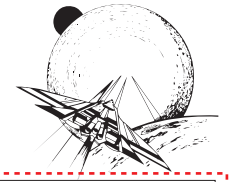
FIREPOWER

Sound Board & Speech Module (C-8228) Assembly Drawing (System 6)

ISSUE NUMBER 3.0 (21 FEB 2007)
CREATED BY: Phil Butcher
www.firepowerpinball.com



BOARD CONNECTIONS:
1 CPU BOARD
2 DRIVER BOARD
3 POWER SUPPLY BOARD
4 MASTER DISPLAY BOARD
5 SLAVE DISPLAY BOARD
6 BACKBOX
7 CABINET
8 PLAYFIELD
9 INSERT BOARD
10 SOUND BOARD
11 NOT ASSIGNED
12 SPEECH MODULE

Speech Module (C-8228)

VOCABULARY	LOCATED IN ROM
FIRE	5T 4971
POWER	5T 4971
ONE (Won)	5T 4971
TWO	5T 4971
THREE	5T 4972
ENEMY	5T 4972
DESTROYED	5T 4972
MISSION	5T 4972 and 5T 4973
ACCOMPLISHED	5T 4973
YOU	5T 4973
ARE	5T 4973

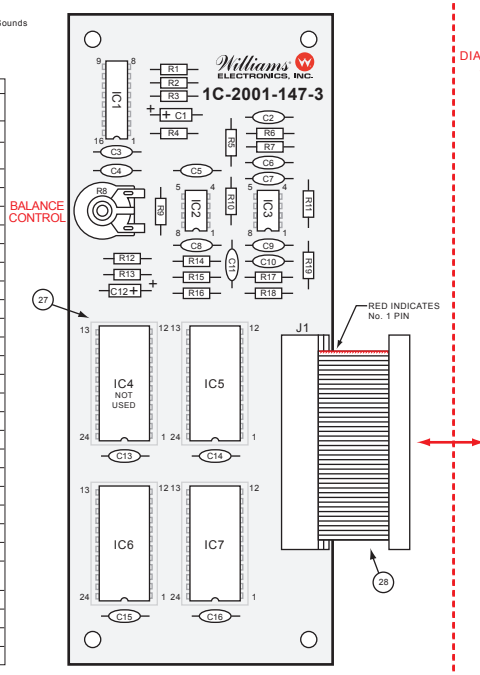
SPECIAL MAINTENANCE INFORMATION:
When the Diagnostic Start★ button is depressed, five electronic sounds are produced.
Next, if the optional speech module is provided, the FIREPOWER vocabulary is produced.
This sequence is continuously repeated until the game is turned OFF and back ON.

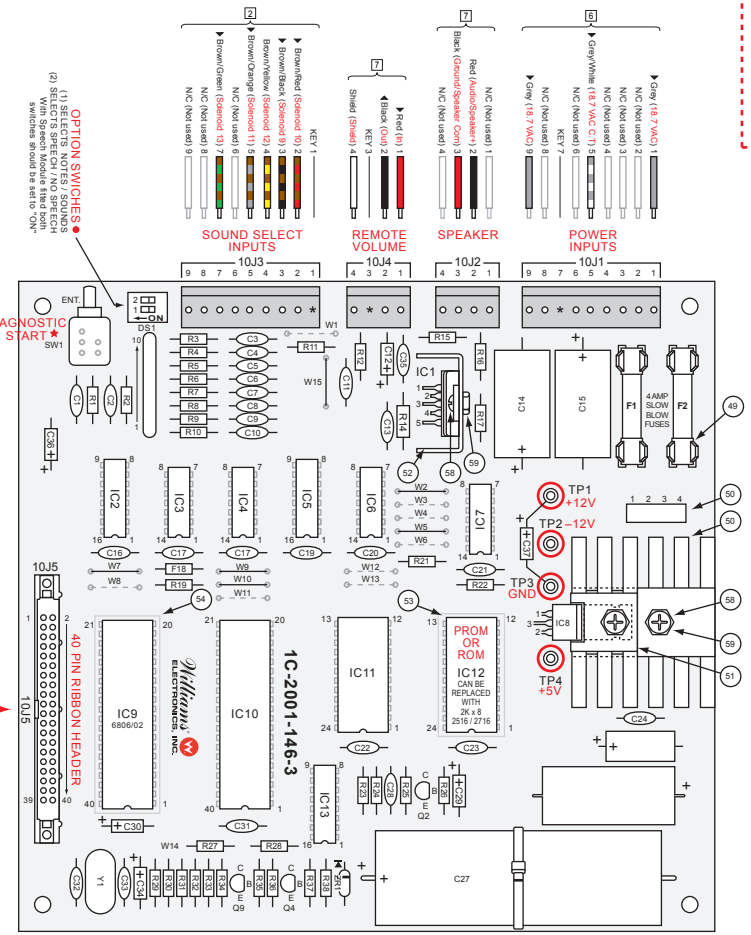
ELECTRICAL ADJUSTMENTS:
Option Switches●
(1) ON = Musical Notes
OFF = Synthesized Sounds
(2) ON = Enable Speech
OFF = Inhibit Speech
Adjust balance on Speech Module.
Adjust Volume in cabinet.

