CARVER

ECS, ECS-U, SBRD
SERVICE MANUAL

CONTENTS **Page**

CARVER Corporation

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CARVER Corporation
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SECTION 1

SAFETY INFORMATION

WARNING.

Any person performing the procedures described in this manual will be exposed to hazardous voltages and the risk of electric shock.

Carver Corporation assumes that any person who removes the cover from the unit has been properly trained in protecting against avoidable injury and shock.

Therefore, the procedures described here are to be performed by qualified electronics service personnel only.

We recommend that the unit be tested only when line isolation is provided by an isolation transformer. The line cord of the unit must be disconnected and the power supply fully discharged before any components are replaced. Failure to do so may result in severe damage to the unit and the risk of electric shock.

The safety tests described on the schematic diagrams must be performed properly before returning the unit to the customer.

SECTION 2

INTRODUCTION

This manual is intended for use by qualified, authorized personnel only.

Due to the unique and complex circuit designs of Carver Corporation, the following procedure is recommended to diagnose & repair problems with speed and accuracy.

The best way to figure out what is wrong is to learn what is working properly first. Then, through the process of elimination, the defective area can be located. Upon locating the defective area, you then would use your own preferred troubleshooting skills.

The removal of parts for testing, should be kept to an absolute minimum. "In circuit" analysis should provide you with enough data to determine correct operation.

Refer to the design history section of the service manual if you locate a part in the circuit that is not the same as the schematic. This section will be of great assistance to you in performing a correct repair.

At Carver Corporation we continually strive for the most reliable, cost-efficient product available.

When updates and service bulletins are sent to you, please take the time to review them and insert them into the correct service manuals.

SECTION 3

SPECIFICATIONS

ECS-U

Electronic Control System Specifications (Nominal)

Frequency Response:		10Hz-20kHz (+0,-0.3dB)
Input Sensitivity:		Unity Gain
Input Impedance:		300K ohm
Output Impedance:		600 ohm
Crosstalk:		-60dB
Total Harmonic Distortion:		<0.1% THD
Signal-to-Noise:		less than 90dB, IHF A-Weighted
IM Distortion:		less than .001%
TIM Distortion:		unmeasurable
Rated Output:		2V RMS
Maximum Output:		3.5V RMS
Operating Voltage:		120VAC
Power Consumption:		3 Watts
Dimensions	Height:	2.5 inches
	Width:	9.0 inches
	Depth:	9.3 inches
Weight:		5 lbs. 8.5 ounces

SECTION 4

CIRCUIT DESCRIPTION
ECS-U

The ECS-U Electronic Control System is designed to optimize the performance of the CARVER Amazing Loudspeakers. It is an active line-level equalizer and signal processor that is to be connected between the pre-amplifier and the power amplifier (or in a tape monitor loop). It provides the following processing features:

1. Variable Bass Q
2. High Frequency Trim
3. Subharmonic Bass enhancement
4. Gundry Perspective
5. Sonic Holography®

The following description applies to the left channel only unless otherwise noted, since the right channel is identical to the left.

INPUT STAGE AND GUNDRY PERSPECTIVE

The input buffer (U1-4) has an input impedance of 300k ohms to prevent loading down the input signal. It provides a gain of 6.8dB followed by a voltage divider (R406, R405) that reduces the gain to a net total of 5.2dB at U1-10. The "Gundry Perspective" notch filter (U2-10) can be switched into the circuit at this point (SW 2), which provides a 3.5dB cut at 3.3kHz. This creates the psychoacoustic effect of increasing the perceived distance between the sound source and the listener.

SUB BASS ACTIVATOR

U3-4 is a unity gain buffer amp which is followed by the Sub Bass switch (SW 1). When engaged, the signal is routed to the Sub Bass Activator Circuit. U7-4 provides a low frequency boost of 3dB at 30Hz (+4dB at 20Hz) and U12-10 provides a boost of 2.5dB at 20Hz, for a net total of +6.5dB at 20Hz. This helps to restore fundamental bass frequencies that may have been lost in the recording process, particularly on phonograph records and cassette tapes. (Note: The ECS version contained additional circuitry in the Sub Bass Activator that was deleted in the ECS-U version. See the ECS circuit description for details.)

SONIC HOLOGRAM

(Refer to the block diagram of the Sonic Hologram Generator on page 9 for a better understanding of this circuit description.) SW 3 is in series with SW 1, and routes the signal to the Sonic Hologram Generator when engaged. U9-10 provides a 3dB notch at 2kHz and a low frequency boost below 400Hz (leveling off at +6dB below 100Hz) to optimize the overall hologram equalization. From this point, the left and right channels are no longer separate and identical. U10-4 is a differential amplifier that amplifies the difference between the left and right channels. It is followed by a high-pass buffer (U10-10) with a cut-off frequency of 700Hz, to prevent low bass dimensional aberrations. Acting in parallel with the difference amp and the high-pass buffer amp is the 4kHz notch filter at U15-4. The left and right channels are summed via R62 and R109, and the filter provides a 3.5dB notch at 4kHz for mono voice equalization. This is followed by a phase shifter (U15-3) which inverts the signal and supplies some additional delay. The output of the phase shifter is summed with the output of the high-pass buffer (U10-10) via R117 and R66, and also summed with the inverted output (U15-10) of the high-pass buffer via R118 and R121. Each of these two summing junctions feeds identical phase shift networks that each provide a 119μS delay (360° phase shift at 8.4kHz). Each phase shift network is composed of four identical phase shifters (see block diagram). Three taps from each phase shift network are summed and fed to the crossfeed buffers (U10-12 and U17-7), one of which amplifies the difference between the summed phase shifted output at R150 and the high-pass buffer output, and the other which amplifies the difference between the summed phase shifted output at R151 and the inverted high-pass buffer output. By using tapped summed delays, a wider optimized listening position is attainable.

It is at this point that separate left and right channels are restored, starting with the crossfeed buffers. U18-8 is a gyrator that provides a 3.5dB cut at 225Hz, which helps smooth low frequency ambient response. U18-12 is a gyrator that provides a 2.5dB cut at 3.5KHz, which provides a "Gundry" dip to give the listener an increase in perceived distance from the sound stage. U10-3 is a unity gain output buffer (voltage follower) that returns the signal to the main circuit path via SW3.

BASS Q AND HIGH FREQUENCY TRIM

U6-10 contains the variable Bass Q and High Frequency Trim in its feedback loop. RP1 provides an 8dB boost and a 4dB cut at 20Hz, and RP2 provides a 4.5dB boost and a 2.5dB cut at 20kHz.

MUTING

Turn on muting is accomplished by Q400 (Q500 right channel), located at the output. When power is applied, Q9 is initially forward biased, which in turn forward biases Q10. Q10 applies +4.5VDC to the base resistor R435 of Q400, turning it on and grounding the R432-R434 junction. This provides at least 40dB attenuation of the signal, as well as unwanted turn-on transients, at the output jack. C74 charges through R175, forward biasing Q8 after about 2 seconds, when it reaches 2.4VDC. This causes the emitter of Q9 to go less positive as the base goes more positive, switching it off. This turns off Q10 (and Q11) which in turn shuts off Q400 (Q500), allowing the full signal to pass to the output jack.

When power is removed, Q8 immediately turns off, increasing the voltage at the emitter of Q9. This keeps it forward biased (and the muting activated) until the power supply discharges.

POWER SUPPLY

The power supply is a straight forward design, using a full-wave bridge rectifier and 1000µF filter capacitors (C65 and C67) to provide a bipolar unregulated supply voltage of 16.0VDC to Q6 and Q7. D11 and D12 maintain a constant 12VDC zener voltage at the bases of Q6 and Q7, which in turn provide a constant +/-11.5VDC to the rest of the circuit. Additional filtering is performed by C66 and C68 to smooth out any remaining residual ripple.

CIRCUIT DESCRIPTION
ECS

The ECS was designed to be used with the original Silver Edition of The Amazing Loudspeaker. It contains speaker equalization at the Input section, and additional circuitry in the Sub Bass Activator circuit that was later removed when the crossover within the Silver Speakers was redesigned. This change created the current ECS-U version and allows the Silver Speakers (and the Platinum Speakers) to be used with or without a control box, at the users discretion.

SPEAKER EQUALIZATION (ECS only)

In addition to the Input and Gundry perspective circuitry described for the ECS-U, the ECS contains gyrator circuits following the input buffer to provide speaker equalization. U2-4 provides a 3dB notch at 1kHz. U2-10 provides a 4dB notch at 3.1kHz (-7.5dB with Gundry switch in). U3-10 provides a 5dB notch at 5.8kHz, U4-10 provides a 2.5dB notch at 300Hz, and U6-4 provides a 2dB notch at 1.5kHz.

SUB BASS ACTIVATOR (ECS Version)

The left and right signals are combined through R4 and R5, and continue on to a low-pass 18dB/ octave Butterworth filter (U8-4), with a cutoff frequency of 70Hz. At this point the signal splits into two branches. The upper branch begins with a high pass filter (U8-10) that provides a gain of 7dB above the cutoff frequency of 50Hz, and a 6dB/ octave rolloff below 60Hz. Thus, U8-4 and U8-10 combine to form a bandpass filter with a low and high cutoff of 45Hz and 85Hz.This bandpassed signal feeds U9-4, which operates in saturation due to its open loop configuration, thereby converting the signal into square waves. The square waves drive Q-1 which acts as a level shifter and supplies the input of U14 with a positive pulse of 11VDC for every cycle of the incoming signal.

U14 is a Dual D-type Flip-Flop that divides the input frequency by two (1/2f) which creates a subharmonic an octave below the fundamental frequency. The lower branch consists of another low-pass Butterworth filter (U9-3, identical to U8-4) and DC rectification (U8-3 and U8-12), which provide the control voltage for the operational transconductance amplifier (U13). The OTA functions as an automatic gain control. RP3 adjusts the amplitude of the subharmonic through U7, which allows adjusting the amount of "Sub Bass" signal to be mixed with the "dry" signal at U12. U12 pins 4 and 3 are a 10Hz to 60Hz bandpass filter, which effectively recreates a sine wave from the subharmonic square wave. Finally, this signal is added to the left and right unprocessed signals (U12-10 and U12-12) and returned to the main signal path via SW 1.

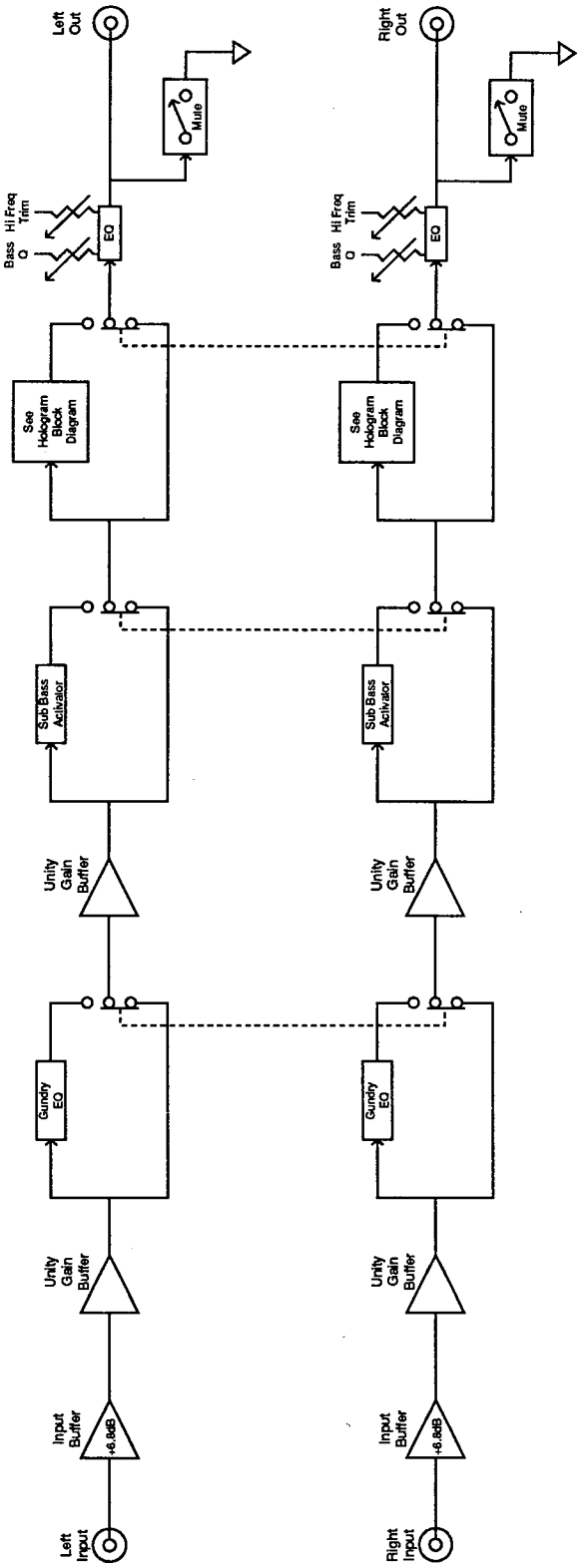
CIRCUIT DESCRIPTION
SBRD
Sub Bass Room Damper

The Sub Bass Room Damper was designed to optimize the bass frequency response of the original Amazing Loudspeakers for an individual's preference, and to the room acoustics of the listening environment. Like the ECS and the ECS-U, it is to be connected between the pre-amplifier and the power amplifier (or in a tape monitor loop).

It contains a pair of RC filters for each channel to provide selectable low frequency attenuation to change the "Q" of the speaker. The Normal Damping Output (Q=.7) provides a moderate dip of 2dB at 150Hz and returns to flat at 20Hz. The Maximum Damping Output (Q=.5) provides a low frequency roll-off of -3dB at 100Hz and -5dB at 20Hz.

