

ALESIS
RA100 Amplifier
(PA)
Service Manual

P/N: 8-31-0020-A

Preface

This document is intended to assist the service technician in the operation, maintenance and repair of the Alesis device. Together with the User Reference Manual, this document provides a complete description of the functionality and serviceability of the Device. Any comments or suggestions you may have pertaining to the document are welcome and encouraged.

READ THIS!

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Warnings

TO REDUCE THE RISK OF ELECTRIC SHOCK OR FIRE, DO NOT EXPOSE THIS PRODUCT TO WATER OR MOISTURE.



The arrowhead symbol on a lightning flash inside a triangle is intended to alert the user to the presence of un-insulated "dangerous voltage" within the enclosed product which may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point inside a triangle is intended to alert the user to the presence of important operating, maintenance and servicing instructions in the literature which accompanies the product.

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Regarding the Power Supply Fuse



CAUTION: The product under service may employ the use of a replaceable fuse. Danger of fire or electrocution if fuse is incorrectly replaced. Replace with only the same type or equivalent type recommended by the equipment manufacturer.

Regarding the Internal Battery



CAUTION: The product under service may employ the use of a internal battery. Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instruction.

Safety Instructions

Carefully read the applicable items of the operating instructions and these safety suggestions before using this product. Use extra care to follow the warnings written on the product itself and in the operating instructions. Keep the operating instructions and safety suggestions for reference in the future.

1. Power Source. The product should only be connected to a power supply which is described either in the operating instructions or in markings on the product.
2. Power Cord Protection. AC power supply cords should be placed such that no one is likely to step on the cords and such that nothing will be placed on or against them.
3. Periods of Non-use. If the product is not used for any significant period of time, the product's AC power supply cord should be unplugged from the AC outlet.
4. Foreign Objects and Liquids. Take care not to allow liquids to spill or objects to fall into any openings of the product.
5. Water or Moisture. The product should not be used near any water or in moisture.
6. Heat. Do not place the product near heat sources such as stoves, heat registers, radiators or other heat producing equipment.
7. Ventilation. When installing the product, make sure that the product has adequate ventilation. Improperly ventilating the product may cause overheating, which may damage the product.
8. Mounting. The product should only be used with a rack which the manufacturer recommends. The combination of the product and rack should be moved carefully. Quick movements, excessive force or uneven surfaces may overturn the combination which may damage the product and rack combination.
9. Cleaning. The product should only be cleaned as the manufacturer recommends.
10. Service. The user should only attempt the limited service or upkeep specifically described in the operating instructions for the user. For any other service required, the product should be taken to an authorized service center as described in the operating instructions.
11. Damage to the Product. Qualified service personnel should service the unit in certain situations including without limitation when:
 - a. Liquid has spilled or objects have fallen into the product,
 - b. The product is exposed to water or excessive moisture,
 - c. The AC power supply plug or cord is damaged,
 - d. The product shows an inappropriate change in performance or does not operate normally, or
 - e. The enclosure of the product has been damaged.

The input signal drives QX15 (one half of a diff amp pair; consisting of transistors QX15 and QX16). QX16 is driven by a feedback signal from the output section through a 39K resistor (RX30). This 39K resistor is used to match the impedance seen at the base of QX15 so that the voltage at the base of both transistors is approximately 0.1V. This insures consistent operation of the input diff amp.

The output of the first diff amp is used to drive a second diff amp pair (QX12 and QX13) where the actual gain of the amplifier is set up. This is done with a V_{be} multiplier (QX04) connected to the second diff amp pair that can be used to adjust the amount of current that the output section will deliver to the load (more about this in section XX).

The output of the second diff amp pair drives the output stage that consists of two pairs of driver and power transistors (QX05/QX07 and QX01/QX03). This stage of the circuit is where the current to the output is amplified.

The input diff amp (QX15 and QX16) is protected from high input voltages with a limiter made up of two diodes (DX08 and DX09) connected in parallel (with reverse polarities) directly across the bases of both transistors. This limiter is used to keep the input voltages at or below 0.7V.

The mute fast supply circuit is also connected into the input stage to eliminate any voltage surges that could be caused during power up or power down that could damage circuit components or speakers. This circuit consists of a JFET (QX11) connected across the supply storage capacitor (CX08) for the input diff amp and an RC time constant that charges the gate of the JFET. As the unit is powered up, the JFET acts like a 30Ω resistor short to ground around the supply storage cap until a -10V supply from the units power supply is applied to the gate of the JFET through the RC time constant (RX43 and CX09). Once CX09 is charged and applied to the gate, the JFET turns off and allows CX08 to charge and supply voltage for the input stage. As the unit is powered down, CX09 quickly discharges through DX13 and C4 turning the JFET back on and shorting any leftover supply voltage to ground immediately.