ACHIEVEMENT	*PHRASE*
Game start, collecting FIREPOWER bonus	*FIREPOWER*
Making "F-I-R-E"	*FIRE*
Lighting POWER	*POWER*
Spotting "1-6" lamps	*Enemy destroyed*
MULTI-BALL play	*Fire 1, 2, 3*
Winning Extra Ball	*You won one mission*
Making Special	*Mission accomplished*
Tilt	*You are destroyed*
High Score to Date	*FIREPOWER mission accomplished*

GAME OVER – *RANDOM PHRASE*

You destroyed FIREPOWER.	*Mission destroyed you*
Enemy destroyed you.	*Enemy power won*
Mission 213 accomplished.	*You destroyed enemy mission*
You are enemy.	*Enemy mission*
Enemy fire destroyed you.	*You won, FIREPOWER destroyed*
Fire destroyed you.	*FIREPOWER destroyed*





BILL OF MATERIALS				
ITEM NO.	PART No.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	IC-2001-147-3		BARE P.C. BOARD	1
2	5A-9335	IC1	555I6 CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	5A-9321	IC2, IC3	1458 DUAL OP-AMP	2
4				
5				
6				
7				
8				
9				
10	5A-8846	R11	RESISTOR, FC, 220 K OHM 5% ¼ WATT	1
11	5B-8817	R1, R2, R3, R4, R14, R16	RESISTOR, FC, 10 K OHM 10% ¼ WATT	6
12	5A-8824	R5	RESISTOR, FC, 43 K OHM 5% ¼ WATT	1
13	5A-9333	R6	RESISTOR, FC, 180 K OHM 5% ¼ WATT	1
14	5A-9342	R7	RESISTOR, FC, 36 K OHM 5% ¼ WATT	1
15	5A-9185	R8	POTENTIOMETER, 5 K OHM	1
16	5A-9324	R9, R10, R15, R18, R19	RESISTOR, FC, 27 K OHM 10% ¼ WATT	5
17	5B-8997	R12, R13	RESISTOR, FC, 2.7 K OHM 5% ¼ WATT	2
18	5A-8772	R17	RESISTOR, FC, 15 K OHM 5% ¼ WATT	1
19	5A-9030	C4	CAPACITOR, .047 MFD. 20% 50 V.	1
20	5A-9350	C6	CAP., CERAMIC, 180 PFD. 5% 100 V.	1
21	5A-8980	C3, C5, C7, C8, C9, C13 THRU C16	CAP., CERAMIC, .01 MFD. +80% –20% 50 V.	9
22	5A-9031	C1	CAP., TANTALUM, 1 MFD. 20% 25 V.	1
23	5A-9347	C2	CAP., CERAMIC, 1800 PFD. 5% 50V.	1
24	5A-9343	C12	CAPACITOR, ELECTROLYTIC, 10 MFD. 20% 20 V. LOW LEAK	1
25	5A-9348	C11	CAP., CERAMIC, 4700 PFD. 5% 50 V.	1
26	5A-9346	C10	CAP., CERAMIC, 1200 PFD. 5% 50 V.	1
27	5A-9004		24 PIN SOCKET	4
28	5A-9352	J1	RIBBON CABLE ASSEMBLY	1