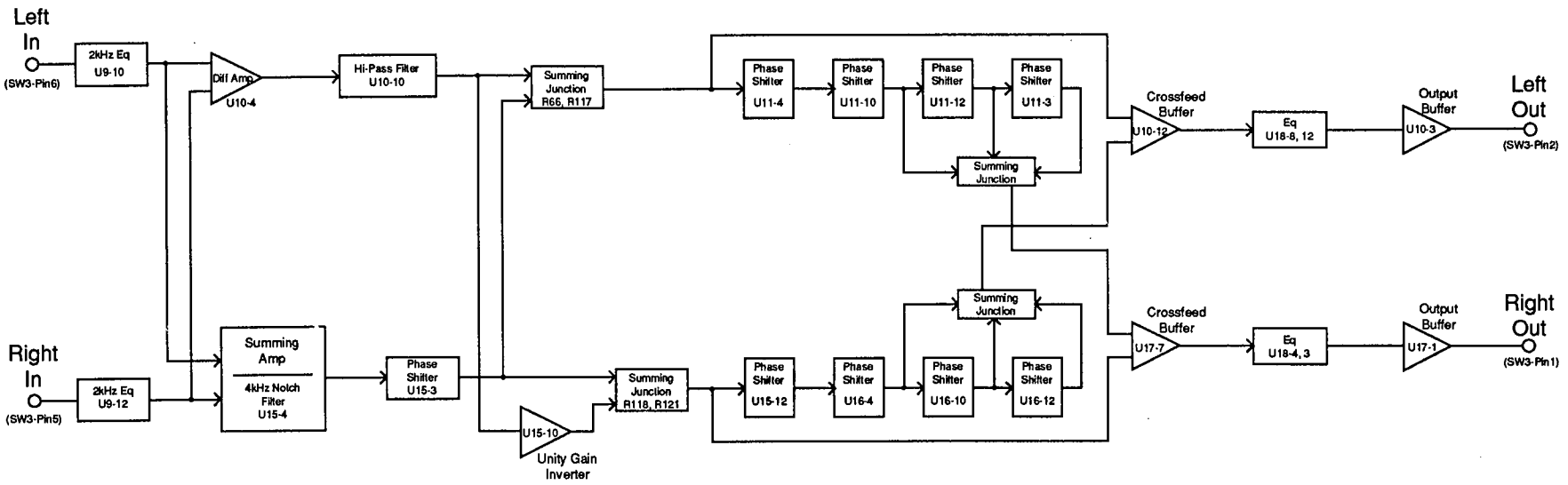
SECTION 5
BLOCK DIAGRAMS

ECS-U BLOCK DIAGRAM

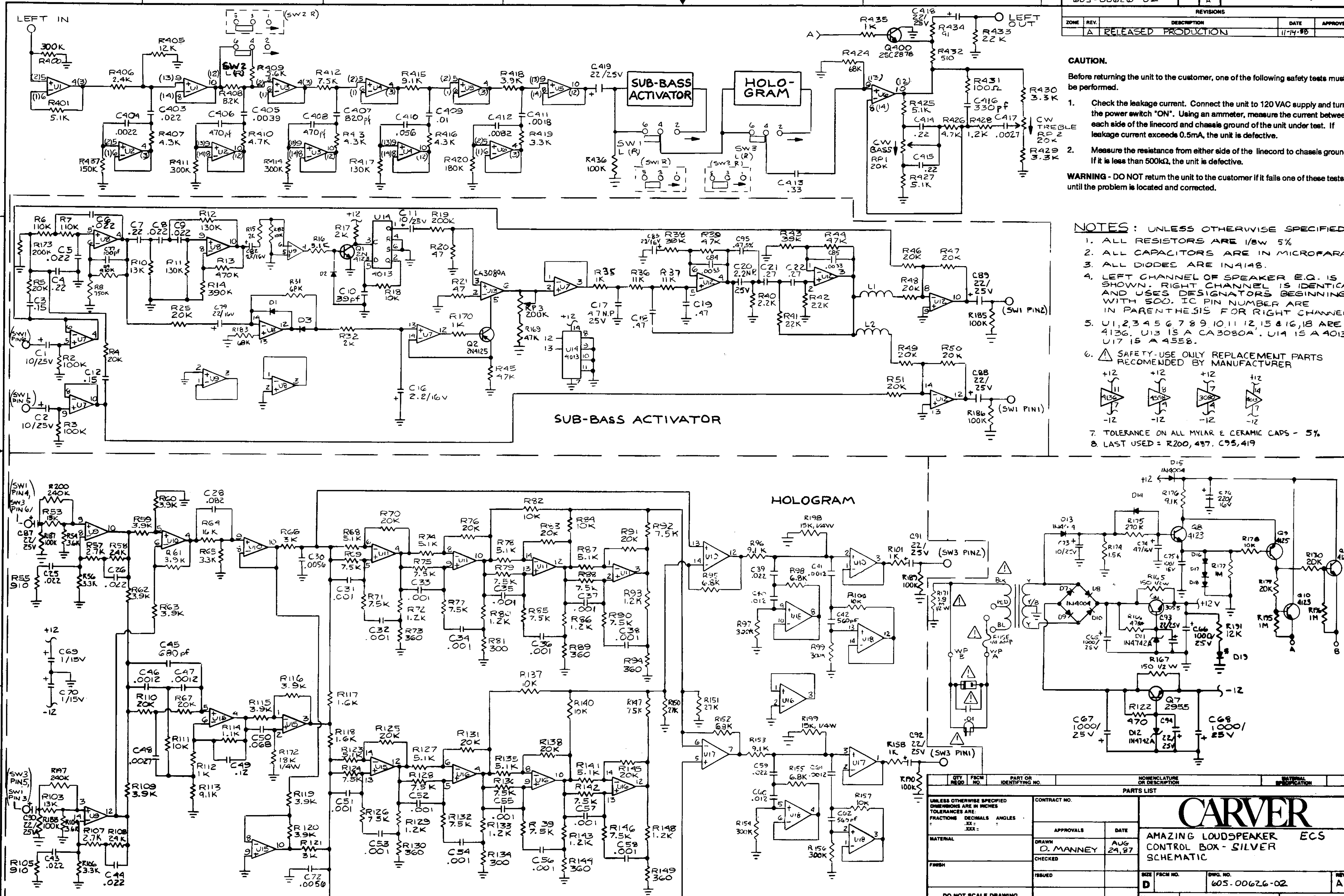


BLOCK DIAGRAM

ECS/ECS-U SONIC HOLOGRAM



SECTION 6
SCHEMATICS AND LAYOUTS



DWG. NO.	SH	REV.
605-00626-02		A

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASED PRODUCTION	11-14-88	

CAUTION.

Before returning the unit to the customer, one of the following safety tests must be performed.

1. Check the leakage current. Connect the unit to 120 VAC supply and turn the power switch "ON". Using an ammeter, measure the current between each side of the linecord and chassis ground of the unit under test. If leakage current exceeds 0.5mA, the unit is defective.
2. Measure the resistance from either side of the linecord to chassis ground. If it is less than 500kΩ, the unit is defective.

WARNING - DO NOT return the unit to the customer if it fails one of these tests until the problem is located and corrected.

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTORS ARE 1/8W 5%
2. ALL CAPACITORS ARE IN MICROFARADS
3. ALL DIODES ARE IN4148.
4. LEFT CHANNEL OF SPEAKER E.Q. IS SHOWN. RIGHT CHANNEL IS IDENTICAL AND USES DESIGNATORS BEGINNING WITH 500. IC PIN NUMBER ARE IN PARENTHESIS FOR RIGHT CHANNEL.
5. U1,2,3,4,5,6,7,8,9,10,11,12,15 & 16,18 ARE 4136. U13 IS A CA3080A. U14 IS A 4013. U17 IS A 4558.
6. ⚠ SAFETY-USE ONLY REPLACEMENT PARTS RECOMENDED BY MANUFACTURER
7. TOLERANCE ON ALL MYLAR & CERAMIC CAPS - 5%
8. LAST USED = R200, 437. C95, 419

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN D. MANNEY	AUG 24, 87
CHECKED	
ISSUED	

CARVER

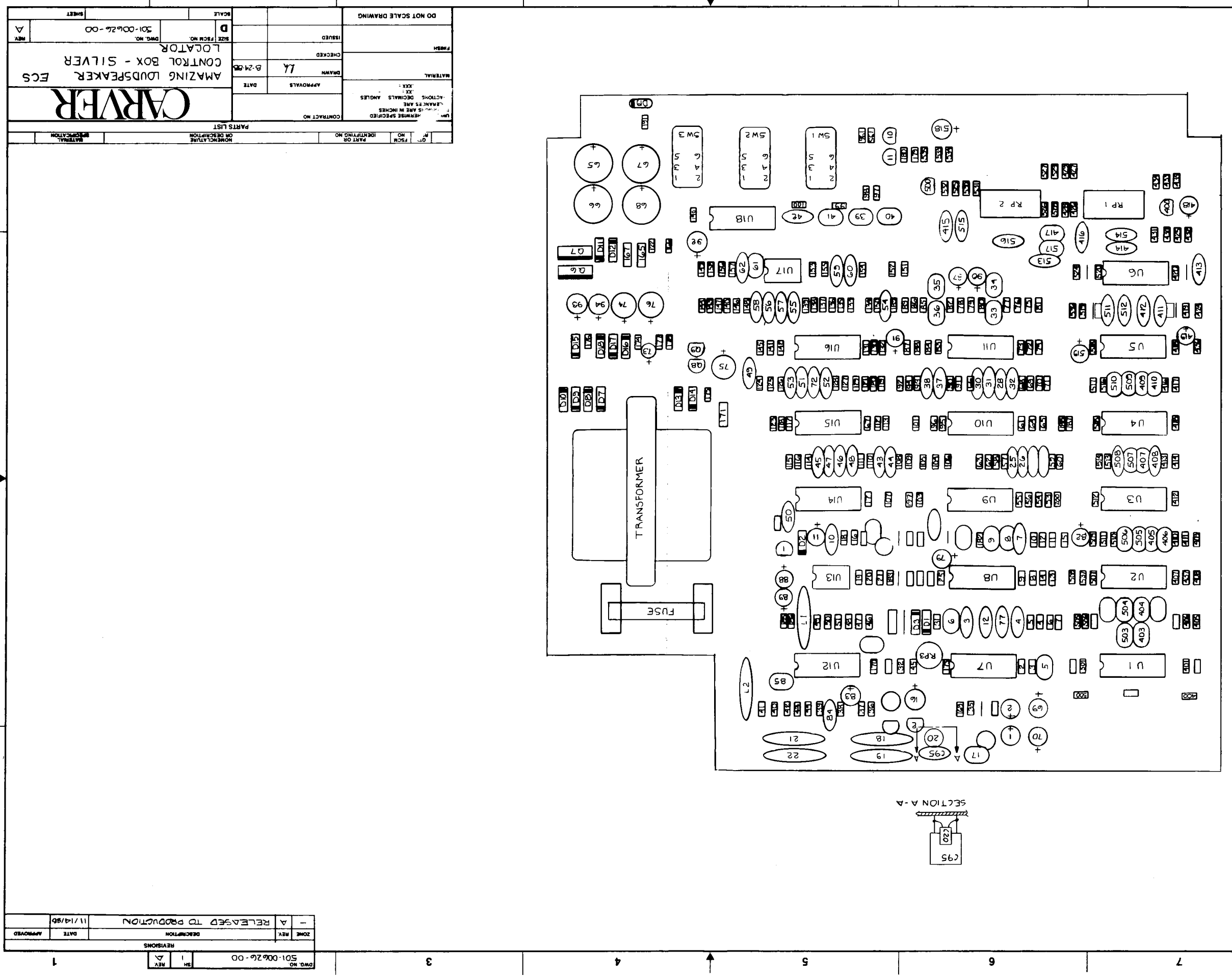
AMAZING LOUDSPEAKER ECS
CONTROL BOX - SILVER
SCHEMATIC

SIZE	FSCM NO.	DWG. NO.	REV.
D		605-00626-02	A

SCALE — SHEET 1 OF 1

13

14



PARTS LIST					
QTY	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	

CONTRACT NO	APPROVALS	DATE
	DRAWN	8-24-98
	CHECKED	
	ISSUED	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCE ON
FRACTIONS ± DECIMALS ± ANGLES ±
.XX ±
.XXX ±

MATERIAL
FINISH
DO NOT SCALE DRAWING

CARVER

AMAZING LOUDSPEAKER ECS
CONTROL BOX - SILVER
LOCATOR

SIZE	FSCM NO.	DWG. NO.	REV.
D		501-00626-00	A

SCALE SHEET

ZONE	REV.	DESCRIPTION	DATE	APPROVED
–	A	RELEASED TO PRODUCTION	11/14/96	

REVISIONS

DWG. NO	SH	REV
501-00626-00	1	A

DWG. NO.	SH	REV.
605-00626-02		G

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	RELEASED PRODUCTION	11-14-88	
	B	INCORPORATED ECO NO 923	1-19-89	
	C	INCORPORATED PER ECO 979	3-9-89	
	D	INCORPORATED PER ECO 1000	3-22-89	
	E	ADDED R438&538 PER ECO # 1056	5-8-89	
	F	INCORPORATED ECO'S 1123	6-15-89	
	G	INCORP ECO # 1428	3/30/90	

CAUTION.

Before returning the unit to the customer, one of the following safety tests must be performed.

1. Check the leakage current. Connect the unit to 120 VAC supply and turn the power switch "ON". Using an ammeter, measure the current between each side of the linecord and chassis ground of the unit under test. If leakage current exceeds 0.5mA, the unit is defective.
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2. ALL CAPACITORS ARE IN MICROFARADS
3. ALL DIODES ARE IN4148.
4. LEFT CHANNEL OF SPEAKER E.Q. IS SHOWN. RIGHT CHANNEL IS IDENTICAL AND USES DESIGNATORS BEGINNING WITH 500. IC PIN NUMBER ARE IN PARENTHESIS FOR RIGHT CHANNEL
5. U1,2,3, 6,7, 9,10,11,12,15 & 16,18 ARE 4136. U13 IS A CA3080A'. U14 IS A 4013. U17 IS A 4558.
6. ⚠ SAFETY-USE ONLY REPLACEMENT PARTS RECOMENDED BY MANUFACTURER
7. TOLERANCE ON ALL MYLAR & CERAMIC CAPS ± 5%
8. LAST USED = R206, 438, C99, 419, JP23
9. NOT USED: R34, 44

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
± .XX ± ±
.XXX ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN D. MANNEY	AUG 29,87
CHECKED	
ISSUED	

CARVER

ECS-U CONTROL BOX
SCHEMATIC

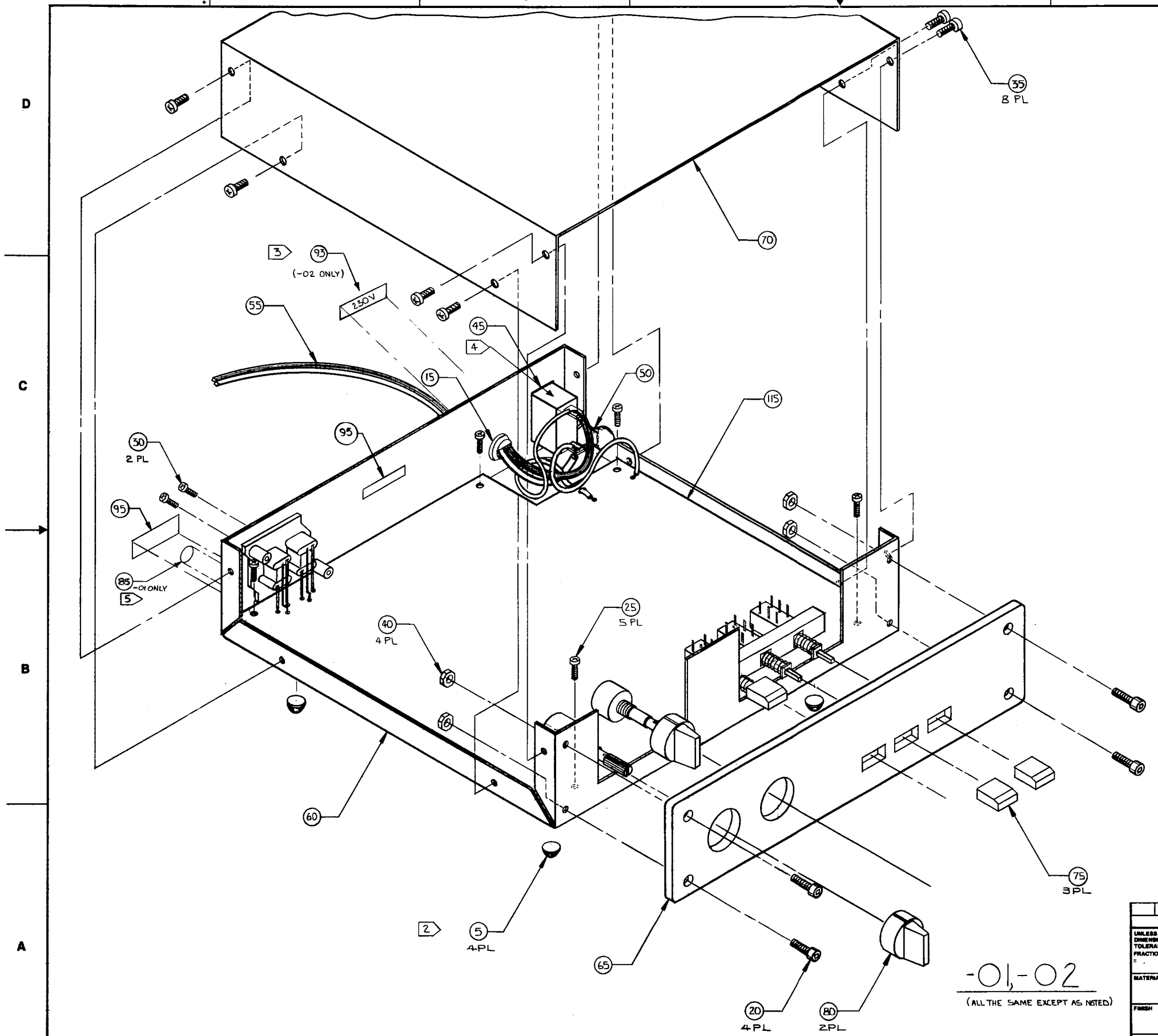
SIZE	FSCM NO.	DWG. NO.	REV.
D		605-00626-02	G