The thermal shutdown circuit is also connected into the input stage. This circuit is similar to the mute fast supply in that a transistor (QX10) is connected across the supply storage capacitor to the input stage and, when turned on, shorts the supply voltage to ground. The biasing voltage for QX10 is determined by a transistor (QX09 -placed in the heat sink) in parallel with a voltage divider at the base of QX10. The base of QX09 is left open so that it acts like a zener diode and can drop about 7.7V across it. This voltage is applied to RX39 and RX40 and keeps about 0.48V at the base of QX10. As temperature increases in the heat sink, the voltage across QX09 begins to increase, causing a larger voltage to be seen at the base of QX10. As this voltage increases, QX10 begins to turn on and short some of the supply voltage to the input stage to ground. This causes a reduction in output current and allows the unit to cool down.

The first stage drives a second diff amp pair that is used to drive the output stage. This is where the clip indicator is connected.

As QX12 and QX13 are being turned on and off, there is a constant current being delivered through RX27. This current sets up a voltage drop of about 0.45V that is seen at the base of QX14. Any sharp increase in current through QX12 or QX13 will cause a voltage peak at the base of QX14 and turn it on. When QX14 is turned on, DX11 becomes forward biased and allows CX16 to discharge through RX42 and turns off QX18. The LED is no longer forward biased and turns off.

The outputs of QX12 and QX13 are connected to a V_{be} multiplier where the current gain of the output stage can be adjusted. This output is used to drive the output stage.

The base current of QX04 is set up by a current mirror and can be adjusted with RX08. Since the voltage across RX08 and RX09 remains constant at 0.7V, adjusting RX08 will determine the amount of current that flows through RX10 which in turn determines the output voltage of the V_{be} multiplier ($V_{R20} + 0.7V$) that drives the output section. This V_{be} voltage drop is what determines the amount of current that can flow through QX01 and QX07 by setting the base currents to QX03 and QX05. This adjustment should be made with the amp powered up at room temperature and the outputs unloaded. With these conditions satisfied, RX08 should be adjusted until the voltage drop across RX18 and RX02 together is about 2.5mV.

As QX13 turns on, the emitter of QX17 gets pulled down to -0.7V which turns it on and allows more current to flow through RX33. This decreases the voltage at the base of QX08 which turns it on faster and decreases the voltage drop across it. This in turn pulls the output voltage drop across the V_{be} multiplier up towards the positive rail and turns on QX05.

When QX12 is turned on, the same thing in that the V_{be} multiplier output is pulled down toward the negative rail and turns on QX03.

QX05/QX07 and QX01/QX03 make up the output sections of the amplifier. They are set up as current amplifiers that deliver large amounts of current to the load.

When QX05 is turned on, 7mA of current flows through RX19 and QX05. This brings the voltage at the base of QX07 to 0.7V below the positive rail and turns it on. This allows a large amount of current to flow through RX18 and RX44 to the load (approximately 5.3 amps for a 4Ω load) and the voltage drop across RX02 decreases.

When QX01 and QX03 are turned on, current is pulled back through RX44 and RX02 which increases the voltage drop across RX02.