BILL OF MATERIALS (PARTS 14 /16/25/63 ARE NOT USED)				
ITEM NO.	PART No.	PART DESIGATION	DESCRIPTION	REQ'D NO.
1	IC-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA 2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INPUT AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W / TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	SC-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
15	5A-9018	ZR1	1N5996 6.8 V. ZENER DIODE	1
17	5A-9158 or 9357	BR1	MDA 200 / 3N253 BRIDGE RECTIFIER	1
18	5A9020	Y1	3.58 MHz CRYSTAL	1
19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R36	RESISTOR, FC, 4.7 K OHM 5% ¼ WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% ¼ WATT	9
21	5A-8984	R12, R15, R28, R36, R38	RESISTOR, FC, 1 K OHM 10% ¼ WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 5% ½ WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 5% ¼ WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 5% ½ WATT	1
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3 K OHM 10% ¼ WATT	1
27	5A-9179	R25	RESISTOR, FC, 3.3 M OHM 10% ¼ WATT	1
28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5% ¼ WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10% ¼ WATT	3
30	5B-939	R34	RESISTOR, FC, 10 K OHM 10% ¼ WATT	1
31	5A-8980	C1, C16 THRU C23, C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAP., ELECTROLYTIC 1 MFD 63V –10/+ 50%	1
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	1
36	5A-9165 or 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 or 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD.15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAP., ELECTROLYTIC, 100 MFD. 10V. ±20%	1
39	5A-8893	C26	CAP., ELECTROLYTIC, 1000 MFD. 25V. ±20%	1
40	5A-9046	C27	CAP., ELECTROLYTIC, 12,000 MFD. 16V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1 K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25V. LOW LEAK ±20%	1
43	5A-9169	C32, C33	CAP., CERAMIC DISC, 27 PFD. 1 K V. ±10%	2
44	5A-9163	C34	CAP., TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAP., TANTALUM, 1 MFD. 25 V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1
48	5A-6314	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5A-9178		FUSE HOLDER	4
50	5A-9172		HEAT SINK THERMALLOY # 6072B	1
51	5A-9173		HEAT SINK THERMALLOY # 6071B	1
52	5A-9199		HEAT SINK THERMALLOY # 6030	1
53	5A-9004		24 PIN SOCKET	1
54	5A-8985		40 PIN SOCKET	1
55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
57	5A-9349	10J5	40 PIN RIBBON HEADER	1
58			6-32 3/8" BINDER HEAD SCREW	3
59			6-32 HEX NUT	3
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER 22 GAUGE WITH INSULATION	7
61	5A-9248	TP1 THRU TP4	TERMINAL # 1502-1	4
62	5A-9363	R11	RESISTOR, FC, 5.6 K OHM 5% ½ WATT	1
64	5A-9362	SR1	RESISTOR, FC, 4.7 K OHM 10 PIN SIP	1
65	5A-7520-1		TIE WRAP	1

