	41470602
Q2,Q6	2				30000800	R100,R101	2	Selected	1/4W	5%	41XXXX02
Q3	1				30002200	C1,2,5-8	6	150 μF	6V	10%	51150801
Q4	1				30002300	C3,C4	2	39pF	500V	5%	57390100
Q5	1				30000600	C9-12,47-50,65,66	10	1000 μF	25V	-10/+75%	50100903
CR1-8	8				30501700	C13,14,41-46,78	9	5.0 μF	200V	10%	53500601
CR9,CR10	2				30500900	C15-18	4	150pF	500V	5%	57150201
CR11,CR12	2	15V	500MW	1%	30501800	C19,C20	2	.0022 μF	200V	2%	53220301
CR13	1				34300100	C21,C22	2	.0068 μF	200V	2%	53680301
R1	1	100K	LogTaper	10%	45100520	C23-26	4	.068 μF	200V	2%	53680401
R2	1	100K	LinTaper	10%	45100525	C27,28,39,40	4	2.0 μF	200V	10%	53200601
R3,R4	2	100K	LinTaper	10%	45100524	C29,30,35-38,55,56	8	10pF	500V	5%	57100100
R5-8,21,22	6	100K	1/4W	1%	42100502	C31-34	4	300 μF	6V	10%	51330800
R9,R10	2	511 Ω	1/4W	1%	42511202	C51-54	4	.015 μF	200V	2%	53150402
R11-16,53-60,88-91	18	47 Ω	1/4W	5%	41470102	C57-60	4	.0018 μF	200V	2%	53180301
R17,18,61-68	10	1M	1/4W	5%	41100602	C61,C62	2	140 μF	40V	-10/+75%	50140801
R19,20,86,87,99	5	270 Ω	1/4W	5%	41270202	C63,64,67-72,75,	12	.01 μF	500V	20%	52100402
R23-26	4	750K	1/4W	1%	42750502	76,79,80	2	3700 μF	40V	-10/+75%	50370901
R27-30,39,40	6	22M	1/4W	5%	41220702	C73,C74	1	1200 μF	40V	-10/+75%	50120901
R31,R32	2	1K	1/4W	1%	42100302	C77	2	.01 μF	1600V	10%	53100403
R33,R34	2	48.7K	1/4W	1%	42487402	C81,C82	2	5000 μF	25V		50500900
R35,R36	2	12.1K	1/4W	1%	42121402	C83,C84	2	½A S.B.	250V		34500100
R37,R38	2	10 Ω	1/4W	5%	41100102	F1	1				60003201
R41,R42	2	121K	1/4W	1%	42121502	T1	1				23200500
R43,R44	2	2.7K	1/2W	5%	41270303	OT1-OT4	4				24100700
R45-48	4	162K	1/4W	1%	42162502	S1	1				24100400
R49-52,77,79	6	7.5K	1/4W	1%	42750302	S2-7	6				24000700
R69-74	6	42.2K	1/4W	1%	42422402	S8	1				24000800
R75,R76	2	51.1K	1/4W	1%	42511402	S9	1				24100600
R78	1	46.4K	1/4W	1%	42464402	S10	1				64100200
R80,R81	2	619 Ω	1/4W	1%	42619202	K1	1	1750 Ω	24VDC		64100300
R82,83,98	3	6.2K	1/4W	5%	41620302	K2	1	290 Ω	24VDC		23201000
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