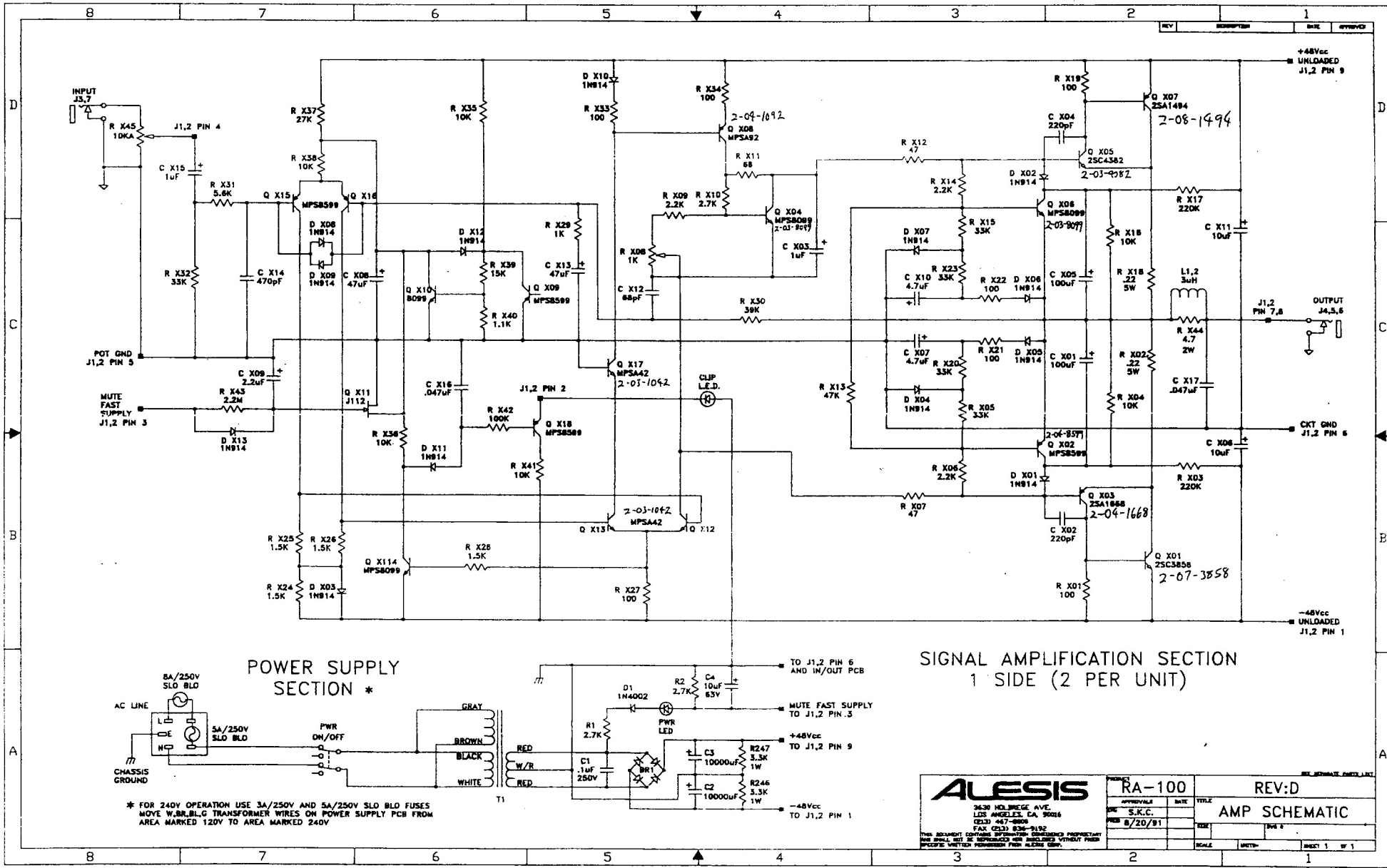
This whole process is seen as large voltage swings at the output that follow the input signal.

L1 is placed in parallel with RX44 so that when the unit is first powered up, any large current transients are forced through RX44. This decreases power to the speakers until the unit reaches steady state operation, at which point the

inductor then acts like a short around RX44. This protects the speakers from being damaged if the unit is on with the volume controls turned up.

**ALESIS
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**SCHEMATIC
AND
PCB
FILES**



POWER SUPPLY SECTION *

SIGNAL AMPLIFICATION SECTION
1 SIDE (2 PER UNIT)

* FOR 240V OPERATION USE 3A/250V AND 5A/250V SLO BLD FUSES
MOVE W,BR,BLG TRANSFORMER WIRES ON POWER SUPPLY PCB FROM
AREA MARKED 120V TO AREA MARKED 240V

ALESIS		REV:D	
3430 HOLLYWOOD AVE. LOS ANGELES, CA. 90016 (213) 467-8808 FAX (213) 836-9192		AMP SKECH	
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BOM