TROUBLESHOOTING: *FAULTY SOUND BOARD OR SPEECH MODULE*

SYMPTOM	CHECK	INDICATION/ACTION
Only electronic sounds with interval are produced.	1. Check that jumper W1 on Sound Board is removed and check setting of balance.	1. –
	2. Check for Speech Data activity:§ a) Sound Board IC10 pin 39 b) Speech Module IC1 pin 12 (13)	2. a) Activity at both pins, proceed. b) Activity at PIA none on Speech Module; check plating and connections. c) No activity; IC10 on Sound Board or IC1 on Speech Module faulty.
	3. Check for Speech Clock activity:§ a) Sound Board IC10 pin 19 b) Speech Module IC1 pin 9 (14)	3. Same as 2.
	4. Check for audio from Speech Module *IC1 pin 3 (2)*§	4. a) 300 mVrms AC typical, proceed. b) No ac; IC1 or associated circuitry faulty.
	5. Check for audio from Speech Module 1C3 pin 7§	5. a) 2 Vrms ac typical. C4, C12, R8, R12, or R13 faulty. Repair or replace. b) No audio. IC3 or associated circuitry faulty. Repair or replace.
	§ During silent interval * First pin no. for C-8228 Speech Module; no.in parentheses for C-8226	
Only electronic sounds without interval are produced.	1. Using logic probe cheek for negative "D" & "B" Address Select pulses after last sound: a) Sound Board IC2 pin 6 ("D") and pin 4 ("B"). b) Speech Module IC6 pin 20 ("D") and IC7 pin 20 ("B").	1. a) All pulses occur. Replace Speech Module IC7. b) "D" Pulse or "B" pulse at Sound Board only; Check plating and connections. c) No "B" pulse; Speech Module IC6 or IC7 or Sound Board IC2 faulty. Repair or replace. d) No "D" pulse; proceed.
	2. Disconnect Speech Module cable and check for pulse at Sound Board IC2 pin 6 (no sounds are produced but a pulse should occur a few seconds after diagnostic pushbutton is depressed).	2. a) Pulse, replace IC6 on Speech Module. b) No pulse, replace IC2 on Sound Board.
Some words replaced by noise.	1. Check for pulsing of "C" Address select: a) Sound Board IC2 pin 5. b) Speech Module IC5 pin 20.	1. a) Pulsing at Sound Board 1C2 only; check plating and connections. b) No pulsing; Sound Board 1C2 or Speech Module 1C5 faulty. Repair or Replace. c) Pulses at both chips; Speech Module

TROUBLESHOOTING: *FAULTY SPEECH MODULE*

SYMPTOM	CHECK	INDICATION/ACTION
Some words garbled.	–	1. Substitute new chips on Speech Module one at a time for IC5, IC6, and IC7.
Sounds produced after Speech Module discon-nected in accordance with Diagnostic Procedure.	1. Remove IC5 IC6 and IC7 from Speech Module. Reconnect module and remove test lead connected to Sound Board in Diagnostic procedures. Repeat self-test.	1. a) Sounds produced, proceed. b) No sounds, replace Speech Module.
	2. Replace chips removed in step 1 one at a time, repeating the self-test.	2. Chip(s) which cause no sounds faulty.
Only speech produced	–	1. IC12, IC10, IC13, or Q2 faulty.
No sounds produced after speech module discon-nected in accordance with diagnostic procedure.	1. a) Disconnect 10P4. b) Short pins 1 and 2 of board connector with fingers and listen for low-level hum from speaker.	1. a) Hum produced, proceed. b) No hum, check speaker connection, and IC1 and associated circuitry.
	2. Check +5V, + 12V, and - 12V.	2. –
	3. Check Q3 collector voltage.	3. a) +5V; proceed. b) 0V: Q3, Q4, or associated circuitry faulty.
	4. Check for activity at IC9 pin 37.	4. a) No activity Y I or 1C9 faulty. b) Activity. Substitute new plug-in chips or replace sound board.

TROUBLESHOOTING: *SOLENOID TEST*

SYMPTOM	CHECK
Functions properly in Self-Test but one or more sounds missing in solenoid test.	1. Check connection at 10P3 and 2P9. 2. Replace ROM or PROM. 3. Check for pulse from Driver Board, replace driver if pulse missing. 4. Check for pulse from Sound Board buffer; replace buffer if pulse missing. 5. Check for pulses from IC6 output; replace IC6 if any pulses are missing. 6. Replace Sound Board.
Functions properly in Self-Test, but all sounds are missing in solenoid test.	1. Check connectors 10P13 and 2P9. 2. Replace ROM or PROM. 3. Remove connector 10P3 and momentarily. ground one of the used pins at I0J3. If a sound is produced a solenoid driver transistor is stuck on. Repair or replace Driver Board. 4. Check that 1C5/IC7 buffer outputs are not stuck low; check that 1C6 output is not stuck high. Replace faulty chip. 5. Replace Sound Board.