SCALE — SHEET 1 OF 1

DWG. NO.	SH	REV.
607-00425-XX	1	E

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
	B	INCORPATED ECO# 1427	4-9-90	
	C	INCORP ECO # 1490 LN	6-13-90	
	D	INCORP ECO # 1543	8-9-90	
	E	INCORP ECO # 1615	11-26-90	



-01, -02
(ALL THE SAME EXCEPT AS NOTED)

5 PLACE C.L.A. STICKER ON BOTTOM OF UNIT, UNDER SERIAL #.

4 INSTALL ITEM# 45 "WIDE BLADE ON TOP"

3 INSTALL ITEM # 93 (LABEL) ON -02 ONLY APPROX. WHERE SHOWN. COVER SILKSCREEN OUTPUT RATING -/ 120VAC 50/60 Hz 115 WATTS

2 APPLY BUMPONS .5"x.5" FROM EDGES OF CHASSIS

1 ALL ITEMS ARE ON PART LISTS 607-00425-01, REV H AND 607-00425-02, REV F.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
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FRACTIONS ± . DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL 1

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CONTRACT NO.

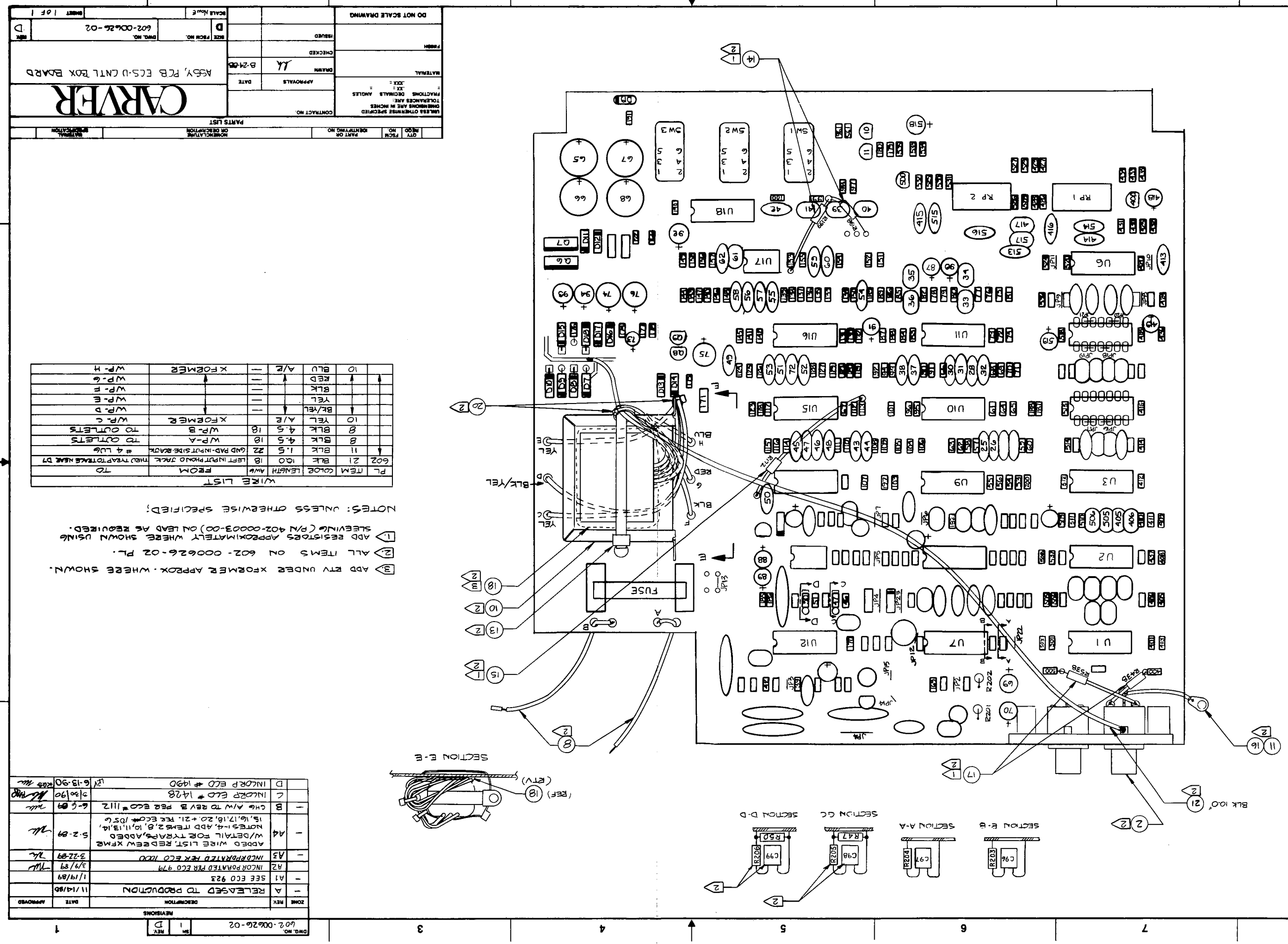
APPROVALS	DATE
DRAWN BIBIANA CAMPBELL	6-24-88
CHECKED	
ISSUED	

CARVER

FINAL ASSEMBLY
ECS-U

SIZE D | FSCM NO. | DWG. NO. 607-00425-XX | REV. E

SCALE 1:1 | SHEET 1 OF 1



ITEM	COLOR	LENGTH	AWG	FROM	TO
PL					
602 21	BLK	10.0	18	LEFT INPUT PHONO JACK	THRU TRAP TO TEMPLE NEAR D7
11	BLK	1.5	22	GND PAD-INPUT SIDE BRACK	# 4 LUGS
8	BLK	4.5	18	W/P-A	TO OUTLETS
8	BLK	4.5	18	W/P-B	TO OUTLETS
10	YEL	A/R		X FORMER	W/P- C
	BL/YEL				W/P- D
	YEL				W/P- E
	BLK				W/P- F
	RED				W/P- G
10	BLU	A/R		X FORMER	W/P- H

WIRE LIST

1. ADD RTV UNDER XFORMER APPROX. WHERE SHOWN.
2. ALL ITEMS ON 602-000626-02 PL.
3. ADD ESISTORS APPROXIMATELY WHERE SHOWN USING SLEEVING (P/N 402-00003-00) ON LEAD AS REQUIRED.

NOTES: UNLESS OTHERWISE SPECIFIED;

ZONE	REV	DESCRIPTION	DATE	APPROVED
		REVISIONS		
—	A	RELEASED TO PRODUCTION	11/14/89	
—	A1	SEE ECO 923	1/19/89	
—	A2	INCORPORATED PER ECO 979	3/9/89	
—	A3	INCORPORATED PER ECO 1000	3-22-89	
—	A4	ADDED WIRE LIST, REDREW XFMR W/DETAIL FOR TRAPS, ADDED NOTES 1-4, ADD ITMS 2, 8, 10, 11, 13, 14, 15, 16, 17, 18, 20 + 21. PER ECO# 1050	5-2-89	
—	B	CHG A/W TO REV B PER ECO # 1112	6-6-89	
	C	INCORP ECO # 1428	9/30/90	
	D	INCORP ECO # 1490	6-13-90	

DWG. NO. 602-000626-02	SH 1	REV. D

PART ON IDENTIFYING NO	ITEM NO	QTY REQD	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

CONTRACT NO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
FRACTIONS DECIMALS ANGLES
TOLERANCES ARE: ± .XX ± ± .XXX ±

MATERIAL

FINISH

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	APPROVALS	DATE
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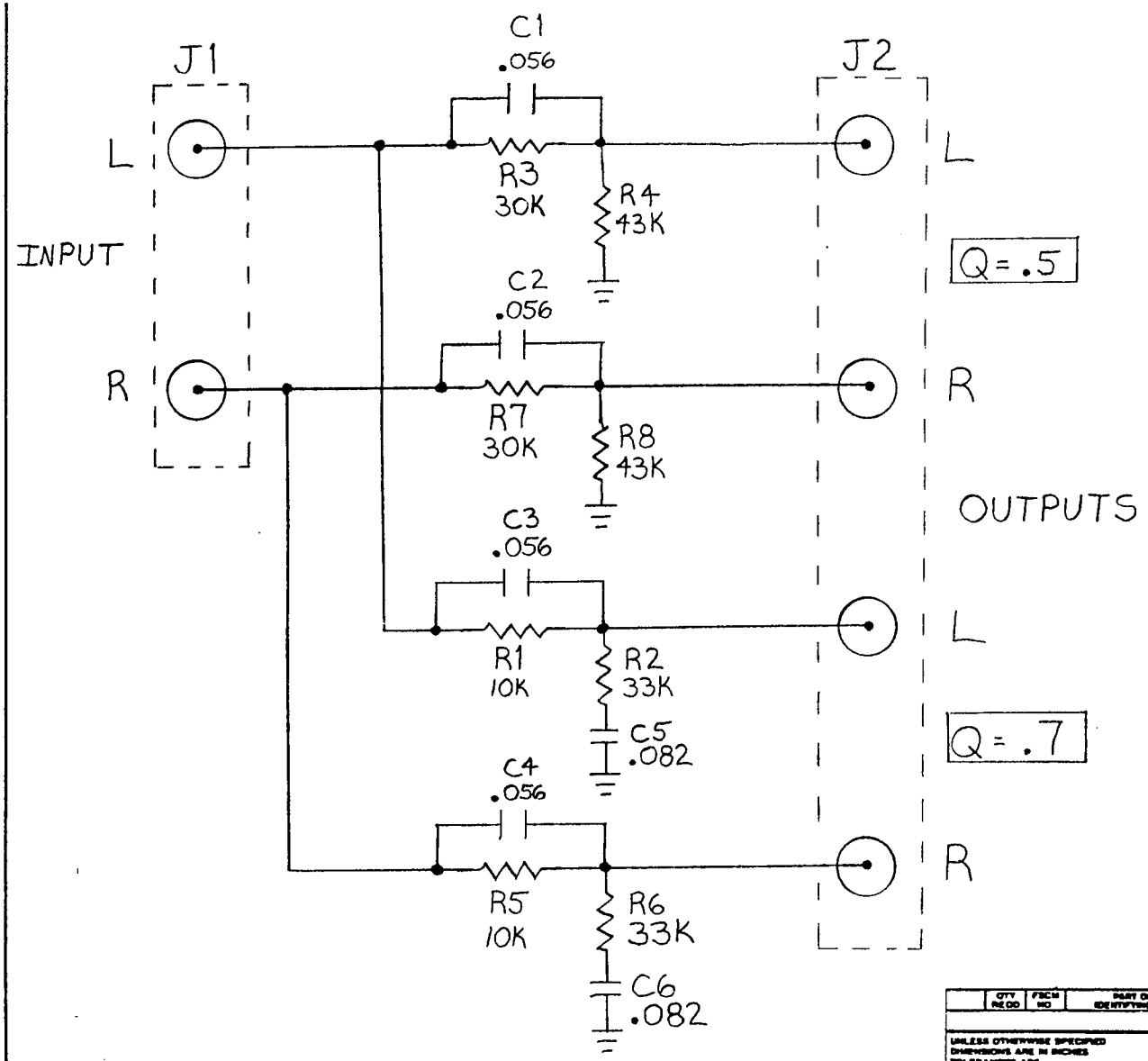
ISSUED		

CARVER

A35V, PCB ECS-U CNTL BOX BOARD

SIZE	FSCM NO.	DWG. NO.	REV.
D		602-000626-02	D

SCALE NONE SHEET 1 OF 1



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
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MATERIAL

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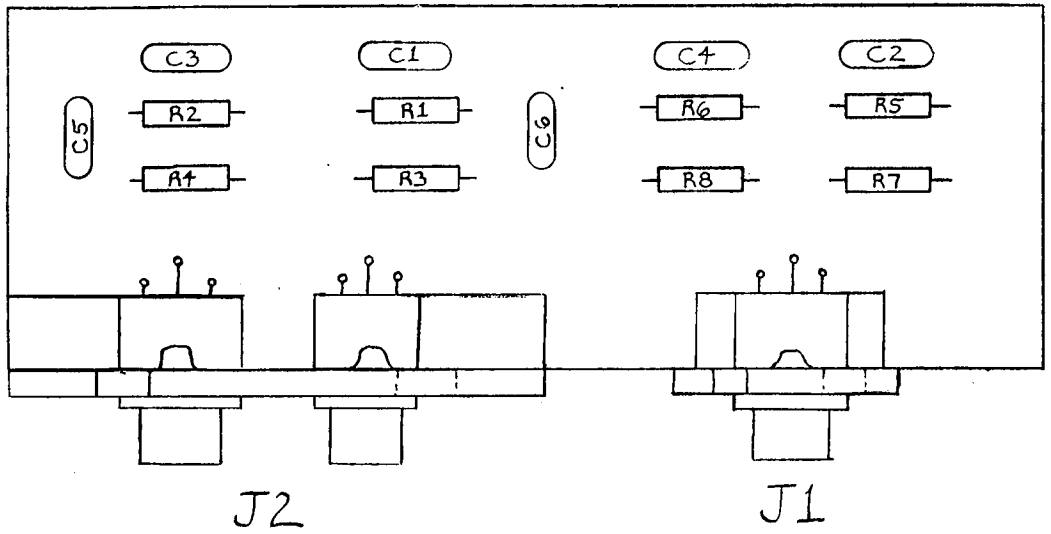
CARVER

Sub Bass Room Damper
Schematic

SIZE	FSCM NO	DWG. NO.	REV
D		605-00551-00	B

SCALE —

SHEET 1 OF 1



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE.
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

CONTRACT NO

APPROVALS	DATE
DRAWN	
CHECKED	
ISSUED	

MATERIAL

FINISH

DO NOT SCALE DRAWING

CARVER

Sub Bass Room Damper
PCB Assy.