GROUP	DESCRIPTION	ALPARTNO	QTYPER	POSITION	PCB	MANUFACT	NOTES
ASS	AMP MODULE W \ HEATSINK	8-20-0028		REPLACEMENT ASSEMBLY			
CAP	100 MF ELEC 6.3V 6x11mm	1-07-0100	4	C101,105,201,205	AMP		6x11mm/0.1
CAP	47 MF ELEC 25V 6x11mm	1-09-0476	4	C108,113,208,213	AMP		6x11mm/0.1
CAP	1.0 MF ELEC 50V 5x11mm	1-11-0105	4	C103,115,203,215	AMP		5x11mm/0.1
CAP	2.2 MF ELEC 50V 5x11mm	1-11-0225	2	C109,209	AMP		5x11mm/0.1
CAP	4.7 MF ELEC 50V 6x11mm	1-11-0475	4	C107,110,207,210	AMP		6x11mm/0.1
CAP	10,000MF ELEC 63V 35x50	1-12-0103	2	C2,3	PWR		35x36/0.4
CAP	10 MF ELEC 63V 6x11mm	1-12-0106	5	C04,106,111,206,211	AMP		6x11mm/0.1
CAP	0.1 MF MONOBLOCK 250V	1-21-0105	1	C1	PWR		0.4 SPC
CAP	0.047 MF POLY 100V 5SP	1-22-0473	4	C116,117,216,217	AMP		0.2 SPC
CER	220 PF CERDISC	1-02-0221	4	C102,104,202,204	AMP		0.2 SPC
CER	330 PF CERDISC	1-02-0371	2	C114,214	AMP		0.2 SPC
CER	68 PF CERDISC	1-02-0680	2	C112,212	AMP		0.2 SPC
CON	SPADE CONN (PCB MOUNT)	4-11-0002	13		PWR		0.2 SPC
CON	9-PIN FEM SIL CONN	4-15-0015	2	HARNESS			0.15 SPC
CON	9-PIN MALE SIL CONN	4-15-0014	2	J1,2	AMP		0.15 SPC
HDW	4-40x3/8 PPB	5-00-0022	12	POWER TRANS			
HDW	6-32x1/4 PPB	5-00-0003	4	P/S PCB			
HDW	10-24x1/2 BLK HEX CAP	5-00-0024	22	EXTERNAL			
HDW	4-24x5/16 PPB PLAST	5-00-1002	2	PUSH CLIP CONN			
HDW	#6 INT STAR BENT LUG	5-01-0011	2	GND (PART OF HARNESS)			
HDW	1/4" FEM SPADE LUG	5-01-0012	22	HARNESS	PWR		
HDW	10-24 KEPS NUT	5-02-1024	5	TRANS/RECT			
HDW	6-32 KEPS NUT	5-02-4401	1	GND			
HDW	FUSE CLIP	5-05-1001	2		AMP		
HDW	HEAT SINK	9-02-1004	2				
JAC	1/4 MONO CLIFF JACK	4-02-0001	4	J3,4,6,7	INOUT		

JAC	PUSH CLP CONN 2 CTR BLK	4-08-0001	1	J5	INOUT		
JAC	IEC320 CONN/FUSE HLDR	4-09-0001	1				
ME	1N4148 100V DIODE	2-00-4148	26	D101-113,201-213	AMP		0.4 SPC
ME	1N4002 200V DIODE	2-01-4002	1	D1	PWR		0.5 SPC
ME	TRANS, MPSA42	2-03-1042	6	Q112,113,117,212,213,217	AMP	MOT	TO92/0.1
ME	TRANS, 2SC4382	2-03-4382	2	Q105,205	AMP	SANKEN	TO220/0.1
ME	TRANS, MPS8099	2-03-8099	8	Q104,106,110,114,204,206,210,214	AMP	MOT	TO92/0.1
ME	TRANS, MPSA92	2-04-1092	2	Q108,208	AMP	MOT	TO92/0.1
ME	TRANS, 2SA1668	2-04-1306	2	Q103,203	AMP	MOT	TO220/0.1
ME	TRANS, MPS8599	2-04-8599	10	Q102,109,115,116,118,202,209,215,216,218	AMP	MOT	TO92/0.1
ME	TRANS, J112 FET	2-05-0112	2	Q111,211	AMP	MOT/NAT	TO92/0.1
ME	TRANS, 2SC3858 W/MICA	2-07-3858	2	Q101,201	AMP	SANKEN	0.2 SPC
ME	TRANS, 2SA1494 W/MICA	2-08-1494	2	Q107,207	AMP	SANKEN	0.2 SPC
ME	2x5mm RECT LED (GRN)	3-00-0002	1	POWER	LED		0.1 SPC
ME	2x5mm RECT LED (RED)	3-02-0003	2	CLIP	LED		0.1 SPC
ME	DPST 16A PWR SWITCH	6-03-0001	1				
ME	BRDGE RECT 10A/200V/300	7-03-0001	1				
ME	XFORMR 120/240 (71.9VC)	7-40-2500	1				
ME	3uH COIL	9-09-0001	2	L1,2	AMP		
MIS	THERM GREASE .01-.02 OZ	7-11-0001	0	Q101,102,103,104,105,106,107,201,202,203,204,205,206,207	AMP		FYI ONLY
MIS	FOAM STRIP	9-23-1016	2	CASE TOP EDGES/FRONT PANEL			
ML	TOP COVER	9-03-1043	1				
ML	BRACKET	9-03-1044	4	AMP PCB-HEATSINK			
ML	FRONT PANEL	9-15-0042	1				
MTL	CASE CHASSIS	9-03-1045	1				
PCB	PCB, PANEL REV C	9-40-1056	1	PWR,POT A/B,AMP A/B,IN/OUT,LED A/B/C			
PLS	KNOB 35mm	9-15-0040	2				
POT	1K TRIMPOT CERMET	0-08-0102	2	R108,208	AMP		