FIREPOWER
Sound Board & Speech Module (C-8225) Assembly Drawing (System 6)

ISSUE NUMBER 3.0 (21 FEB 2007)
CREATED BY: Phil Butcher
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BOARD CONNECTIONS:
1 CPU BOARD
2 DRIVER BOARD
3 POWER SUPPLY BOARD
4 MASTER DISPLAY BOARD
5 SLAVE DISPLAY BOARD
6 BACKBOX
7 CABINET
8 PLAYFIELD
9 INSERT BOARD
10 SOUND BOARD
11 NOT ASSIGNED
12 SPEECH MODULE

Speech Module (C-8225)

VOCABULARY	LOCATED IN ROM
FIRE	5T 4971
POWER	5T 4971
ONE (Won)	5T 4971
TWO	5T 4971
THREE	5T 4972
ENEMY	5T 4972
DESTROYED	5T 4972
MISSION	5T 4972 and 5T 4973
ACCOMPLISHED	5T 4973
YOU	5T 4973
ARE	5T 4973

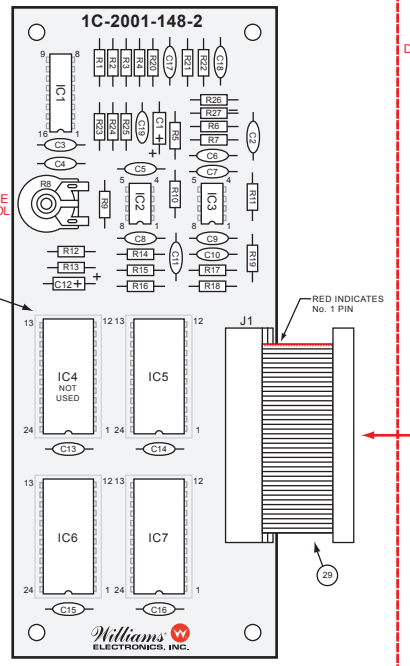
SPECIAL MAINTENANCE INFORMATION:
When the Diagnostic Start* button is depressed, five electronic sounds are produced.
Next, if the optional speech module is provided, the FIREPOWER vocabulary is produced.
This sequence is continuously repeated until the game is turned OFF and back ON.

ELECTRICAL ADJUSTMENTS:
Option Switches*
(1) ON = Musical Notes
OFF = Synthesized Sounds
(2) ON = Enable Speech
OFF = Inhibit Speech
Adjust balance on Speech Module.
Adjust Volume in cabinet.

ACHIEVEMENT	PHRASE
Game start, collecting FIREPOWER bonus	*FIREPOWER*
Making "F-I-R-E"	*FIRE*
Lighting POWER	*POWER*
Spotting "1-6" lamps	*Enemy destroyed*
MULTI-BALL play	*Fire 1, 2, 3*
Winning Extra Ball	*You won one mission*
Making Special	*Mission accomplished*
Tilt	*You are destroyed*
High Score to Date	*FIREPOWER mission accomplished*

GAME OVER – *RANDOM PHRASE*

You destroyed FIREPOWER.	*Mission destroyed you*
Enemy destroyed you.	*Enemy power won*
Mission 213 accomplished.	*You destroyed enemy mission*
You are enemy.	*Enemy mission*
Enemy fire destroyed you.	*You won, FIREPOWER destroyed*
Fire destroyed you.	*FIREPOWER destroyed*



