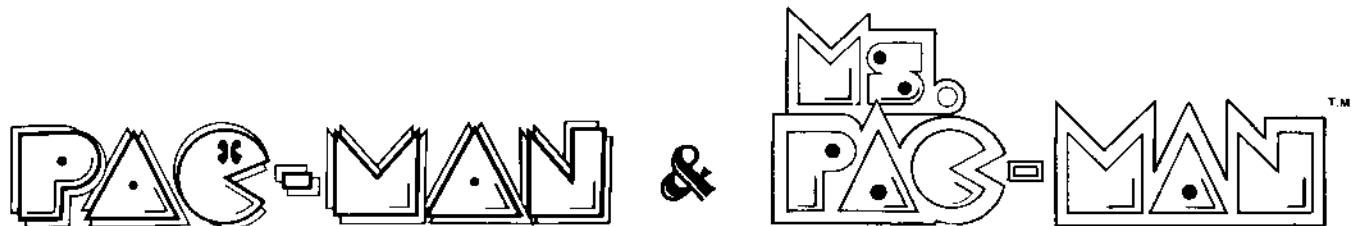
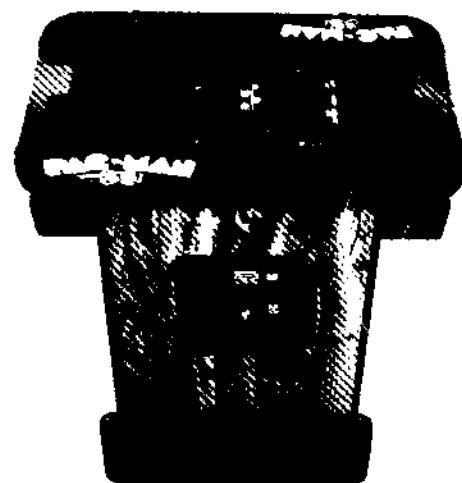
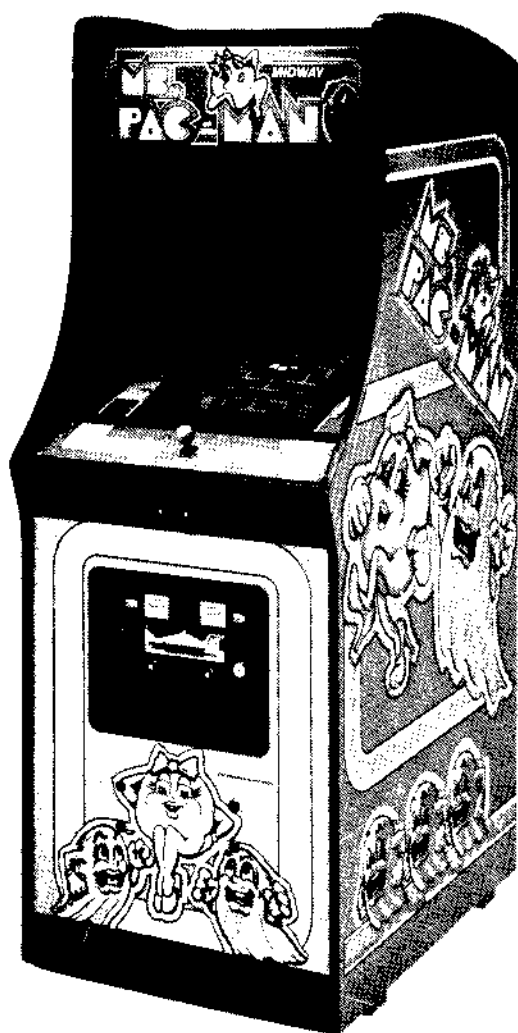