POT	10KA SINGLE	0-09-1005	2	R145,245	POT		
RES	0 OHM 1/4W 5%	0-03-0000	24		AMP		0.4 SPC
RES	100 OHM 1/4W 5%	0-03-0101	14	R101,119,121,122,127,133,134,201,219,221,222,227,233,234	AMP		0.4 SPC
RES	1K OHM 1/4W 5%	0-03-0102	2	R129,229	AMP		0.4 SPC
RES	10K OHM 1/4W 5%	0-03-0103	12	R104,116,135,136,138,141,204,216,235,236,238,241	AMP		0.4 SPC
RES	100K OHM 1/4W 5%	0-03-0104	2	R142,242	AMP		0.4 SPC
RES	1.1K OHM 1/4W 5%	0-03-0112	2	R140,240	AMP		0.4 SPC
RES	1.5K OHM 1/4W 5%	0-03-0152	8	R124-126,128,224-226,228	AMP		0.4 SPC
RES	15K OHM 1/4W 5%	0-03-0153	2	R139,239	AMP		0.4 SPC
RES	2.2K OHM 1/4W 5%	0-03-0222	6	R106,109,114,206,209,214	AMP		0.4 SPC
RES	220K OHM 1/4W 5%	0-03-0224	4	R103,117,203,217	AMP		0.4 SPC
RES	2.2M OHM 1/4W 5%	0-03-0225	2	R143,243	AMP		0.4 SPC
RES	2.7K OHM 1/4W 5%	0-03-0272	4	R1,2,110,210	AP/PR		0.4 SPC
RES	27K OHM 1/4W 5%	0-03-0273	2	R137,237	AMP		0.4 SPC
RES	33K OHM 1/4W 5%	0-03-0333	10	R105,115,120,123,132,205,215,220,223,232	AMP		0.4 SPC
RES	39K OHM 1/4W 5%	0-03-0393	2	R130,230	AMP		0.4 SPC
RES	47 OHM 1/4W 5%	0-03-0470	4	R107,112,207,212	AMP		0.4 SPC
RES	47K OHM 1/4W 5%	0-03-0473	2	R113,213	AMP		0.4 SPC
RES	5.6K OHM 1/4W 5%	0-03-0562	2	R131,231	AMP		0.4 SPC
RES	68 OHM 1/4W 5%	0-03-0680	2	R111,211	AMP		0.4 SPC
RES	0.22 OHM 5W	0-05-0022	4	R102,118,202,218	AMP		1.1 SPC
RES	3.3K 1W CARBON FILM	0-05-0332	2	R246,247	PWR	FUTABA	
RES	4.7 OHM 2W METAL OXIDE	0-05-0470	2	R144,244	AMP		0.8 SPC
RUB	RUBBER FEET	9-23-1024	4	NOT ATTACHED			
WIR	WIRE, 9 PIN ASSY L/R	9-89-0004	2	9 PIN CONN-TERM PIN (2 WIRES PER)			20 GA
WIR	WIRE, BRIDGE RECT	9-89-0005	4	FEM SPADE-TERM PIN			20 GA
WIR	WIRE, I/P ASSY L/R	9-89-0006	2	TERM PIN-TERM PIN (2 WIRES PER)			20 GA
WIR	WIRE, POWER CONN SPADE	9-89-0007	2	FEM SPADE-FEM SPADE			20 GA

WIR	WIRE, POWER CONN TERM	9-89-0008	2	FEM SPADE-TERM			20 GA
WIR	WIRE, POWER CONN RING	9-89-0009	1	FEM SPADE-RING			20 GA
WIR	WIRE, POWER SWITCH	9-89-0010	2	FEM SPADE-FEM SPADE			20 GA
WIR	WIRE, LED RIGHT	9-89-0011	1	TERM PIN-TERM PIN			20 GA
WIR	WIRE, LED LEFT	9-89-0012	1	TERM PIN-TERM PIN			20 GA