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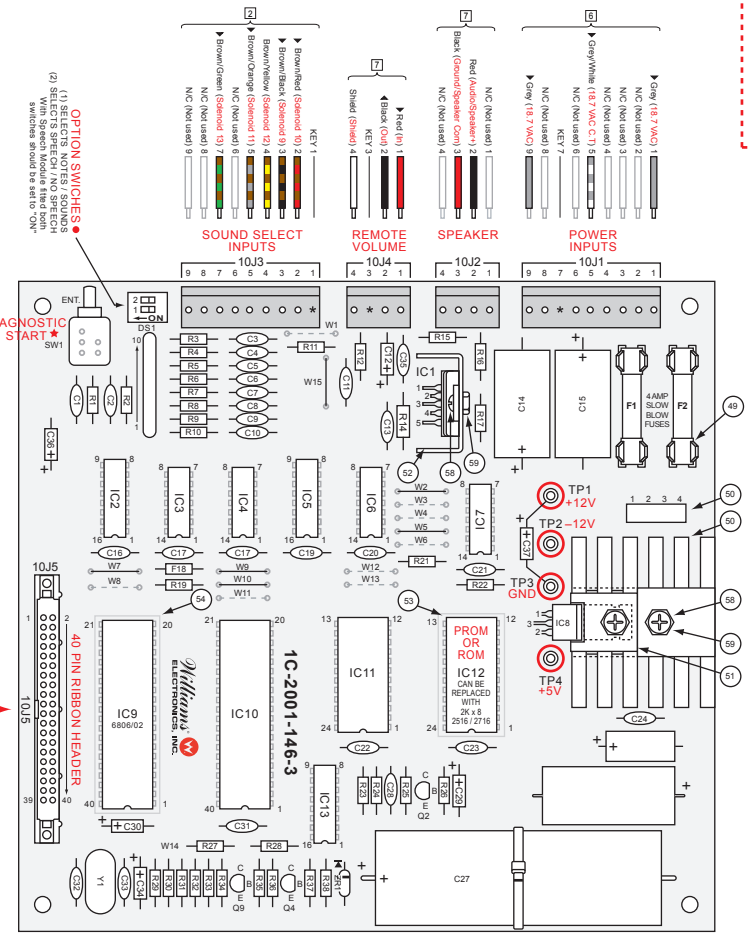
1	IC-2001-148-2		BARE P.C. BOARD	1
2	5A-9334	IC1	3417 CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	5A-9321	IC2, IC3	1458 DUAL OP-AMP	2
4	5A-8992	R1, R4, R22, R23	RESISTOR, FC, 560 OHM 10% ¼ WATT	4
5	5A-8776	R2	RESISTOR, FC, 68 K OHM 5% ¼ WATT	1
6	5A-8983	R3	RESISTOR, FC, 3.3 K OHM 10% ¼ WATT	1
7	5B-8817	R5, R16	RESISTOR, FC, 10 K OHM 10% ¼ WATT	2
8	5A-8773	R6	RESISTOR, FC, 18 K OHM 5% ¼ WATT	1
9	5A-9353	R7	RESISTOR, FC, 6.2 K OHM 5% ¼ WATT	1
10	5A-9324	R9, R10, R11, R15, R18, R19	RESISTOR, FC, 27 K OHM 10% ¼ WATT	6
11	5B-8997	R12, R13	RESISTOR, FC, 2.7 K OHM 10% ¼ WATT	2
12	5A-8772	R14, R17	RESISTOR, FC, 15 K OHM 5% ¼ WATT	2
13	5A-9314	R20	RESISTOR, FC, 1.2 K OHM 10% ¼ WATT	1
14	5A-9331	R21	RESISTOR, FC, 13 K OHM 10% ¼ WATT	1
15	5A-9185	R8	POTENTIOMETER, 5 K OHM	1
16	5A-9218	R24	RESISTOR, FC, 2.2 M. OHM 10% ¼ WATT	1
17	5A-8984	R25, R27	RESISTOR, FC, 1 K OHM 10% ¼ WATT	2
18	5A-9356	R26	RESISTOR, FC, 820 OHM 5% ¼ WATT	1
19	5A-9031	C1	CAP., TANTALUM, 1 MFD. 20% 25 V.	1
20	5A-8980	C2, C3, C5, C7, C8, C9, C13 THRU C16	CAP., CERAMIC, .01 MFD. +80% –20% 50 V.	10
21	5A-9030	C4	CAPACITOR, .047 MFD. 20% 50 V.	1
22	5A-9347	C2	CAP., CERAMIC, 1800 PFD. 5% 50V.	1
23	5A-9346	C10	CAP., CERAMIC, 1200 PFD. 5% 50 V.	1
24	5A-9348	C11	CAP., CERAMIC, 4700 PFD. 5% 50 V.	1
25	5A-9343	C12	CAPACITOR, ELECTROLYTIC, 10 MFD. 20% 20 V. LOW LEAK	1
26	5A-9263	C17	CAPACITOR, .033 MFD. 20% 200 V.	1
27	5A-8996	C18, C19	CAPACITOR, CERAMIC .1 MFD. 20% 25 V.	2
28	5A-9004		24 PIN SOCKET	4
29	5A-9352	J1	RIBBON CABLE ASSEMBLY	1

