

Radio Shack®

Service Manual

TRS-80 VOICE SYNTHESIZER

Catalog Number 26-1180

CUSTOM MANUFACTURED FOR RADIO SHACK  A DIVISION OF TANDY CORPORATION

Specifications

Electrical

Power requirements 120 VAC
60 Hz, 0.10 Amps.
U.L. listed transformer (supplied)
Transformer output rated at 12.5 VAC,
0.8 Amps.

Physical

Cabinet..... 12" WX6-5/32" DX4" H... or
30.5 cm WX15.6 cm DX10.2 cm H
Speaker..... Internal, 4 ohms (nominal)

Environmental

Operating Temperature ... 0° C/ + 43.3° C... or
32° F/ + 110° F
Storage Temperature..... -40° C/ + 70° ... or
-40° F/ + 160° F
Operating Humidity 0 to 95% with no condensation

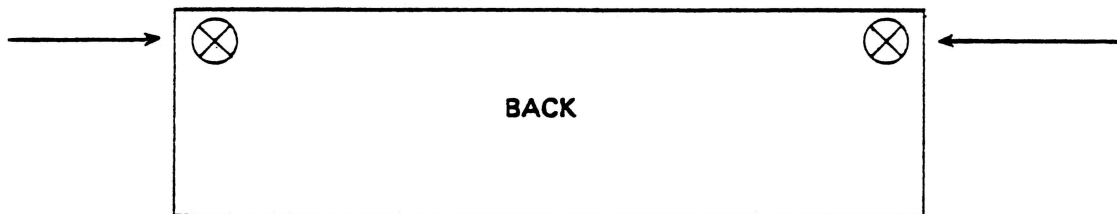
Interface

VIA Ribbon Cable..... Into TRS-80 CPU Edge-Card Jack or Parallel
Jack on the Expansion Interface
32 word FIFO buffered parallel
20 inputs: 1 TTL load per input, lines used:

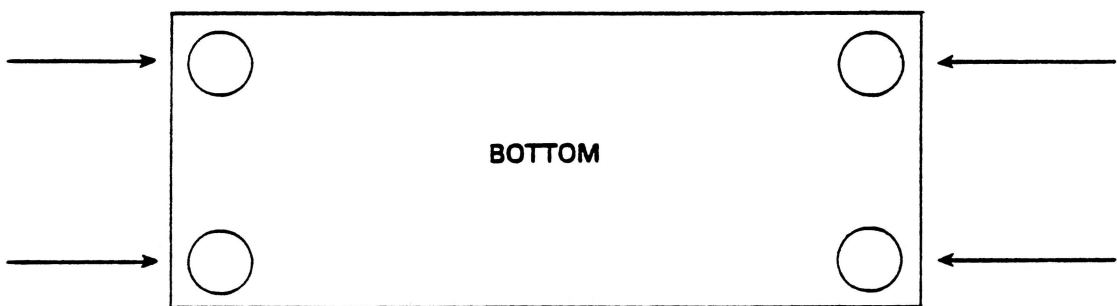
(1) Ground
(6) D0 thru D5
(1) WR
(11) A5 thru A15
(1) SYS RES — (2 TTL loads)
20 Total

Disassembly Instructions

1. Break seal and remove two wood screws on back of cabinet.
2. Remove knob and push LED out of holder by gently pressing on the LED face with your thumb.