SIZE D | FSCM NO. | DWG. NO. 602-00551-00 | REV

SCALE — | SHEET 1 OF 1

SECTION 7

TROUBLESHOOTING THE LOUDSPEAKER CONTROL BOX

ECS & ECS-U

I. IDENTIFYING THE PROBLEM:

Before beginning any bench work, identify the general category of the complaint and use the following outline to locate the reported problem in terms of three categories, each of which leads to a specific set of tests designed to determine whether or not the Loudspeaker Control Box is at fault and then, if it is, to help locate the problem.

II. PROBLEM CATEGORY/PROCEDURE GUIDE:

A) Obvious Malfunctions

1) One or both channels have no output signal.
2) A loud tick, pop, or thump on turn-on or turn-off.
3) Grossly audible hum, noise or distortion.
4) Intermittent operation (audibly cuts in or out).

See "General Troubleshooting"

B) Specification Shortfalls

1) One or both channels fail to meet distortion specs.
2) One or both channels fail to meet noise specs.
3) One or both channels "squeal" or oscillate.

See "IC Replacement"

C) Hologram Image Complaints

1) The Control box causes "crosstalk" between channels.
2) Can't hear any Hologram effects on some program material.
3) Hologram effect alters the harmonic content of instruments.
4) Can't find the Holographic "sweet spot".
5) Just doesn't sound like it used to anymore.

See Section 8 (Test Procedures) step 7 on page 30.

III. UNIVERSAL PROCEDURES:

A) Preliminary Set-up

The following procedures apply to all internal service work on the Loudspeaker Control Box, regardless of which category the complaint fits.

1) Remove the cover from the unit.
2) Verify that the power transformer is wired for the correct line voltage (see "Voltage Conversion").
3) Verify that the proper value line fuse is installed for that voltage.
4) Set Sub Bass Q and High Frequency Trim pots to CENTER, and Sub Bass, Gundry Perspective, and Hologram switches OUT.

IV. GENERAL TROUBLESHOOTING

These procedures apply to the "dead" unit, or units which exhibit severe hum, noise, or distortion that is audible, or units which function intermittently in terms of passing a signal, or units which exhibit a turn-on thump.

A) Test Equipment Used:

1) Variac
2) Digital Voltmeter
3) Dual-Trace Oscilloscope
4) AC Voltmeter connected in parallel with scope.
5) Distortion Analyzer with 80kHz Lo-Pass Filter.
6) 20Hz to 20kHz bandwidth limiting filter for noise tests.

B) Verify operation of the power supply.

1) Double check the AC power source and the line fuse.
2) With the Variac turned down, plug the unit into the Variac and slowly raise the line voltage to 120VAC, watching for excessive current draw (should not exceed 150mA).
3) Measure the bipolar DC supplies. Verify an unregulated voltage of +16.5Vdc (+/- 1.5V) at the cathodes of D8 and D10. Verify an unregulated voltage of -16.5Vdc (+/- 1.5V) at the anodes of D7 and D9.

   Verify a regulated voltage of +11.5Vdc (+/- 1V) at pin 7 of any 4136 IC, and -11.5Vdc (+/- 1V) at pin 11 of any 4136 IC.
4) If step D-3 yields unacceptable results, look for shorted or open components in the power supply, or in the main circuit. A shorted IC can be isolated by desoldering the supply pins of the IC. (Hint: sometimes a shorted IC will get very hot!).
5) If the supply voltages are within limits and a gross malfunction persists, try the following suggestions:

   a) One channel dead.

      Suspect bad solder connections. Also check for a short or crack in the PCB or a non-functioning IC.

   b) Gross hum on one or both channels.

      Check the power supply for excessive AC ripple components (less than 50mV). If this is not the cause, look for open ground connections.

   c) Gross distortion on one or both channels.

      It can be caused by a near short on the output of any IC section, but is more likely to be a bad IC. Moving from input to output while passing a 1 KHz test signal, look at each successive IC output until the guilty device is located.
6) If the unit functions properly except for a loud pop or thump upon power-up, suspect the turn-on mute circuitry. With a 2.5V, 1 KHz output signal present, power down the unit for 5 seconds. Upon turn-on, both outputs should be attenuated at least 40dB for about 2 seconds. If both channels fail this test, suspect the drive circuitry surrounding Q8-Q11. If the drive is correct, suspect Q400 & Q500.

V) IC REPLACEMENT

Excessive levels of noise or distortion are invariably caused by "below-spec" IC's. Prior to replacing any IC for any reasons, however, run the noise and distortion tests described in Section 8 under "Test Procedures".

SECTION 8

TEST PROCEDURES
ECS-U, ECS, SBRD

Test Equipment Needed:

Dual-Trace Oscilloscope

AC Voltmeter capable of measurements in dBV down to -100dBV (1M ohm input impedance).

DC Voltmeter

Sine Wave Signal Generator

Variac

NOTE: 0dBV = 1Vrms

CW = Clockwise

CCW = Counter-clockwise

STEP 1: Preliminary Set-up

a) Turn down Variac. Plug unit under test into Variac.

b) Bass Q and High Frequency Trim at center detents.

c) Sub Bass, Gundry and Hologram switches out.

d) Apply a 100Hz signal at 1Vrms (0dBV) to the left and right inputs. Monitor the left and right outputs with an oscilloscope in parallel with an AC voltmeter.

STEP 2: Check Power Supply

a) Increase the Variac to 120V AC line voltage.
Watch for excessive current draw (should not exceed 150mA).
Verify power LED lights.

b) Verify an unregulated voltage of +16.5Vdc(+/-1.5V) at the cathodes of D8 and D10.
Verify an unregulated voltage of -16.5Vdc(+/-1.5V) at the anodes of D7 and D9.

c) Verify a regulated voltage of +11.5Vdc (+/- 1V) at pin 7 of any 4136 IC, and -11.5Vdc (+/- 1V) at pin 11 of any 4136 IC.

STEP 3: Dethump

Verify an output of 0dBV on both channels (with 0dBV applied at 100Hz).
Turn unit off for about 5 seconds. Apply power and verify output is attenuated 40dB or more for about 2 seconds.

STEP 4: Speaker Equalization

The ECS version (S/N 001-S/N 500) was designed to be used with the Silver Edition of the Amazing Loudspeaker (below S/N 450-CT and 300-T). It contains "Pre-equalization" circuitry that was removed from the ECS-U version concurrent with the redesigning of the Silver Crossover.

a) Reference measurements at 100 Hz, 1Vrms output.
(All switches out, pots centered).

Table 1: Frequency Response (ECS only)

Freq.	dBV out	
100 Hz	0dB	
300 Hz	-2.5dB (+/-0.5dB)	
500 Hz	-1.9dB (+/-0.5dB)	
900 Hz	-4.3dB (+/-1.0dB)	
1.3 kHz	-3.0dB (+/-0.7dB)	
1.7 kHz	-3.6dB (+/-1.0dB)	
3.1 kHz	-9.0dB (+/-2.0dB)	Gundry IN (SW2)
3.1 kHz	-5.4dB (+/-1.3dB)	Gundry OUT (SW2)
5 kHz	-3.0dB (+/-0.7dB)	
7.5 kHz	-5.6dB (+/-1.5dB)	
20 kHz	-2.0dB (+/-0.6dB)	

Table 2: Frequency Response (ECS-U)

Freq.	dBV out	
20 Hz	0.0dB (+/-0.5dB)	
2.0 kHz	0.0dB (+/-0.5dB)	
3.1 kHz	-3.5dB (+/-0.5dB)	Gundry IN (SW2)
3.1 kHz	0.0dB (+/-0.5dB)	Gundry OUT (SW2)
4.0 kHz	0.0dB (+/-0.5dB)	
20 kHz	-0.5dB (+/-0.5dB)	

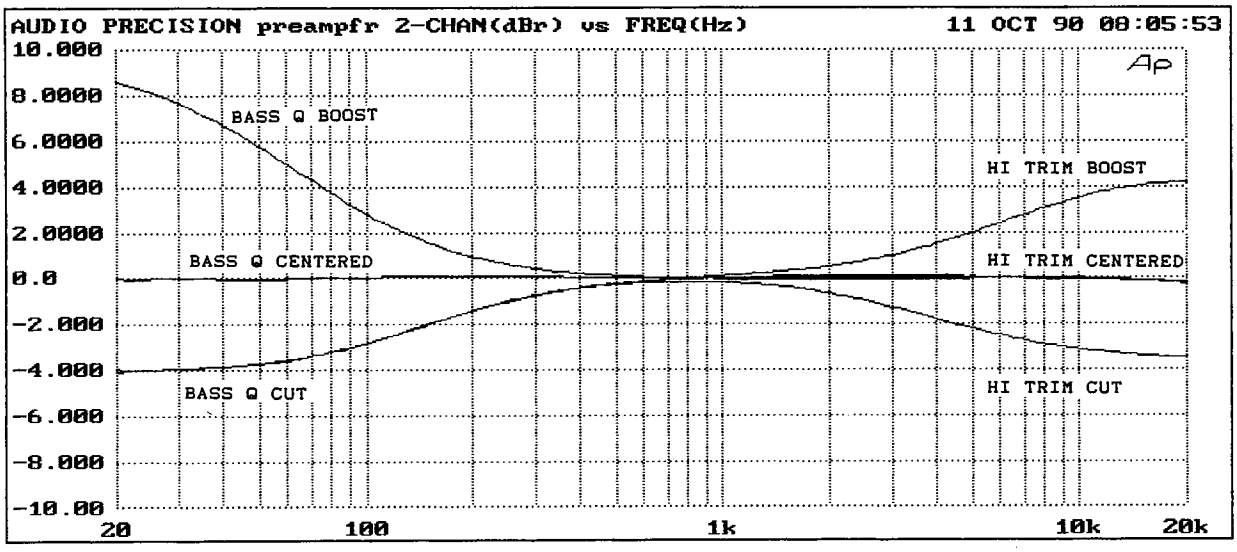


Figure 1 **Frequency Response (ECS-U only)**
Bass Q and High Frequency Trim Boost/Cut

STEP 5: Tone Circuit:

a) Set generator to 20 Hz, 1Vrms output (0dBV).

1) Rotate Bass Q Pot fully CCW.
Verify -4.2dB (+/-0.6dB).

2) Rotate Bass Q Pot fully CW.
Verify +8.4dB (+/-1.0dB).

3) Set Bass Q Pot back to center detent.

b) Set generator to 20KHz, 1Vrms output (0dBV).

1) Rotate High Freq Trim Pot fully CCW.
Verify -2.9dB (+/-0.5dB).

2) Rotate High Freq Trim Pot fully CW.
Verify +4.5dB (+/-0.5dB).

3) Set High Freq Trim Pot back to center detent.

STEP 6: Sub-Bass Test

The ECS version (S/N 001 - S/N 500) will reconstruct low frequency information (100Hz and below) lost by some music reproduction formats. The ECS-U has had the Low Frequency Reconstruction Generator replaced with a Low Frequency Boost circuit.

ECS Version

a) Turn RP3 trimpot fully CW (at rear center of PCB).

b) At each test frequency, readjust the signal generator amplitude for a 0dBV output reference with THE SUB BASS SWITCH OUT.

c) Verify the following readings with the Sub Bass switch pushed in.

Table 3: ECS Sub Bass Frequency Response

Freq.	dBVout
100 Hz	0.0dB (+/-0.5dB)
60 Hz	+7.0dB (+/-1.5dB)
40 Hz	+1.6dB (+/-1.0dB)
20 Hz	+2.5dB (+/-2.0dB)

ECS-U Version

a) At each test frequency, readjust the signal generator amplitude for a 0dBV output reference with THE SUB BASS SWITCH OUT.

b) Verify the following readings with the Sub Bass switch pushed in.

Table 4: ECS-U Sub Bass Frequency Response

Freq.	dBVout
100 Hz	2.2dB (+/-0.5dB)
60 Hz	3.8dB (+/-1.5dB)
40 Hz	5.6dB (+/-1.0dB)
20 Hz	8.6dB (+/-2.0dB)

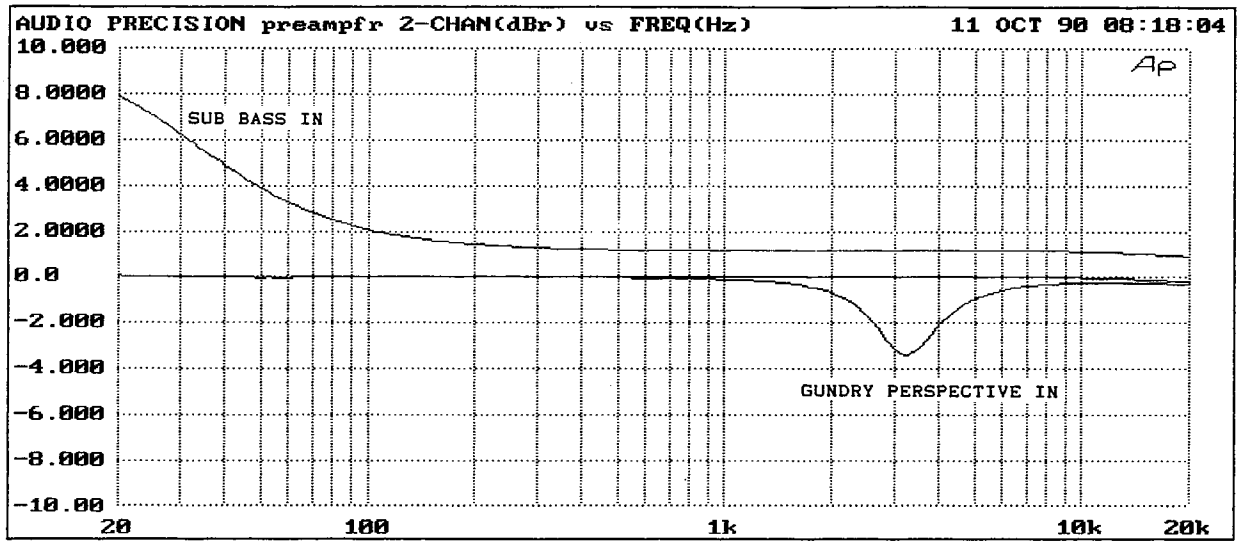


Figure 2 ECS-U Frequency Response with Sub Bass and Gundry Perspective IN/OUT

STEP 7: Hologram

The following tests are designed to verify the critical alignment of the Holographic circuits. Since these circuits purposely cross-feed portions of the stereo signal, expect a considerable amount of "crosstalk" between channels. This is normal and well controlled.

1) Begin with all pushbuttons in the OUT position.
2) Drive both inputs with a 1kHz signal at 1Vrms (0dBV). Verify the presence of identical signals at each output. Switch the HOLOGRAM function to its ON (IN) position.
3) Using a dual-trace oscilloscope, connect one probe to U15-3 and set the scope's triggering to activate and lock on that signal.
4) While driving both channels (at the previously established reference level), adjust the frequency upward while alternately probing U11-3 and U16-12 on the scope's second channel. Compare the phase angles between scope traces until a precise 360° phase shift is exhibited, first at U11 and then at U16. The phase shift networks are tuned correctly if this 360° shift occurs at a frequency between 8.0 kHz and 8.8 kHz on both channels and if both channels' phase shift alignment frequency track within 400 Hz of each other. The nominal frequency is 8.4 kHz @ 360°, which results in 119µS of signal delay.
5) As a further test of the delay networks, their frequency responses may be measured. Because the delay networks are preceded by circuitry with its own frequency response variations, each measurement at a new frequency must be "zeroed" by driving both inputs to the level required to achieve a 0dBV (1Vrms) level at the phase shift network input node, U15-3. The relative responses of the shifters may then be noted at U11-3 and U16-12, and should correspond within 1.5dB to the check-points described by Table 5.