Sound Board



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33	5A-9345	C11	CAPACITOR, CERAMIC, .001 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAP., ELECTROLYTIC 1 MFD 63V –10/+ 50%	1
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	1
36	5A-9165 or 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
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38	5A-8986	C25	CAP., ELECTROLYTIC, 100 MFD. 10V. ±20%	1
39	5A-8993	C26	CAP., ELECTROLYTIC, 1000 MFD. 25V. ±20%	1
40	5A-9046	C27	CAP., ELECTROLYTIC, 12,000 MFD. 16V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1 K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25V. LOW LEAK ±20%	1
43	5A-9169	C32, C33	CAP., CERAMIC DISC, 27 PFD. 1 K V. ±10%	2
44	5A-9163	C34	CAP., TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAP., TANTALUM, 1 MFD. 25 V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1
48	5A-6314	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5A-9178		FUSE HOLDER	4
50	5A-9172		HEAT SINK THERMALLOY # 6072B	1
51	5A-9173		HEAT SINK THERMALLOY # 6071B	1
52	5A-9199		HEAT SINK THERMALLOY # 6030	1
53	5A-9004		24 PIN SOCKET	1
54	5A-8985		40 PIN SOCKET	1
55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
57	5A-9349	10J5	40 PIN RIBBON HEADER	1
58			6-32 3/8" BINDER HEAD SCREW	3
59			6-32 HEX NUT	3
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER 22 GAUGE WITH INSULATION	7
61	5A-9248	TP1 THRU TP4	TERMINAL # 1502-1	4
62	5A-9363	R11	RESISTOR, FC, 5.6 K OHM 5% ¼ WATT	1
64	5A-9362	SR1	RESISTOR, FC, 4.7 K OHM 10 PIN SIP	1
65	5A-7520-1		TIE WRAP	1