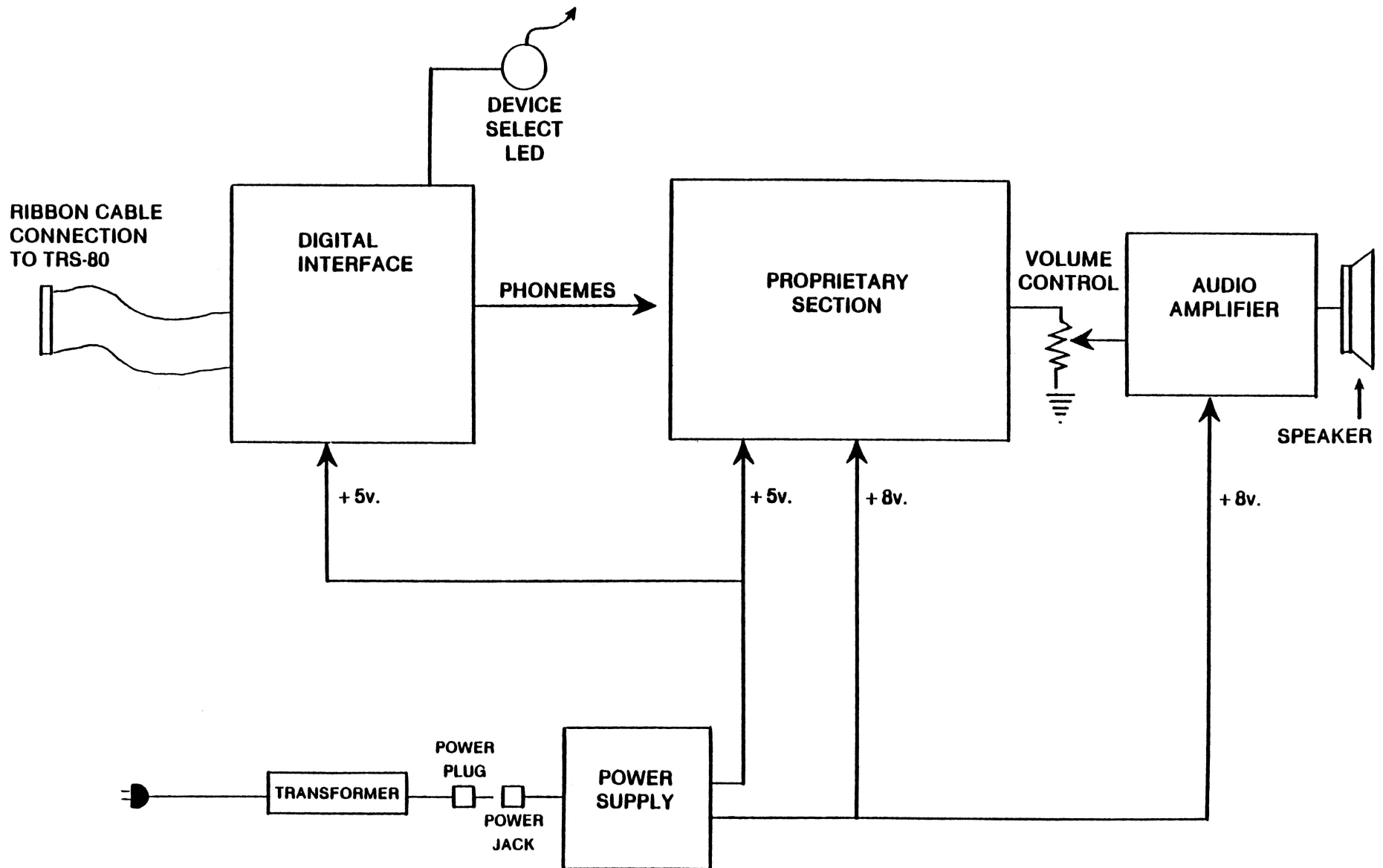


3. *Remove screws that secure the four rubber feet to the bottom of the cabinet.
4. Remove printed circuit board assembly.
5. Remove speaker if necessary.



***NOTE:** If unit contains printed credit card guides in cabinet, it is not necessary to remove the rubber feet.

BLOCK DIAGRAM



Theory of Operation

The Voice Synthesizer accepts digital commands from the TRS-80 and converts them to the basic elements of speech called phonemes (refer to Owner's Manual for phoneme details). The details of the conversion-to-vocalization process are proprietary and will not be covered in this manual; however, most of the likely failure modes occur in the digital interface, power supplies, and audio amplifiers (see Block Diagram). Service information for these sections is contained in this manual.

The Voice Synthesizer is connected to the TRS-80 by means of a ribbon cable for the digital interface. Phoneme instructions are forwarded to the "proprietary section" for vocalization. The "proprietary section" contains various oscillators, filters, and noise sources that are used to generate the speech sounds. An audio amplifier provides the final output signal to drive the speaker. A transformer with a miniature phone jack on the output cable supplies the low-level AC voltage input to the unit.

The AC input is full-wave rectified and filtered in the power supply section located on the printed circuit board. Two DC voltages are supplied as outputs from the voltage regulators——5VDC for most of the logic circuitry and 8VDC for most of the analog and audio circuitry.

Schematic diagrams for the field serviceable sections are located on the following pages.

Power Supply

Low-voltage (12-18 VAC, RMS) input power is supplied to the unit through the power jack and is full-wave rectified by the diode bridge and filtered by C42. The 8-volt regulator and 5-volt regulator supply the total DC requirements of the unit. The 5-volt regulator has a heatsink fastened securely to the tab for adequate heat dissipation. Voltage readings under load should be as shown on the Power Supply Schematic Diagram.