Table 5: Delay Network Test Points/Results

Test Frequency	U15 pin 3	U11 pin 3 U16 pin 12
20 Hz	0dBm	-3.7dB (+/-1.5dB)
800 Hz	0dBm	-3.8dB "
4 kHz	0dBm	-4.2dB "
9 kHz	0dBm	-5.4dB "
14 kHz	0dBm	-6.5dB "

Delay Time: U15 pin 3 to either U11 pin 3 or U16 pin 12; 360° @ 8.4 kHz (i.e. 119µS)

6) There is no provision for adjustment of the phase networks. However, if they deviate from the performance as described in steps 4 and 5, a stage-by-stage comparison between channels (U11-4, 10, 12, and 3 & U15-12, U16-4, 10 and 12) should reveal the detuned element(s). Replacement of the .001µf phase shift capacitors with known close-tolerance parts is the fix.

7) Proceed to verify the overall frequency response and cross-channel feed characteristics per Table 6. Please note that the frequencies of interest are in the smoother portion of the overall response curves. We have already dealt with the alignment of the critical phase shift networks which are responsible for the "comb" filter effect above 4 kHz.

Test conditions are as follows:

Set generator to 2kHz, 1Vrms output (0dBV) reference.

Hologram switched IN (engaged), all others switches OUT (disengaged). Drive one channel alone to measure the "DRIVEN" and the "UNDRIVEN" (cross-feed) responses. Drive both channels simultaneously to measure the composite "BOTH CHANNELS DRIVEN" response. Measured results must be within the tolerances listed in Table 6.

Table 6: Composite Test Points/Results

Freq.	L out/ R out (both driven)	Left only driven	
		L out	R out
20 Hz	+2.0dB(+/-1.0dB)	-10.8dB (+/-2dB)	+0.8dB (+/-1dB)
100 Hz	+1.5dB(+/-1.0dB)	-0.3dB (+/-1dB)	-2.2dB (+/-1dB)
1 kHz	-2.7dB(+/-1.2dB)	+1.6dB (+/-1dB)	-4.5dB(+/-1.5dB)
3 kHz	-1.0dB(+/-1.2dB)	-1.4dB(+/-1.2dB)	-9.0dB(+/-3.0dB)
20 kHz	-2.3dB(+/-2.0dB)	+1.2dB(+/-2.0dB)	-10dB(+/-3.0dB)

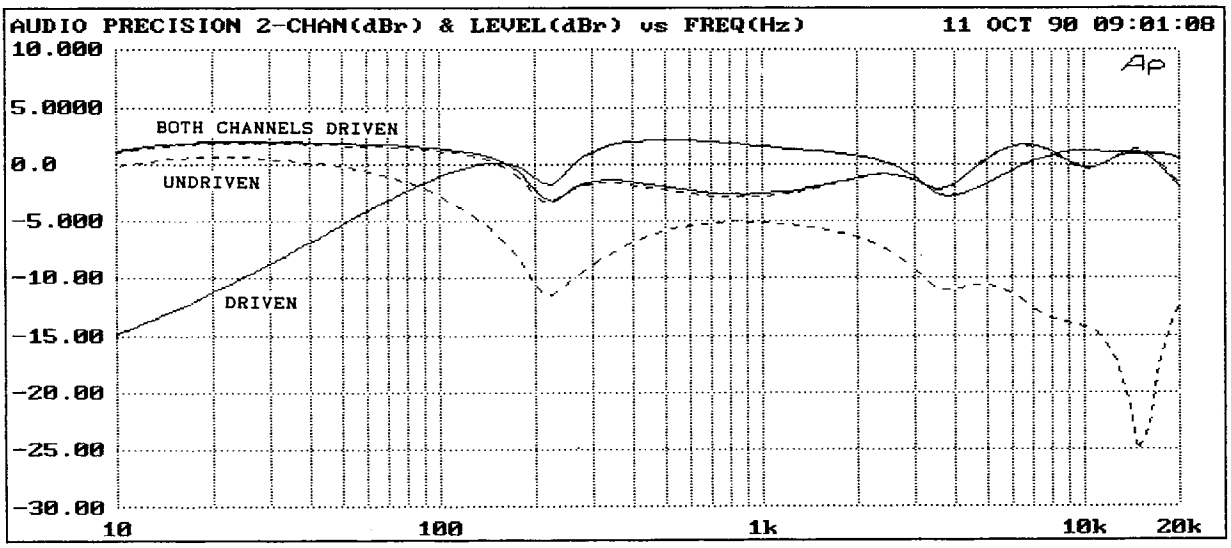


Figure 3 ECS-U Hologram Frequency Response

8) If the frequency response tests show errors, it is advisable to disconnect the phase networks temporarily and repeat the frequency response tests. This is accomplished by desoldering and lifting one end of resistors R82, R84, R92, R137, R140 and R147. With the "comb" filtering defeated in this way, trouble-shooting of the remaining input circuitry is much more straight forward. Test conditions are the same as before.

9) Drive each channel alone and then both channels together. Use the block diagram to pinpoint the location of any error sources in the response if the curves deviate from the values given in Table 7. The acceptable deviation from the nominal values is +/-1.5dB.

Table 7: Phase Network Disabled Test points/Results

Freq	L out/ R out (both driven)	Left only driven L out	Left only driven R out
20 Hz	+1.8dB(+/-1.5dB	-5.6dB(+/-1.5dB)	-3.0dB(+/-1.5dB)
100 Hz	+1.2dB(+/-1.5dB)	-4.0dB(+/-1.5dB)	-5.0dB(+/-1.5dB)
1 kHz	-6.8dB(+/-1.5dB)	-7.6dB(+/-1.5dB)	-22dB(+/-1.5dB)
3 kHz	-12dB(+/-1.5dB)	-11.2dB(+/-1.5dB)	-25dB(+/-1.5dB)
20 kHz	-8.8dB(+/-1.5dB)	-8.0dB(+/-1.5dB)	-29dB(+/-1.5dB)

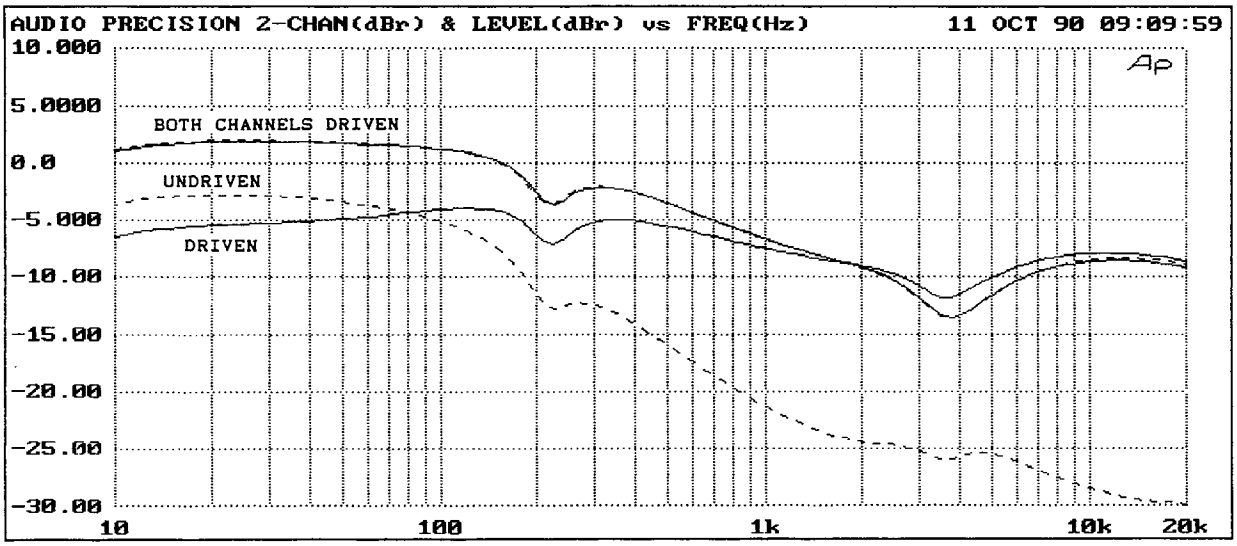


Figure 4 ECS-U Hologram Frequency Response with Phase Networks Disabled

STEP 8: Check Noise Floor

a) Using an AC voltmeter capable of making noise measurements in the microvolt range, verify the following noise measurements.

With shorted inputs, all switches out, Bass Q and High Frequency Trim pots centered:

	Flat (to 80kHz)	A-Weighted
	37uV (-88dBV)	10uV (-100dBV)

As above, with Hologram switch engaged:

	150uV (-76dBV)	32uV (-90dBV)

As above, release Hologram switch, engage Sub Bass

	65uV (-84dBV)	18uV (-95dBV)

***** END OF TEST *****

TEST PROCEDURE FOR THE SUB-BASS ROOM DAMPER BOX (SBRD)

Test Equipment Needed: AC Voltmeter capable of measurements in dBV, with at least 1M ohm input impedance.

Sine Wave Signal Generator

STEP 1. Connect signal source to the input of the "box".

STEP 2. Drive unit with 1.0Vrms at 3kHz (0dBV).
Connect AC Voltmeter to "Normal" output jacks (Q=.7).
Verify -0.1dB (+/- 0.1dB).

STEP 3. Change frequency to 300 Hz.
Verify -1.3dB (+/- 0.2dB).

STEP 4. Change frequency to 30 Hz.
Verify -0.6dB (+/- 0.2dB).

STEP 5. Check stereo separation by muting either channel.
Separation should be greater than 60dB. Remove mute.

STEP 6. Move AC Voltmeter to "Max" output jacks (Q=.5).

STEP 7. Change frequency to 3 kHz
Verify -0.1dB (+/- 0.1dB).

STEP 8. Change frequency to 300 Hz.
Verify -0.6dB (+/- 0.2dB).

STEP 9. Change frequency to 30 Hz.
Verify -4.3dB (+/- 0.3dB).

STEP 10. Check stereo separation by muting either channel.
Separation should be greater than 60dB. Remove mute.

***** END OF TEST *****

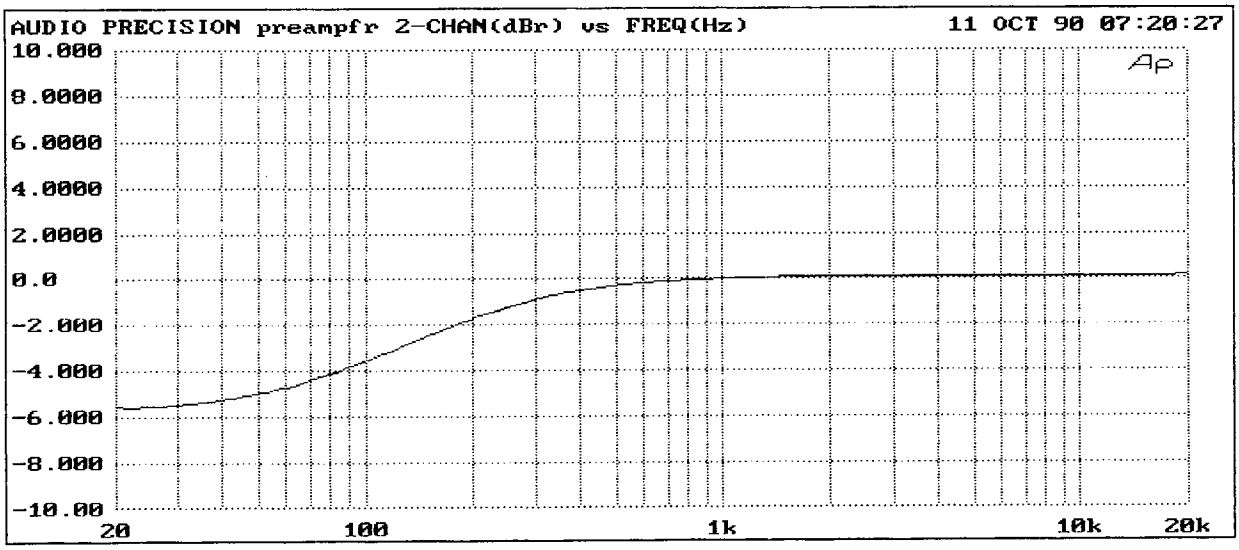


Figure 5 Sub Bass Room Damper Frequency Response
Q = .5

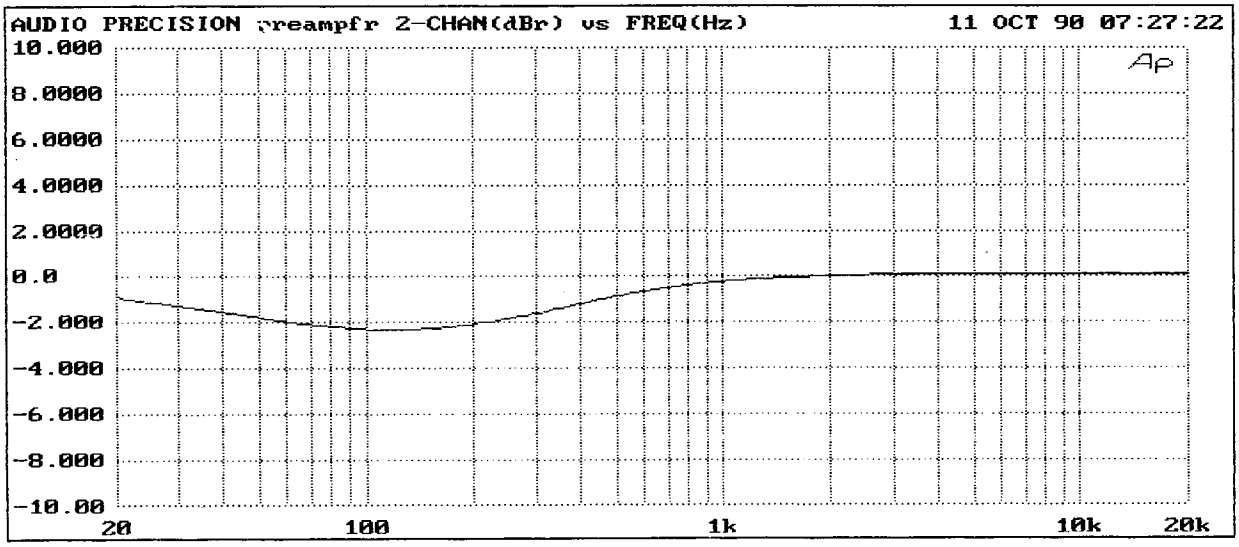


Figure 6 Sub Bass Room Damper Frequency Response
Q = .7

Section 9
APPENDICES

Appendix A
PARTS ORDERING

Please provide the Model numbers of the units involved when ordering genuine CARVER replacement parts.
Also provide the CARVER part number and the generic part number to confirm the correct part needed.
The Carver Parts Department is open from Monday thru Friday, 7:00 a.m.to 4:45 p.m. PST.
The following phone number is to be used for part orders only!
Technical assistance is not available on this line.

1-800-433-0547

Or if you prefer to FAX in your part order, please use the following phone number.

1-206-775-9180

From time to time, when it is necessary, we may make a substitution for the original part ordered, due to circuit revisions or part availability.

Random deviation from the original CARVER designated part is not recommended!
Complete PCB replacement is not recommended. You must have prior approval for warranty repair should PCB replacement be necessary.