TROUBLESHOOTING: *FAULTY SOUND BOARD OR SPEECH MODULE*

SYMPTOM	CHECK	INDICATION/ACTION
Only electronic sounds with interval are produced.	1. Check that jumper W1 on Sound Board is removed and check setting of balance.	1. –
	2. Check for Speech Data activity:§ a) Sound Board IC10 pin 39 b) Speech Module IC1 pin 12 (13)	2. a) Activity at both pins, proceed. b) Activity at PIA none on Speech Module; check plating and connections. c) No activity; IC10 on Sound Board or IC1 on Speech Module faulty.
	3. Check for Speech Clock activity:§ a) Sound Board IC10 pin 19 b) Speech Module IC1 pin 9 (14)	3. Same as 2.
	4. Check for audio from Speech Module °IC1 pin 3 (2)§	4. a) 300 mVrms AC typical, proceed. b) No ac; IC1 or associated circuitry faulty.
	5. Check for audio from Speech Module 1C3 pin 7§	5. a) 2 Vrms ac typical. C4, C12, R8, R12, or R13 faulty. Repair or replace. b) No audio. IC3 or associated circuitry faulty. Repair or replace.
	§ During silent interval * First pin no. for C-8228 Speech Module; no.in parentheses for C-8226	
Only electronic sounds without interval are produced.	1. Using logic probe cheek for negative "D" & "B" Address Select pulses after last sound: a) Sound Board IC2 pin 6 ("D") and pin 4 ("B"). b) Speech Module IC6 pin 20 ("D") and IC7 pin 20 ("B").	1. a) All pulses occur. Replace Speech Module IC7. b) "D" Pulse or "B" pulse at Sound Board only; Check plating and connections. c) No "B" pulse; Speech Module IC6 or IC7 or Sound Board IC2 faulty. Repair or replace. d) No "D" pulse; proceed.
	2. Disconnect Speech Module cable and check for pulse at Sound Board IC2 pin 6 (no sounds are produced but a pulse should occur a few seconds after diagnostic pushbutton is depressed).	2. a) Pulse, replace IC6 on Speech Module. b) No pulse, replace IC2 on Sound Board.
Some words replaced by noise.	1. Check for pulsing of "C" Address select: a) Sound Board IC2 pin 5. b) Speech Module IC5 pin 20.	1. a) Pulsing at Sound Board 1C2 only; check plating and connections. b) No pulsing; Sound Board 1C2 or Speech Module 1C5 faulty. Repair or Replace. c) Pulses at both chips; Speech Module

TROUBLESHOOTING: *FAULTY SPEECH MODULE*

SYMPTOM	CHECK	INDICATION/ACTION
Some words garbled.	–	1. Substitute new chips on Speech Module one at a time for IC5, IC6, and IC7.
Sounds produced after Speech Module discon-nected in accordance with Diagnostic Procedure.	1. Remove IC5 IC6 and IC7 from Speech Module. Reconnect module and remove test lead connected to Sound Board in Diagnostic procedures. Repeat self-test.	1. a) Sounds produced, proceed. b) No sounds, replace Speech Module.
	2. Replace chips removed in step 1 one at a time, repeating the self-test.	2. Chip(s) which cause no sounds faulty.
Only speech produced	–	1. IC12, IC10, IC13, or Q2 faulty.
No sounds produced after speech module discon-nected in accordance with diagnostic procedure.	1. a) Disconnect 10P4. b) Short pins 1 and 2 of board connector with fingers and listen for low-level hum from speaker.	1. a) Hum produced, proceed. b) No hum, check speaker connection, and IC1 and associated circuitry.
	2. Check +5V, + 12V, and - 12V.	2. –
	3. Check Q3 collector voltage.	3. a) +5V; proceed. b) 0V: Q3, Q4, or associated circuitry faulty.
	4. Check for activity at IC9 pin 37.	4. a) No activity Y I or 1C9 faulty. b) Activity. Substitute new plug-in chips or replace sound board.

TROUBLESHOOTING: *SOLENOID TEST*

SYMPTOM	CHECK
Functions properly in Self-Test but one or more sounds missing in solenoid test.	1. Check connection at 10P3 and 2P9.
	2. Replace ROM or PROM.
	3. Check for pulse from Driver Board, replace driver if pulse missing.
	4. Check for pulse from Sound Board buffer; replace buffer if pulse missing.
	5. Check for pulses from IC6 output; replace IC6 if any pulses are missing.
	6. Replace Sound Board.
Functions properly in Self-Test, but all sounds are missing in solenoid test.	1. Check connectors 10P13 and 2P9.
	2. Replace ROM or PROM.
	3. Remove connector 10P3 and momentarily. ground one of the used pins at I0J3. If a sound is produced a solenoid driver transistor is stuck on. Repair or replace Driver Board.
	4. Check that 1C5/IC7 buffer outputs are not stuck low; check that 1C6 output is not stuck high. Replace faulty chip.
	5. Replace Sound Board.