Audio Amplifier

Synthesized speech signals flow to the audio amplifier section through R58 and the Volume Control. IC8 is an audio power amplifier with an output power of slightly less than 1 watt. The external components located around this amplifier provide compensation, feedback, and bias. C40 blocks DC from being applied to the speaker.

Digital Interface

The digital interface section of the Voice Synthesizer serves two basic functions, storage and decoding.

Storage

The circuitry of the digital interface stores 6 bit binary words that are inputted from the TRS-80 into a temporary holding memory called a "FIFO" (first-in, first-out). These 6-bit binary words are ASCII-encoded and represent phonetic sounds that are to be voiced by the Synthesizer section. The ASCII characters are generated from the TRS-80 keyboard.

Decoding

The second function of the digital interface section is decoding. The decoding circuitry recognizes a special command character (question mark) when it is loaded into video memory address location decimal 164352. When this occurs, the computer selects and enables the Voice Synthesizer, essentially "telling" it that it "is now time to talk". The "device select" function keeps the Synthesizer silent during normal program execution. Thus, it will remain silent until the computer selects the Voice Synthesizer.

Address lines (A5 through A15) are brought into the ribbon cable connector from the TRS-80 computer. When the program statement "PRINT AT 992" is used, the ASCII characters that are used to represent speech are displayed on the screen starting at display location 992. Since there are 1,034 display locations on the screen, there are 32 locations left for entering ASCII characters. The FIFO memory in the Voice Synthesizer is 32 words deep by 6 bits wide. Only 32 characters at a time can be jammed into the FIFO. The phonemes are then clocked out of the

FIFO in the same order that they were stored. When the PRINT AT 992 statement is read, it causes A5 through A13 to go to a logic level "1" and A14 and A5 to a logic level "0". A14 and A5 are inverted by IC1, a hex inverter, such that all address lines are fed into a multiple-input NAND gate. The output of the NAND gate will start high and pulse low when the address is decoded. This pulse will be short, since the computer will read that particular address at a high rate of speed. Thus, the output is effectively high when the Voice Synthesizer is not selected. When the proper address location is read, the output will pulse low momentarily. Meanwhile, the command character "?" must also be present simultaneously with the address select. When these two are both decoded, then a true "device select" occurs and the interface transmits a control signal to the FIFO memory which "tells" it to start storing the ASCII words. When a question mark occurs again, it shuts off the FIFO loading process.

Typical Command Sequence

PRINT AT 992, "?H38L8 + U?" This program statement tells the Voice Synthesizer to say "Hello". This simple statement can be broken down as follows:

1. PRINT AT 992: Puts all "1's" on input of IC2
2. ?: The binary equivalent of the ASCII question mark is 0011 1111. Only the low 6 data bits are used such that it is essentially all "1's" (111111). Then the data and address bits are all high. These bits are gated by IC3 and IC6, and eventually toggle a flip-flop (IC9). The outputs of the flip-flop turns on the LED ("Device Select"). The Q output is routed to the select line of the FIFO, thereby telling it to start accepting data. Pin 6 of IC9 is high and pulses low on "device select" and flashes the LED. Pin 5 is low and transition to high, thereby selecting the FIFO. These conditions then remain locked until the second question mark is read.

NOTE: For Level II Computers, the command is Print @ 992, ...

3. H38L8↑ U: These are the ASCII characters that are processed into speech elements. The data bits 0-5 make these characters.

BINARY EQUIVALENT

992 111111 ?	993 001000 H	994 110011 3	995 111000 8	996 001100 L
997 111000 8	998 011010 ↑	999 010101 U	1000 010000 Space	1001 111111 ?

4. ?: The second question mark causes flip to reset to original condition, as it was before the "select". This turns off the LED (IC9 pin 6 goes high) and "de-selects" the FIFO, thereby telling it to stop loading (IC9 pin 5 goes low).