Appendix B

PARTS LISTS

ALS SILVER CONTROL BOX
ECS BELOW S/N 500

NOTE: For use with speakers below S/N 450-CT & 300-T.

FROM BOM 11/27/89 Part Number: 604-00423-00

CAPACITORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
201-00006-00	CAP CER DISC	39 pF 10% 1 KV	C10
201-00012-00	CAP CER DISC	100 pF 10% 1 KV	C77
201-00021-00	CAP CER DISC	330 pF 10% 1 KV	C416, 516
201-00023-00	CAP CER DISC	470 pF 10% 1 KV	C406, 408, 506, 508
201-00025-00	CAP CER DISC	560 pF 10% 1 KV	C42, 62
201-00026-00	CAP CER DISC	680 pF 10% 1 KV	C45
201-00028-00	CAP CER DISC	820 pF 10% 1 KV	C407, 507
204-00054-00	CAP MYLAR	.001 µF 5%	C31-38, 51-58
204-00055-00	CAP MYLAR	.0012 µF 5%	C41, 46, 47, 61
204-00057-00	CAP MYLAR	.0018 µF 5%	C411, 511
204-00076-00	CAP MYLAR	.0022 µF 5%	C404, 504
204-00058-00	CAP MYLAR	.0027 µF 5%	C48, 417, 517
204-00059-00	CAP MYLAR	.0033 µF 5%	C84, 85
204-00077-00	CAP MYLAR	.0039 µF 5%	C405, 505
204-00061-00	CAP MYLAR	.0056 µF 5%	C30, 72
204-00078-00	CAP MYLAR	.0082 µF 5%	C412, 512
204-00062-00	CAP MYLAR	.01 µF 5%	C409, 509
204-00063-00	CAP MYLAR	.012 µF 5%	C40, 60
204-00019-00	CAP MYLAR	.022 µF 5%	C5, 6, 8, 9, 25, 26, 39, 43, 44, 59, 403, 503
204-00079-00	CAP MYLAR	.056 µF 5%	C410, 510
204-00066-00	CAP MYLAR	.068 µF 5%	C50
204-00041-00	CAP MYLAR	.082 µF 5%	C28
204-00068-00	CAP MYLAR	12 µF 5%	C49
204-00069-00	CAP MYLAR	.15 µF 5%	C3,12
204-00071-00	CAP MYLAR	.22 µF 5%	C4, 7, 414, 415, 514, 515
204-00074-00	CAP MYLAR	.27 µF 5%	C21, 22
204-00072-00	CAP MYLAR	.33 µF 5%	C413, 513
204-00073-00	CAP MYLAR	.47 µF 5%	C18, 19, 95
205-00053-00	CAP LYTIC RAD	1µF/16V	C69, 70
205-00093-00	CAP LYTIC RAD	2.2µF/16V	C16
205-00107-00	CAP LYTIC RAD NP	2.2µF/25V	C20
205-00098-00	CAP LYTIC RAD NP	4.7µF/25V	C17
205-00094-00	CAP LYTIC RAD	10µF/25V	C1, 2, 11, 73
205-00011-00	CAP LYTIC RAD	22µF/16V	C79, 82, 83
205-00012-00	CAP LYTIC RAD	22µF/35V	C87-94, 418, 419, 518, 519
205-00013-00	CAP LYTIC RAD	47µF/16V	C74

CAPACITORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
205-00016-00	CAP LYTIC RAD	100µF/16V	C75
205-00017-00	CAP LYTIC RAD	220µF/16V	C76
205-00025-00	CAP LYTIC RAD	1000µF/25V	C65, 66, 67, 68

RESISTORS

(ALL RESISTORS ARE 1/8W UNLESS OTHERWISE NOTED)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00038-00	RES CFILM	47 OHM 1/8W	R20, 21
250-00045-00	RES CFILM	91 OHM 1/8W	R434, 534
250-00046-00	RES CFILM	100 OHM 1/8W	R431, 531
250-00057-00	RES CFILM	300 OHM 1/8W	R81, 134
250-00059-00	RES CFILM	360 OHM 1/8W	R73, 89, 94, 130, 144, 149
250-00062-00	RES CFILM	470 OHM 1/8W	R122, 166
250-00063-00	RES CFILM	510 OHM 1/8W	R432, 532
250-00069-00	RES CFILM	910 OHM 1/8W	R55, 105
250-00070-00	RES CFILM	1.0 K 1/8W	R35, 101, 112, 158, 170, 435, 535
250-00071-00	RES CFILM	1.1 K 1/8W	R114
250-00072-00	RES CFILM	1.2 K 1/8W	R72, 80, 86, 93, 129, 133, 143, 148, 428, 528
250-00073-00	RES CFILM	1.5 K 1/8W	R174
250-00075-00	RES CFILM	1.6 K 1/8W	R117, 118
250-00077-00	RES CFILM	2.0 K 1/8W	R15, 17, 32
250-00078-00	RES CFILM	2.2 K 1/8W	R40
250-00079-00	RES CFILM	2.4 K 1/8W	R406, 506
250-00080-00	RES CFILM	2.7 K 1/8W	R57, 107
250-00081-00	RES CFILM	3.0 K 1/8W	R66, 121
250-00082-00	RES CFILM	3.3 K 1/8W	R56, 65, 106, 419, 429, 430, 519, 529, 530
250-00083-00	RES CFILM	3.6 K 1/8W	R54, 104
250-00084-00	RES CFILM	3.9 K 1/8W	R59-63, 109, 115, 116, 119, 120, 418, 518
250-00085-00	RES CFILM	4.3 K 1/8W	R407, 413, 416, 507, 513, 516
250-00086-00	RES CFILM	4.7 K 1/8W	R410, 426, 510, 526
250-00087-00	RES CFILM	5.1 K 1/8W	R16, 68, 74, 78, 87, 123, 127, 135, 141, 401, 425,427,501,525,527
250-00088-00	RES CFILM	5.6 K 1/8W	R409, 509
250-00090-00	RES CFILM	6.8 K 1/8W	R95, 98, 152, 155
250-00091-00	RES CFILM	7.5 K 1/8W	R69, 71, 75, 77, 79, 85, 88, 90, 92, 124, 126, 128, 132,136,139,142,146,147,412,512
250-00092-00	RES CFILM	8.2 K 1/8W	R408, 508
250-00093-00	RES CFILM	9.1 K 1/8W	R96, 113, 153, 176, 415, 515
250-00094-00	RES CFILM	10 K 1/8W	R18, 82, 84, 100, 111, 137, 140, 157, 178
250-00095-00	RES CFILM	11 K 1/8W	R36, 37
250-00096-00	RES CFILM	12 K 1/8W	R191, 405, 505
250-00097-00	RES CFILM	13 K 1/8W	R10, 53, 103
250-00099-00	RES CFILM	16 K 1/8W	R64
250-00101-00	RES CFILM	20 K 1/8W	R4, 5, 25, 46-51, 67, 70, 76, 83, 91, 93, 110, 125, 131,138,145,179,180
250-00102-00	RES CFILM	22 K 1/8W	R41, 42, 433, 533
250-00103-00	RES CFILM	24 K 1/8W	R58, 108
250-00104-00	RES CFILM	27 K 1/8W	R150, 151

RESISTORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00108-00	RES CFILM	39 K 1/8W	R38, 43
250-00110-00	RES CFILM	47 K 1/8W	R39, 44, 45, 169
250-00114-00	RES CFILM	68 K 1/8W	R31, 183, 424, 524
250-00118-00	RES CFILM	100 K 1/8W	R2, 3, 182, 185-190, 436, 536
250-00119-00	RES CFILM	110 K 1/8W	R6, 7
250-00121-00	RES CFILM	130 K 1/8W	R11, 12, 417, 517
250-00122-00	RES CFILM	150 K 1/8W	R437, 537
250-00123-00	RES CFILM	180 K 1/8W	R420, 520
250-00125-00	RES CFILM	200 K 1/8W	R19, 173
250-00127-00	RES CFILM	240 K 1/8W	R197, 200
250-00128-00	RES CFILM	270 K 1/8W	R175
250-00129-00	RES CFILM	300 K 1/8W	R97, 99, 154, 156, 400, 411, 414, 500, 511, 514
250-00132-00	RES CFILM	390 K 1/8W	R14
250-00134-00	RES CFILM	470 K 1/8W	R13
250-00138-00	RES CFILM	750 K 1/8W	R8
250-00139-00	RES CFILM	910 K 1/8W	R9
250-00142-00	RES CFILM	1.0 M 1/8W	R177, 195, 196
251-10050-00	RES CFILM	150 OHM 1/2W	R165, 167
251-10156-00	RES CFILM	3.9 M 1/2W	R171
259-10010-00	POT DUAL	20KB VERT	RP1, RP2
259-30005-00	POT TRIM	200K PCB MT	RP3

DIODES

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
320-20001-00	DIODE	IN4148 75V	D1-3,14,16-18
320-20004-00	DIODE	IN4004 400V	D7,8,9,10,13,15
320-30001-00	ZENER	1N4742 12V	D11,12
320-40001-00	LED RED		D19

TRANSISTORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
321-40009-00	XISTOR	2N4125 PNP	Q2, 9
321-40010-00	XISTOR	2N4123 NPN	Q1, 8, 10, 11
321-60000-00	XISTOR	MJE3055 NPN	Q6
321-60002-00	XISTOR	MJE2955 PNP	Q7
321-90002-00	XISTOR	2SC2878A NPN	Q400, 500

INTEGRATED CIRCUITS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
330-30004-00	IC CA3080A	U13
330-20001-00	IC 4013BPC	U14
330-30003-00	IC XR4136	U1-12, 15, 16, 18
330-30008-00	IC 4558	U17

INDUCTORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
601-00397-00	CHOKE 5-TURN	L1
601-00398-00	CHOKE 8-TURN	L2
617-10035-00	TRANSFORMER	

MISCELLANEOUS ITEMS

CARVER P/N	DESCRIPTION	QUANTITY
101-30002-00	BUMPONS, RUBBER FEET	4
105-40001-00	FUSEHOLDER CLIP PC MT	2
109-10007-00	PHONO JACK QUAD PC MT	1
111-20001-00	SOLDER LUG #4	1
118-90001-00	STRAIN RELIEF	1
151-00052-00	SCREW MACH SCKT HD BLK 6-32x3/8	4
151-20001-00	SCREW MACH PP BLK 440x1/4	5
151-30002-00	SCREW SHT MTL PP ZC 4x3/8"	2
151-30052-00	SCREW SHT MTL PP BLK 6x3/8"(Cover)	8
152-10002-00	KEPNUT 6-32x5/16 ZC	4
159-50001-00	TYRAP 3-3/8"	3
159-50004-00	TYRAP 7-3/8"	1
160-00001-00	CONVENIENCE OUTLET	1
315-10503-00	FUSE AGC 1/4 A	1
318-10000-00	SWITCH PUSH 1 KEY	3
401-10103-00	WIRE 18 AWG TEW BLK 4.5"	2
401-10646-00	WIRE 22 AWG TR-64 BLK 1.5"	1
401-30001-00	JUMPER .2"	2
401-90010-00	LINECORD 18/2 POLARIZED	1
502-30035-01	CHASSIS SCREENED	1
503-40024-01	PANEL, SCREENED	1
504-20031-01	COVER, TOP PAINTED	1
508-20001-01	BUTTON MOLDED	3
508-20023-00	KNOB SPEAKER SELECT	2

PACKING

CARVER P/N	DESCRIPTION	QUANTITY
532-20029-00	BOX, TALS CONTROL	1
532-20030-00	FOAM, TALS CONTROL	2
990-20049-00	OWNERS MANUAL	1

ALS CONTROL BOX ECS-U S/N 500 AND ABOVE

Part Number: 607-00425-01 (Final ECS-U 120V)

CAPACITORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
201-00021-00	CAP CER DISC	330 pF 10% 1KV	C416, 516
201-00023-00	CAP CER DISC	470 pF 10% 1KV	C406, 506
201-00025-00	CAP CER DISC	560 pF 10% 1KV	C42, 62
201-00026-00	CAP CER DISC	680 pF 10% 1KV	C45
201-00035-00	CAP CER DISC	.01 uF 125V UL	
204-00054-00	CAP MYLAR	.001 uF 5%	C31-38, 51-58
204-00055-00	CAP MYLAR	.0012 uF 5%	C41, 46, 47, 61
204-00058-00	CAP MYLAR	.0027 uF 5%	C48, 417, 517
204-00077-00	CAP MYLAR	.0039 uF 5%	C405, 505
204-00061-00	CAP MYLAR	.0056 uF 5%	C30, 72
204-00063-00	CAP MYLAR	.012 uF 5%	C40, 60
204-00019-00	CAP MYLAR	.022 uF 5%	C25, 26, 39, 43, 44, 59
204-00066-00	CAP MYLAR	.068 uF 5%	C50
204-00041-00	CAP MYLAR	.082 uF 5%	C28
204-00027-00	CAP MYLAR	.1 uF 5%	C98, 99
204-00068-00	CAP MYLAR	.12 uF 5%	C49, 96, 97
204-00071-00	CAP MYLAR	.22 uF 5%	C414, 415, 514, 515
204-00072-00	CAP MYLAR	.33 uF 5%	C413, 513
205-00053-00	CAP LYTIC	1uF/16V RAD	C69, 70
205-00094-00	CAP LYTIC	10uF/25V RAD	C73
205-00012-00	CAP LYTIC	22uF/35V RAD	C87-94, 418, 419, 518, 519
205-00013-00	CAP LYTIC	47uF/16V RAD	C74
205-00016-00	CAP LYTIC	100uF/16V RAD	C75
205-00017-00	CAP LYTIC	220uF/16V RAD	C76
205-00025-00	CAP LYTIC	1000uF/25V RAD	C65, 66, 67, 68

RESISTORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00020-00	RES CFILM	10 OHM 1/8W	R409, 509
250-00045-00	RES CFILM	91 OHM 1/8W	R434, 534
250-00046-00	RES CFILM	100 OHM 1/8W	R431, 531
250-00062-00	RES CFILM	470 OHM 1/8W	R122, 166
250-00063-00	RES CFILM	510 OHM 1/8W	R432, 532
250-00069-00	RES CFILM	910 OHM 1/8W	R55, 105
250-00070-00	RES CFILM	1.0 K 1/8W	R101, 112, 158, 170, 435, 535
250-00071-00	RES CFILM	1.1 K 1/8W	R114
250-00072-00	RES CFILM	1.2 K 1/8W	R428, 528
250-00073-00	RES CFILM	1.5 K 1/8W	R174
250-00079-00	RES CFILM	2.4 K 1/8W	R406, 506
250-00080-00	RES CFILM	2.7 K 1/8W	R57, 107, 408, 508
250-00082-00	RES CFILM	3.3 K 1/8W	R56, 65, 106, 429, 430, 529, 530
250-00083-00	RES CFILM	3.6 K 1/8W	R54, 104

RESISTORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00084-00	RES CFILM	3.9 K 1/8W	R59-R63, 109, 115, 116, 418, 518
250-00085-00	RES CFILM	4.3 K 1/8W	R403, 503
250-00086-00	RES CFILM	4.7 K 1/8W	R410, 426, 510, 526
250-00087-00	RES CFILM	5.1 K 1/8W	R401, 425, 427, 501, 525, 527
250-00090-00	RES CFILM	6.8 K 1/8W	R95, 98, 152, 155
250-00091-00	RES CFILM	7.5 K 1/8W	R412, 512
250-00093-00	RES CFILM	9.1 K 1/8W	R96, 113, 153, 176, 415, 515
250-00094-00	RES CFILM	10 K 1/8W	R100, 111, 157, 178
250-00096-00	RES CFILM	12 K 1/8W	R191, 405, 505
250-00097-00	RES CFILM	13 K 1/8W	R53, 103
250-00099-00	RES CFILM	16 K 1/8W	R64
250-00100-00	RES CFILM	18 K 1/8W	R46, 51
250-00101-00	RES CFILM	20 K 1/8W	R67, 110, 179, 180
250-00102-00	RES CFILM	22 K 1/8W	R42, 433, 533
250-00103-00	RES CFILM	24 K 1/8W	R58, 108
250-00104-00	RES CFILM	27 K 1/8W	R47, 50
250-00110-00	RES CFILM	47 K 1/8W	R39, 169
250-00114-00	RES CFILM	68 K 1/8W	R424, 524
250-00118-00	RES CFILM	100 K 1/8W	R182, 185-R190, 436, 536
250-00122-00	RES CFILM	150 K 1/8W	R437, 537
250-00123-00	RES CFILM	180 K 1/8W	R420, 520
250-00127-00	RES CFILM	240 K 1/8W	R197, 200
250-00128-00	RES CFILM	270 K 1/8W	R175
250-00129-00	RES CFILM	300 K 1/8W	R97, 99, 154, 156, 400, 411, 414, 500, 511, 514
250-00142-00	RES CFILM	1.0 M 1/8W	R177, 195, 196
251-00070-03	RES CFILM	1 K 1/4W	R438, 538
251-00101-03	RES CFILM	20 K 1/4W	R201, 202
251-00105-00	RES CFILM	30 K 1/4W	R203, 204
251-00109-00	RES CFILM	43 K 1/4W	R205, 206
251-10156-00	RES CFILM	3.9 Meg 1/2W	R171
252-00031-00	RES MFILM	301 OHM 1/8W 1%	R81, 134
252-00037-00	RES MFILM	357 OHM 1/8W 1%	R73, 89, 94, 130, 144, 149
252-00102-00	RES MFILM	1.21 K 1/8W 1%	R72, 80, 86, 93, 129, 133, 143, 148
252-00106-00	RES MFILM	1.62 K 1/8W 1%	R117, 118
252-00113-00	RES MFILM	3.01 K 1/8W 1%	R66, 121
252-00118-00	RES MFILM	3.92 K 1/8W 1%	R119, 120
252-00125-00	RES MFILM	5.11 K 1/8W 1%	R68, 74, 78, 87, 123, 127, 135, 141
252-00130-00	RES MFILM	7.50 K 1/8W 1%	R69, 71, 75, 77, 79, 85, 88, 90, 92, 124, 126, 128, 132, 136, 139, 142, 146, 147
252-00138-00	RES MFILM	10.0 K 1/8W 1%	R82, 84, 137, 140
252-00145-00	RES MFILM	20.0 K 1/8W 1%	R70, 76, 83, 91, 125, 131,138,145
252-00152-00	RES MFILM	26.7 K 1/8W 1%	R150, 151
259-10010-00	POT DUAL	20KB VERT	RP1, RP2

DIODES

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
320-20001-00	DIODE	IN4148 75V	D14, 16, 17, 18
320-20004-00	DIODE	IN4004 400V	D7, 8, 9, 10, 13, 15
320-30001-00	ZENER	1N4742 12V	D11, 12
320-40001-00	LED RED		D19

TRANSISTORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
321-40009-00	XISTOR	2N4125 PNP	Q9
321-40010-00	XISTOR	2N4123 NPN	Q8, 10, 11
321-60000-00	XISTOR	MJE3055 NPN	Q6
321-60002-00	XISTOR	MJE2955 PNP	Q7
321-90002-00	XISTOR	2SC2878A NPN	Q400, 500

INTEGRATED CIRCUITS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
330-30003-00	OP AMP	XR4136	U1, 2, 3, 6, 7, 9, 10, 11, 12, 15, 16, 18
330-30008-00	OP AMP	XR1458/4558	U17

MISCELLANEOUS ITEMS

CARVER P/N	DESCRIPTION	QUANTITY
101-30002-00	BUMPONS, RUBBER ROUND SMALL	4
105-40001-00	FUSEHOLDER CLIP PC MT	2
109-10007-00	PHONO JACK QUAD PC MT	1
111-20001-00	SOLDER LUG #4	1
118-90001-00	STRAIN RELIEF	1
151-00052-00	SCREW MACH SCKT HD BLK 6-32x3/8	4
151-20001-00	SCREW MACH PP BLK 440x1/4	5
151-30002-00	SCREW SHT MTL PP ZC 4x3/8"	2
151-30051-05	SCREW SHT MTL PP BLK 6x1/4" (Cover)	8
152-10002-00	KEPNUT 6-32x5/16 ZC	4
159-50001-00	TYRAP 3-3/8"	2
159-50004-00	TYRAP 7-3/8"	1
160-00001-00	CONVENIENCE OUTLET (Wide blade on top)	1
315-10503-00	FUSE AGC 1/4 A	1
318-10000-00	SWITCH PUSH 1 KEY	3
401-10103-00	WIRE 18 AWG TEW BLK 4.5"	2
401-10185-00	WIRE 18 AWG TR-65 BLK 10.0"	1
401-10646-00	WIRE 22 AWG TR-64 BLK 1.5"	1
401-30002-00	JUMPER INSULATED .3"	8
401-30003-00	JUMPER INSULATED .4"	3
401-30005-00	JUMPER INSULATED .5"	1
401-30011-00	JUMPER INSULATED .15"x.250"	3
401-30012-00	JUMPER NON-INSULATED .10"	8
401-90010-00	LINECORD 18/2 POLARIZED	1
502-30035-01	CHASSIS SCREENED	1

MISCELLANEOUS ITEMS (Cont.)

CARVER P/N	DESCRIPTION	QUANTITY
503-40024-01	PANEL, SCREENED	1
504-20031-01	COVER, TOP PAINTED	1
508-20001-10	BUTTON MOLDED	3
508-20023-00	KNOB SPEAKER SELECT	2
617-10035-00	TRANSFORMER	1

PACKING

CARVER P/N	DESCRIPTION	QUANTITY
532-20050-00	BOX, TALS CONTROL	1
532-30033-00	FOAM, TALS CONTROL	2
990-20060-00	OWNERS MANUAL	1

SUB BASS ROOM DAMPER (SBRD)

REV. A (with RCA male cables for input)

CAPACITORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
204-00028-00	CAP MYLAR .12uF 10%	C1-C6

RESISTORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
251-00086-00	RES CFILM 4.7 K 1/4W	R1, R5
251-00098-00	RES CFILM 15 K 1/4W	R3, R7
251-00099-00	RES CFILM 16 K 1/4W	R2, R6
251-00102-00	RES CFILM 22 K 1/4W	R4, R8

REV. B (with RCA female jacks for input)

CAPACITORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
204-00051-00	CAP MYLAR .056uF 10%	C1-C4
204-00026-00	CAP MYLAR .082uF 10%	C5, C6

RESISTORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
251-00094-00	RES CFILM 10 K 1/4W	R1, R5
251-00105-00	RES CFILM 30 K 1/4W	R3, R7
251-00106-00	RES CFILM 33 K 1/4W	R2, R6
251-00109-00	RES CFILM 43 K 1/4W	R4, R8

MISCELLANEOUS

CARVER P/N	DESCRIPTION	NOTES
	DUAL RCA PHONO LEADS (REV. A only)	
109-10002-00	DUAL RCA JACK (REV. B only)	
109-10003-00	QUAD RCA JACK	
502-30032-01	CHASSIS	
504-20030-01	TOP COVER	
601-00551-00	PCB (STUFFED)	

Appendix C

DESIGN HISTORY

Engineering Change Orders for Model ECS/ECS-U Electronic Speaker Control System Assembly
Note: Revision levels for assemblies may be different than revision levels for schematic diagrams.

ECO#:891	DATE:11/17/88	REV.B Board Assembly
REASON FOR CHANGE:	Black wire too short.	
PROCEDURE:	Change wire from 3.5" to 4.5".	

ECO#:896	DATE:11/28/88	REV.C Board Assembly
REASON FOR CHANGE:	Move parts to correct BOM. Diode too short.	
PROCEDURE:	Change D11,12 prep length from .3" to .4".	

ECO#:926	DATE:1/27/89	REV.D Board Assembly
REASON FOR CHANGE:	Improve reliability of U-1.	
PROCEDURE:	Cut traces between input jacks and U-1 and add 1k ohm resistors.	

The next change created the ECS-U universal control box.

ECO#:923-1	DATE:1/25/89	REV.E Board Assembly - Effective S/N 500
REASON FOR CHANGE:	Allow the Amazing Loudspeaker Silver Edition to be used without a control box.	
PROCEDURE:	Remove parts in speaker equalization circuit and sub-bass enhancement circuit, and redesign silver crossover.	

ECO#:979	DATE:3/9/89	REV.F Board Assembly - Effective S/N 600
REASON FOR CHANGE:	To reduce 60Hz hum.	
PROCEDURE:	Add R46,51,403,503. Add ground wire. Change transformer orientation.	

ECO#:1000	DATE:3/22/89	- Effective S/N 795
REASON FOR CHANGE:	Eliminate intermittant oscillation in sub-bass circuit.	
PROCEDURE:	Replace R44 with jumper. Add jumper near U-7.	

ECO#:1056	DATE:5/8/89	REV.G Board Assembly
REASON FOR CHANGE:	Move parts to correct BOM. Add tywrap to transformer.	
PROCEDURE:	No effect on assembly.	

ECO#:1123	DATE:6/15/89	REV.G1 Board Assembly - Effective S/N 2060
REASON FOR CHANGE:	Improve performance of hologram circuit.	
PROCEDURE:	Replace 5% tolerance resistors with 1% parts.	

ECO#:1214	DATE:8/31/89	REV.H Board Assembly
REASON FOR CHANGE:	Change BOM level.	
PROCEDURE:	No effect on assembly.	

ECO#:1280	DATE:10/25/89	REV.J Board Assembly
REASON FOR CHANGE:	Eliminate duplicate part number.	
PROCEDURE:	No effect on assembly.	
ECO#:1428	DATE:4/18/90	REV.K PCB Assembly
		REV.C Final Assembly
REASON FOR CHANGE:	Correct Bill of Materials.	
PROCEDURE:	No effect on assembly.	
ECO#:1490	DATE:6/5/90	REV.L PCB Assembly
		REV.D Final Assembly
REASON FOR CHANGE:	Change jumper length on PCB. Change screw length on Final Assembly.	
PROCEDURE:	Change jumper from .7" to .15"x.250". Change screw from 6x3/8" to 6x1/4".	

ECS/ECS-U Electronic Speaker Control System Assembly

(The evolution, up to REV.L)

P/N 602-00626-02

REV.B 11/17/88
REV.C 11/28/88
REV.D 01/27/89
REV.E 1/25/89
REV.F 3/09/89
REV.G 5/08/89
REV.H 08/31/89
REV.J 10/25/89
REV.K 4/18/90
REV.L 6/5/90

Note: REV.E created the ECS-U version.

CAPACITORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
201-00006-00	CAP CER DISC	39 pF 10% 1 KV	C10
Omit at REV.E			
201-00012-00	CAP CER DISC	100 pF 10% 1 KV	C77
Omit at REV.E			
201-00021-00	CAP CER DISC	330 pF 10% 1 KV	C416, 516
201-00023-00	CAP CER DISC	470 pF 10% 1 KV	C406, 408, 506, 508
Omit at REV.E: C408, 508			
201-00025-00	CAP CER DISC	560 pF 10% 1 KV	C42, 62
201-00026-00	CAP CER DISC	680 pF 10% 1 KV	C45
201-00028-00	CAP CER DISC	820 pF 10% 1 KV	C407, 507
Omit at REV.E			
204-00054-00	CAP MYLAR	.001 uF 5%	C31-38, 51-58
204-00055-00	CAP MYLAR	.0012 uF 5%	C41, 46, 47, 61
204-00057-00	CAP MYLAR	.0018 uF 5%	C411, 511
Omit at REV.E			
204-00076-00	CAP MYLAR	.0022 uF 5%	C404, 504
Omit at REV.E			
204-00058-00	CAP MYLAR	.0027 uF 5%	C48, 417, 517
204-00059-00	CAP MYLAR	.0033 uF 5%	C84, 85
Omit at REV.E			
204-00077-00	CAP MYLAR	.0039 uF 5%	C405, 505
204-00061-00	CAP MYLAR	.0056 uF 5%	C30, 72
204-00078-00	CAP MYLAR	.0082 uF 5%	C412, 512
Omit at REV.E			
204-00062-00	CAP MYLAR	.01 uF 5%	C409, 509
Omit at REV.E			

CAPACITORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
204-00063-00	CAP MYLAR	.012 uF 5%	C40, 60
204-00019-00	CAP MYLAR	.022 uF 5%	C5, 6, 8, 9, 25, 26, 39, 43, 44, 59, 403, 503
Omit at REV.E: C5, 6, 8, 9, 403, 503			
204-00079-00	CAP MYLAR	.056 uF 5%	C410, 510
Omit at REV.E			
204-00066-00	CAP MYLAR	.068 uF 5%	C50
204-00041-00	CAP MYLAR	.082 uF 5%	C28
	Add at REV.E:		
204-00027-00	CAP MYLAR	.1 uF 5%	C98, 99
204-00068-00	CAP MYLAR	.12 uF 5%	C49
	Add at REV.E:		C96, 97
204-00069-00	CAP MYLAR	.15 uF 5%	C3, 12
Omit at REV.E			
204-00071-00	CAP MYLAR	.22 uF 5%	C4, 7, 414, 415, 514, 515
Omit at REV.E: C4, 7			
204-00074-00	CAP MYLAR	.27 uF 5%	C21, 22
Omit at REV.E			
204-00072-00	CAP MYLAR	.33 uF 5%	C413, 513
204-00073-00	CAP MYLAR	.47 uF 5%	C18, 19, 95
Omit at REV.E			
205-00053-00	CAP LYTIC RAD	1uF/16V	C69, 70
205-00093-00	CAP LYTIC RAD	2.2UF/16V	C16
Omit at REV.E			
205-00107-00	CAP LYTIC RAD	2.2uF/25VNP	C20
Omit at REV.E			
205-00098-00	CAP LYTIC RAD	4.7uF/25VNP	C17
Omit at REV.E			
205-00094-00	CAP LYTIC RAD	10uF/25V	C1, 2, 11, 73
Omit at REV.E: C1, 2, 11			
205-00011-00	CAP LYTIC RAD	22uF/16V	C79, 82, 83
Omit at REV.E			

CAPACITORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
205-00012-00	CAP LYTIC RAD	22uF/35V	C87-94, 418, 419, 518, 519
205-00013-00	CAP LYTIC RAD	47uF/16V	C74
205-00016-00	CAP LYTIC RAD	100uF/16V	C75
205-00017-00	CAP LYTIC RAD	220uF/16V	C76
205-00025-00	CAP LYTIC RAD	1000uF/25V	C65, 66, 67, 68