Troubleshooting Chart

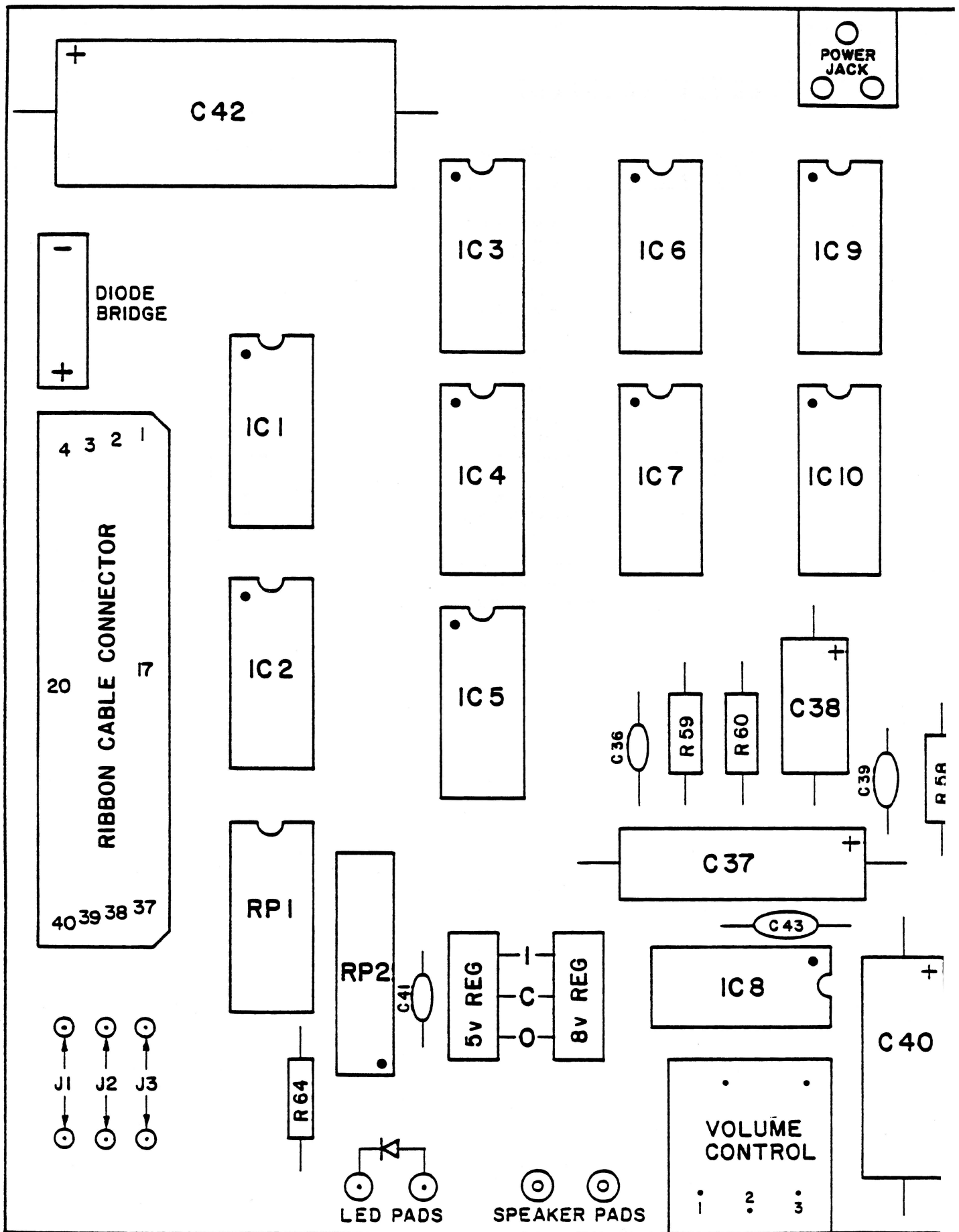
Symptom	Remedy
1. No audio output and "Device Select" indicator not working. (no pop in speaker as unit is turned on)	<ol style="list-style-type: none"> 1. Faulty power connection: check insertion of power plug. 2. Defective transformer: replace the transformer 3. Bad 8v. regulator: replace regulator 4. IC-8 Bad: replace IC-8
2. No audio: device select not working. Pop is heard in speaker at turn on.	<ol style="list-style-type: none"> 1. Bad 5 v. regulator. 2. IC-2 pin 9 does not go low when proper address is present. Replace IC-2. 3. IC-1, 3, 6 or 9 bad — replace bad device.
3. No audio: device select flashes, pop is heard in speaker at turn on.	<ol style="list-style-type: none"> 1. "Fi Fo's" not transferring data. <ol style="list-style-type: none"> a. IC 4, 5, 7 or 10 bad — replace bad device. b. phoneme clock malfunctioning: return to manufacturer. 2. Audio signal blocked inside proprietary section — return to manufacturer.
4. Talks too fast	<ol style="list-style-type: none"> 1. Pitch is also too high: 5v. regulator output too low (L 4.5v). Bad 5v. regulator — replace bad device. 2. Pitch is normal: failure in proprietary section — return to manufacturer
5. Talks too slow	<ol style="list-style-type: none"> 1. Pitch also too low: 5v. regulator too high or 8v. regulator low — replace bad device 2. If pitch is normal: failure in proprietary section — return to manufacturer.

Parts List

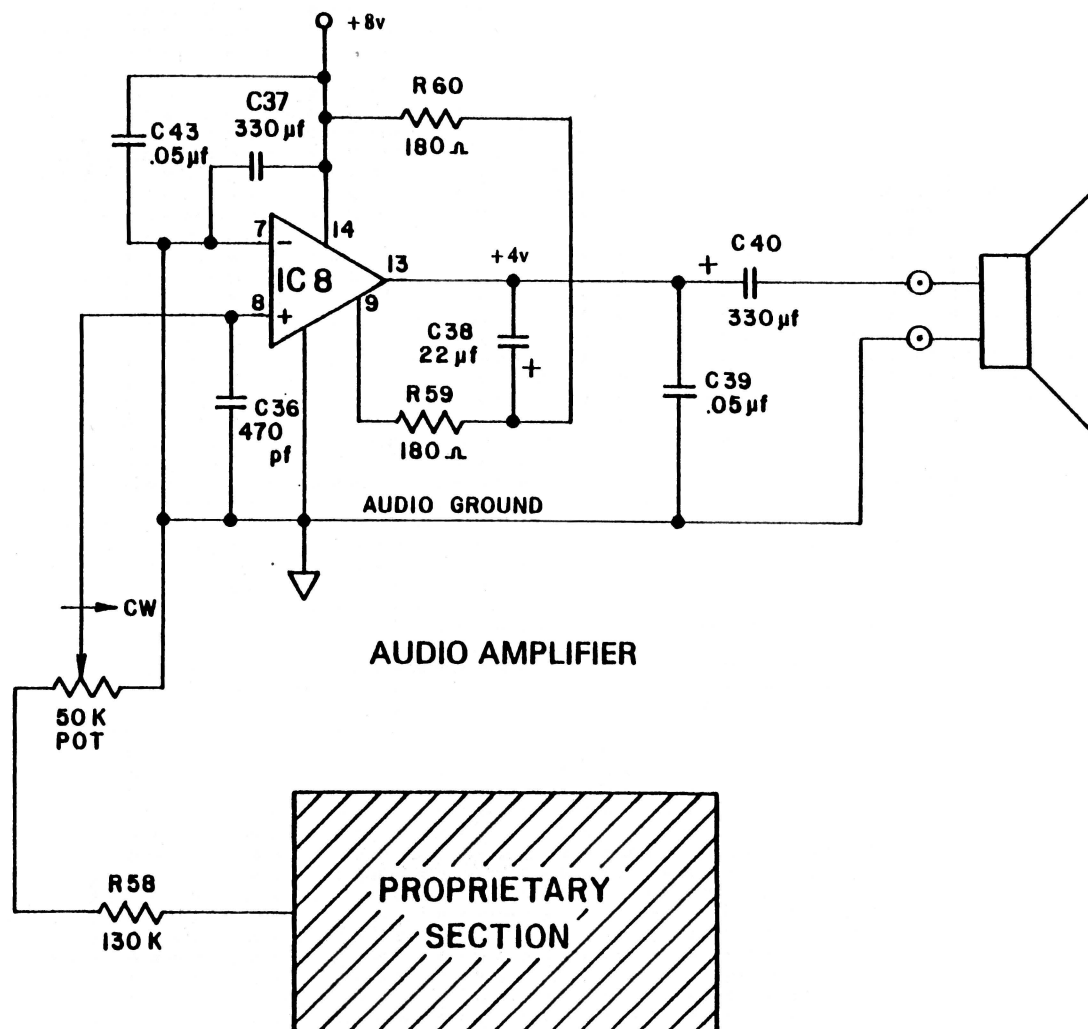
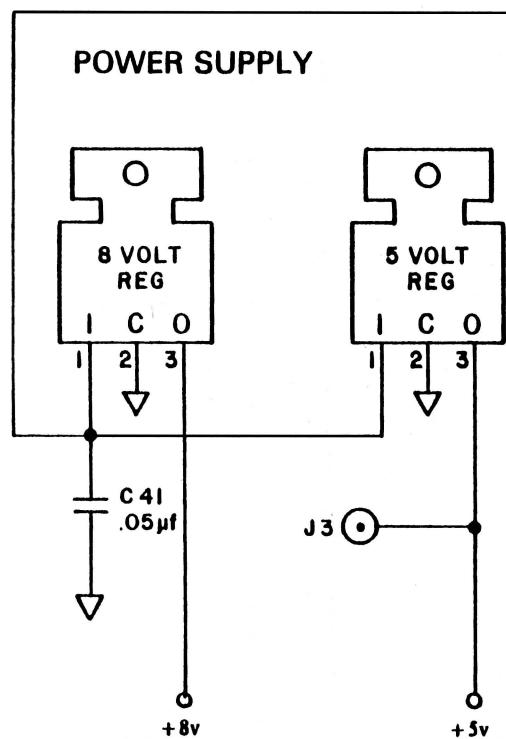
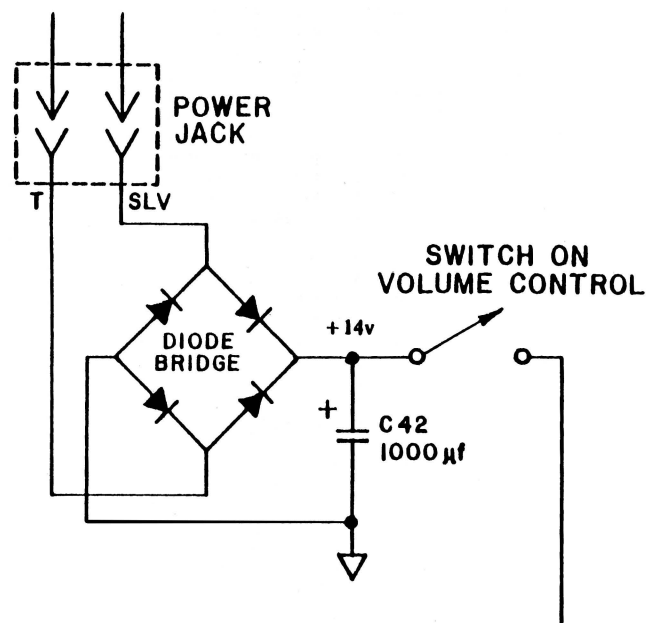
Reference Number	Description	Mfg. Part Number	Radio Shack Part Number
IC 1	SN7404N	1	AMX-4163
IC 2	SN74S133N	5	AMX-4167
IC 3	SN74S11N	3	AMX-4165
IC 4	CD40105BE	14	AMX-4168
IC 5	CD40105BE	14	AMX-4169
IC 7	CD40105BE	14	AMX-4170
IC 10	CD40105BE	14	AMX-4171
IC 6		2	AMX-4164
IC 8		18	AMX-4172
IC 9	SN7474N	4	AMX-4166
5 V Reg.	78M05	21	AMX-4173
8 V Reg.	78M08	22	AMX-4174
D3	T1 3/4	24	ADX-1260
		25	ART-2174
Diode Bridge	MDA-200	26	ADX-1261
C 36	470pf, 50v.	34	
C 42	1000MF, 25v.	41	
C 37	330MF, 16v.	42	
C 40	330MF, 16v.		
C 38	22MF, 16v.	43	
C 39	.05MF, Disc	44	
C 43	.05MF, Disc	44	
R 58	130K, 1/4 W., 5%	64	
R 59	180 ohm, 1/4 W., 5%	45	
R 60	180 ohm, 1/4 W., 5%	45	
R 64	270 ohm, 1/4 w., 5%	46	
	Locking Nuts	89	AHD-7135
	Heatsink for	86	AHH-0325
	5 V Reg.		
	Miniature Phone	85	AJ-6710
	Jack		
	Knob	98	AK-3514

Parts List (continued)

Reference Number	Description	Mfg. Part Number	Radio Shack Part Number
	Rubber Feet w/Screws	95	Af-0263
	On/Off Volume Control	84	AP-1970
	PC Board Stand- Off	88	ART-2175
	Control Plate/ Label	96	ART-2176
	Radio Shack Nameplate/ Label	97	ART-2177
RP1	Resistor Pack	80	ARX-0114
RP2	" "	81	ARX-0115
	Speaker	91	AS-4824
	Ribbon Cable Assy.	28	AW-2354
	Case	92	AZ-4832
	Completed PC Board Assembly	VST-1 or VST-2	
	Power Transformer	PS-7204-M	



PRINTED CIRCUIT BOARD PARTS PLACEMENT



POWER SUPPLY AND AUDIO AMPLIFIER SCHEMATICS

RIBBON CABLE CONNECTOR