RESISTORS

(ALL RESISTORS ARE 1/8W 5% UNLESS OTHERWISE NOTED)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
	Add at REV.E:		
250-00020-00	RES CFILM	10 OHM 1/8W	R409, 509
250-00038-00	RES CFILM	47 OHM 1/8W	R20, 21
Omit at REV.E			
250-00045-00	RES CFILM	91 OHM 1/8W	R434, 534
250-00046-00	RES CFILM	100 OHM 1/8W	R431, 531
250-00057-00	RES CFILM	300 OHM 1/8W	R81, 134
Omit at REV.G1			
250-00059-00	RES CFILM	360 OHM 1/8W	R73, 89, 94, 130, 144, 149
Omit at REV.G1			
250-00062-00	RES CFILM	470 OHM 1/8W	R122, 166
250-00063-00	RES CFILM	510 OHM 1/8W	R432, 532
250-00069-00	RES CFILM	910 OHM 1/8W	R55, 105
250-00070-00	RES CFILM	1.0 K 1/8W	R35, 101, 112, 158, 170, 435, 535
Omit at REV.E: R35			
250-00071-00	RES CFILM	1.1 K 1/8W	R114
250-00072-00	RES CFILM	1.2 K 1/8W	R72, 80, 86, 93, 129, 133, 143, 148, 428, 528
Omit at REV.G1: R72, 80, 86, 93, 129, 133, 143, 148			
250-00073-00	RES CFILM	1.5 K 1/8W	R174
250-00075-00	RES CFILM	1.6 K 1/8W	R117, 118
Omit at REV.G1			
250-00077-00	RES CFILM	2.0 K 1/8W	R15, 17, 32
Omit at REV.E			
250-00078-00	RES CFILM	2.2 K 1/8W	R40
Omit at REV.E			
250-00079-00	RES CFILM	2.4 K 1/8W	R406, 506

RESISTORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00080-00	RES CFILM	2.7 K 1/8W	R57, 107,
	Add at REV.E: R408, 508		
250-00081-00	RES CFILM	3.0 K 1/8W	R66, 121
Omit at REV.G1			
250-00082-00	RES CFILM	3.3 K 1/8W	R56, 65, 106, 419, 429, 430, 519, 529, 530
Omit at REV.E: R419, 519			
250-00083-00	RES CFILM	3.6 K 1/8W	R54, 104
250-00084-00	RES CFILM	3.9 K 1/8W	R59-R63, 109, 115, 116, 119, 120, 418, 518
Omit at REV.G1: R119, 120			
250-00085-00	RES CFILM	4.3 K 1/8W	R407, 413, 416, 507, 513, 516
Omit at REV.E: All			
	Add at REV.F: R403, 503		
250-00086-00	RES CFILM	4.7 K 1/8W	R410, 426, 510, 526
250-00087-00	RES CFILM	5.1 K 1/8W	R16, 68, 74, 78, 87, 123, 127, 135, 141, 401, 425, 427, 501, 525, 527
Omit at REV.E: R16			
Omit at REV.G1: R68, 74, 78, 87, 123, 127, 135, 141			
250-00088-00	RES CFILM	5.6 K 1/8W	R409, 509
Omit at REV.E			
250-00090-00	RES CFILM	6.8 K 1/8W	R95, 98, 152, 155
250-00091-00	RES CFILM	7.5 K 1/8W	R69, 71, 75, 77, 79, 85, 88, 90, 92, 124, 126, 128, 132, 136, 139, 142, 146, 147, 412, 512
Omit at REV.G1: R69. 71, 75, 77, 79, 85, 88, 90, 92, 124, 126, 128, 132, 136, 139, 142, 146, 147			
250-00092-00	RES CFILM	8.2 K 1/8W	R408, 508
Omit at REV.E			
250-00093-00	RES CFILM	9.1 K 1/8W	R96, 113, 153, 176, 415, 515
250-00094-00	RES CFILM	10 K 1/8W	R18, 82, 84, 100, 111, 137, 140, 157, 178
Omit at REV.E: R18			
Omit at REV.G1: R82, 84, 137, 140			
250-00095-00	RES CFILM	11 K 1/8W	R36, 37
Omit at REV.E			
250-00096-00	RES CFILM	12 K 1/8W	R191, 405, 505
250-00097-00	RES CFILM	13 K 1/8W	R10, 53, 103
Omit at REV.E: R10			
250-00099-00	RES CFILM	16 K 1/8W	R64

RESISTORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
	Add at REV.F:		
250-00100-00	RES CFILM	18 K 1/8W	R46, 51
250-00101-00	RES CFILM	20 K 1/8W	R4, 5, 25, 46-51, 67, 70, 76, 83, 91, 93, 110, 125, 131, 138, 145, 179, 180
Omit at REV.E: R4, 5, 25, 47-50			
Add at REV.E: R34			
Omit at REV.F: R46, 51			
Omit at REV.G1:R70, 76, 83, 91, 93, 125, 131, 138, 145			
250-00102-00	RES CFILM	22 K 1/8W	R41, 42, 433, 533
Omit at REV.E: R41			
250-00103-00	RES CFILM	24 K 1/8W	R58, 108
250-00104-00	RES CFILM	27 K 1/8W	R150, 151
	Add at REV.E: R47, 50		
Omit at REV.G1: R150, 151			
250-00108-00	RES CFILM	39 K 1/8W	R38, 43
Omit at REV.E			
250-00110-00	RES CFILM	47 K 1/8W	R39, 44, 45, 169
Omit at REV.E: R44, 45			
250-00114-00	RES CFILM	68 K 1/8W	R31, 183, 424, 524
Omit at REV.E: R31, 183			
250-00118-00	RES CFILM	100 K 1/8W	R2, 3, 182, 185-190, 436, 536
Omit at REV.E: R2, 3			
250-00119-00	RES CFILM	110 K 1/8W	R6, 7
Omit at REV.E			
250-00121-00	RES CFILM	130 K 1/8W	R11, 12, 417, 517
Omit at REV.E			
250-00122-00	RES CFILM	150 K 1/8W	R437, 537
250-00123-00	RES CFILM	180 K 1/8W	R420, 520
250-00125-00	RES CFILM	200 K 1/8W	R19, 173
Omit at REV.E			
250-00127-00	RES CFILM	240 K 1/8W	R197, 200
250-00128-00	RES CFILM	270 K 1/8W	R175
250-00129-00	RES CFILM	300 K 1/8W	R97, 99, 154, 156, 400, 411, 414, 500, 511, 514
250-00132-00	RES CFILM	390 K 1/8W	R14
Omit at REV.E			

RESISTORS (Cont.)

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
250-00134-00	RES CFILM	470 K 1/8W	R13
Omit at REV.E			
250-00138-00	RES CFILM	750 K 1/8W	R8
Omit at REV.E			
250-00139-00	RES CFILM	910 K 1/8W	R9
Omit at REV.E			
250-00142-00	RES CFILM	1.0 M 1/8W	R177, 195, 196
	Add at REV.D:		
251-00070-03	RES CFILM	1.0 K 1/4	R438, 538
	Add at REV.E:		
251-00101-03	RES CFILM	20 K 1/4W	R201, 202
251-00105-00	RES CFILM	30 K 1/4W	R203, 204
251-00109-00	RES CFILM	43 K 1/4W	R205, 206
251-10050-00	RES CFILM	150 OHM 1/2W	R165, 167
Omit at REV.E			
251-10156-00	RES CFILM	3.9 M 1/2W	R171
	Add at REV.G1:		
252-00031-00	RES MFILM	301 OHM 1/8W 1%	R81, 134
252-00037-00	RES MFILM	357 OHM 1/8W 1%	R73, 89, 94, 130, 144, 149
252-00102-00	RES MFILM	1.21 K 1/8W 1%	R72, 80, 86, 93, 129, 133, 143, 148
252-00106-00	RES MFILM	1.62 K 1/8W 1%	R117, 118
252-00113-00	RES MFILM	3.01 K 1/8W 1%	R66, 121
252-00118-00	RES MFILM	3.92 K 1/8W 1%	R119, 120
252-00125-00	RES MFILM	5.11 K 1/8W 1%	R68, 74, 78, 87, 123, 127, 135, 141
252-00130-00	RES MFILM	7.50 K 1/8W 1%	R69, 71, 75, 77, 79, 85, 88, 90, 92, 124, 126, 128, 132, 136, 139, 142, 146, 147
252-00138-00	RES MFILM	10.0 K 1/8W 1%	R82, 84, 137, 140
252-00145-00	RES MFILM	20.0 K 1/8W 1%	R70, 76, 83, 91, 125, 131, 138, 145
252-00152-00	RES MFILM	26.7 K 1/8W 1%	R150, 151
259-10010-00	POT DUAL	20KB VERT	RP1, RP2
259-30005-00	POT TRIM	200K PCB MT	RP3
Omit at REV.E			

DIODES

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
320-20001-00	DIODE	1N4148 75V	D1-3, 14, 16-18
Omit at REV.E: D1-3			
320-20004-00	DIODE	1N4004 400V	D7, 8, 9, 10, 13, 15
320-20014-00	ZENER	1N4742 12V	D11, 12 (.3 prep)
Changed at REV.C to:			
320-30001-00	ZENER	1N4742 12V	D11, 12 (.4 prep)
320-40001-00	LED RED		D19

TRANSISTORS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
321-40009-00	XISTOR	2N4125 PNP	Q2, 9
Omit at REV.E: Q2			
321-40010-00	XISTOR	2N4123 NPN	Q1, 8, 10, 11
Omit at REV.E: Q1			
321-60000-00	XISTOR	MJE3055 NPN	Q6
321-60002-00	XISTOR	MJE2955 PNP	Q7
321-90002-00	XISTOR	2SC2878A NPN	Q400, 500

INTEGRATED CIRCUITS

CARVER P/N	DESCRIPTION		REF DESIGNATIONS
330-30004-00	IC	CA3080A	U13
Omit at REV.E			
330-20001-00	IC	4013BPC	U14
Omit at REV.E			
330-30003-00	IC	XR4136	U1-12, 15, 16, 18
Omit at REV.E: U4, 5, 8			
330-30008-00	IC	4558	U17

INDUCTORS

CARVER P/N	DESCRIPTION	REF DESIGNATIONS
616-00064-00	CHOKE 5-TURN	L1
Changed at REV.C to:		
601-00397-00	CHOKE 5-TURN	L1
Omit at REV.E		
616-00065-00	CHOKE 8-TURN	L2
Changed at REV.C to:		
601-00398-00	CHOKE 8-TURN	L2
Omit at REV.E		
617-10035-00	TRANSFORMER	

MISCELLANEOUS ITEMS

CARVER P/N	DESCRIPTION	QUANTITY
101-30002-00	BUMPONS, RUBBER FEET	4
105-40001-00	FUSEHOLDER CLIP PC MT	2
109-10007-00	PHONO JACK QUAD PC MT	1
111-20001-00	SOLDER LUG #4	1
118-90001-00	STRAIN RELIEF	1
151-00052-00	SCREW MACH SCKT HD BLK 6-32x3/8	4
151-20001-00	SCREW MACH PP BLK 440x1/4	5
151-30002-00	SCREW SHT MTL PP ZC 4x3/8"	2
151-30052-00	SCREW SHT MTL PP BLK 6x3/8"	8
152-10002-00	KEPNUT 6-32x5/16 ZC	4
159-50001-00	TYRAP 3-3/8"	3
159-50004-00	TYRAP 7-3/8"	1
160-00001-00	CONVENIENCE OUTLET	1
315-10503-00	FUSE AGC 1/4 A	1
318-10000-00	SWITCH PUSH 1 KEY	3
401-10145-00	WIRE 18 AWG TEW BLK 3.5"	2
Changed at REV.B to:		
401-10103-00	WIRE 18 AWG TEW BLK 4.5"	2
	Add at REV.F:	
401-10147-00	WIRE 18 AWG TR-64 BLK 10.5"	1
Changed at REV.G to:		
401-10185-00	WIRE 18 AWG TR-64 BLK 10.0"	1
401-10646-00	WIRE 22 AWG TR-64 BLK 1.5"	1
401-30001-00	JUMPER .2"	2
401-90010-00	LINECORD 18/2 POLARIZED	1
502-30035-01	CHASSIS SCREENED	1
503-40024-01	PANEL, SCREENED	1
504-20031-01	COVER, TOP PAINTED	1
508-20001-01	BUTTON MOLDED	3
508-20023-00	KNOB SPEAKER SELECT	2

PACKING

CARVER P/N	DESCRIPTION	QUANTITY
532-20029-00	BOX, TALS CONTROL	1
532-20030-00	FOAM, TALS CONTROL	2
990-20049-00	OWNERS MANUAL	1

Appendix D

VOLTAGE CONVERSION FOR ECS/ECS-U

Bill of Materials

Qty	Part Number	Description
1	315-10502-00	Fuse AGC 1/8
1	315-10503-00	Fuse AGC 1/4
1	530-10088-00	Label 220VAC 50Hz

Directions for Change (120V to 220V)

1. Locate the jumper wire at the left hand side of the fuse (see Fig. 1).
2. Move jumper to the position nearest the fuse.
3. Replace AGC 1/4A fuse with AGC 1/8A fuse (P/N 315-10502-00).
4. Apply the 220VAC 50Hz label over the 120VAC 50/60Hz printing near the line cord.

Directions for Change (220V to 120V)

1. Locate the jumper wire at the left hand side of the fuse (see Fig. 1).
2. Move jumper to the position furthest away from the fuse.
3. Replace AGC 1/8A fuse with AGC 1/4A fuse (P/N 315-10503-00).
4. Remove the 220VAC 50Hz label near the line cord.

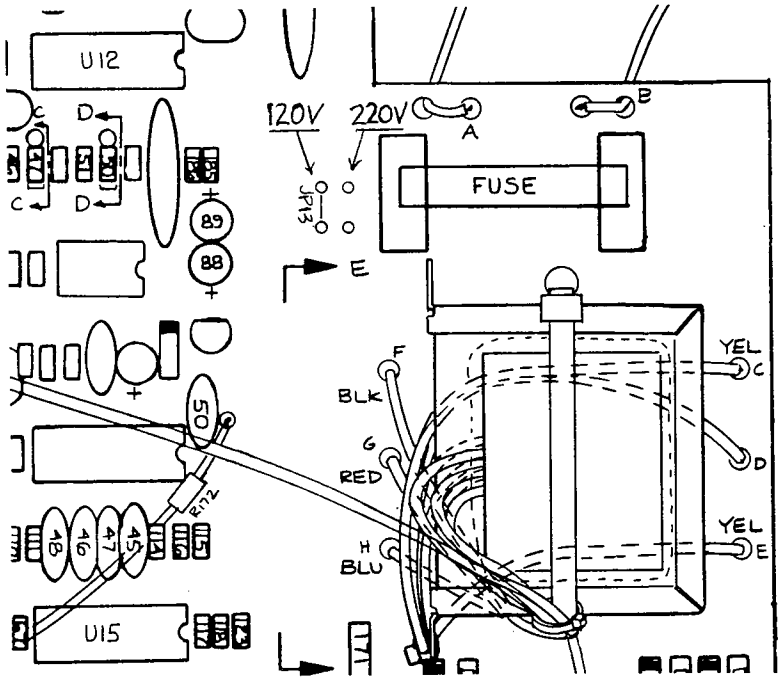


Figure 1

Appendix E

SERVICE BULLETINS

Please insert Carver Service Bulletins pertaining to the ECS, ECS-U or SBRD here to ensure proper repair in the future.

Printed in U.S.A

P/N 990-20060-01