MIDWAY'S



TROUBLE SHOOTING LOGIC BOARD PART I



COCKTAIL #933



UP-RIGHT #932

MINI #934

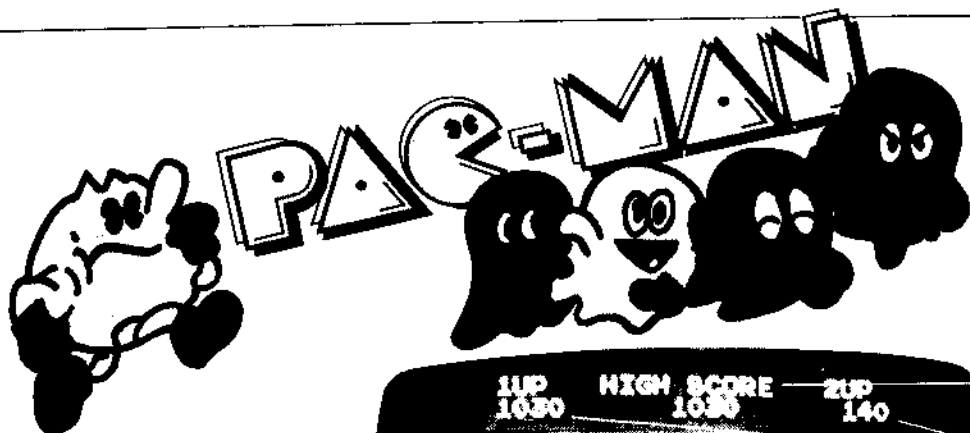
PHONE:
(312) 452-5200

FORM-00238-8012



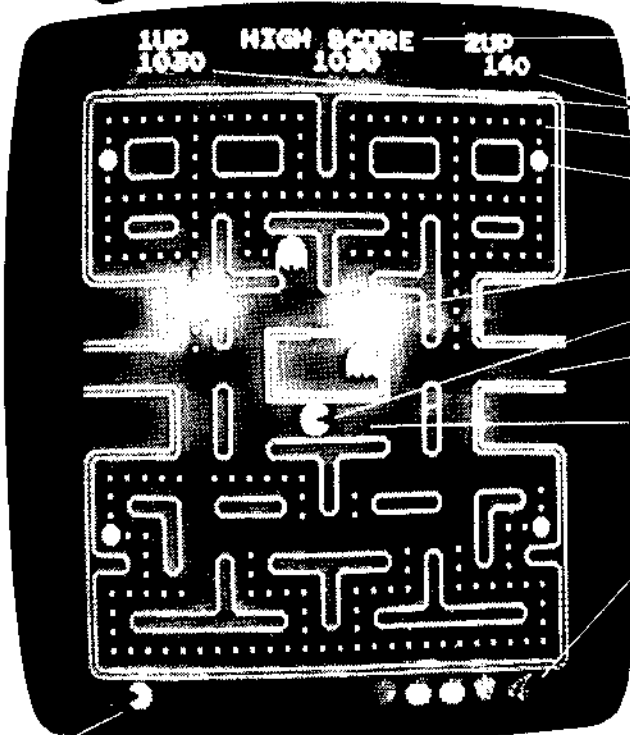
MIDWAY MFG. CO.
A BALLY COMPANY
10750 WEST GRAND AVENUE
FRANKLIN PARK, ILLINOIS 60131
U.S.A.

PHONE:
TOLL FREE
800-323-7182



A sensational, full color video game for 1 or 2 players that tickles vision and challenges reflexes. Adding to the fun are musical refrains, chomping and action sounds along with amusing cartoon shows between racks.

The player, using a single handle control guides the PAC-MAN about the maze, scoring points by munching up the Dots in his path. Four Ghost Monsters—Inky, Blinky, Pinky and Clyde— chase after the PAC-MAN trying to capture and deflate him. The PAC-MAN can counterattack by eating the big, Power Capsule that enables him to overpower the Monsters for additional score. After all the Dots are gobbled up, the screen is cleared, and PAC-MAN continues for another round. Each rack features a special Fruit Target in the maze, which if eaten, earns Bonus Points. Players start with three PAC-MEN. An additional PAC-MAN is awarded for 10,000 points.



HIGH SCORE — Retained and displayed daily.

PLAYERS' SCORE

DOTS — 10 Points Each.

POWER CAPSULE — 50 Points Each.

GHOST MONSTERS

PAC-MAN — The 'main' man.

ESCAPE 'Warp' TUNNEL — Out one side— reappear on other.

BONUS FRUIT TARGET — Appear below Monster's Den twice during each rack.

NUMBER OF SCREENS CLEARED — Fruit indicates how many times player has cleared the screen of dots.

- Screen cleared once.
- ◐ Screen cleared twice.
- ◑ Screen cleared 3 times.
- ◒ Screen cleared 4 times.
- ◓ Screen cleared 5 times.
- etc. —

PAC-MAN REMAINING

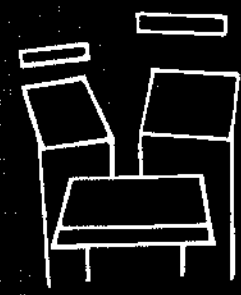
1 Quick, eat the flashing Power Capsule.

Inky Blinky Pinky Clyde

2 When the PAC-MAN powers up, the Monsters start to run away.

3 Points double for each Monster caught.

1600 800 400 200



58 1/2"	19 1/2"	24"
149 cm	49.5 cm	61 cm
29"	32"	22"
74 cm	81.25 cm	56 cm
73"	26 1/4"	34"
185.5 cm	67.25 cm	86.25 cm

MIDWAY MFG. CO.
 A BALLY COMPANY
 10750 West Grand Avenue
 Franklin Park, Illinois 60131
 For service information—call toll free 800-323-7182

DISTRIBUTED BY:

GENERAL INSTRUCTIONS FOR "PAC-MAN"

INSTALLATION

1. Remove shipping cleats located on bottom of cabinet.
2. Install four (4) provided leg levelers to bottom of cabinet and level cabinet.
3. The power is controlled by a switch located on top of the cabinet. Additional taps have been provided on the transformer to compensate for fluctuating line voltage.

LINE VOLTAGE SAFETY SWITCH

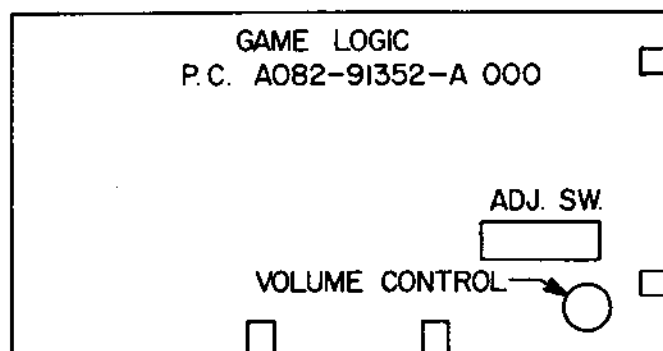
A line voltage safety switch has been provided for your protection. It is located on the right rear side of the cabinet in the back door area. When the back door is removed, it opens the circuit to the line voltage. To restore power (when servicing), pull switch fully out.

VOLUME CONTROL

The volume control pot is located on the Game Logic Board (P.C. A082-91352-A000). This pot controls the volume of all sounds and may be varied as desired by rotating pot control.

ADJUSTMENT SWITCHES

Located on Game Logic Board (P.C. A082-91352-A000) and may be adjusted as indicated on separate instruction card in back box area.



TO REMOVE CONTROL PANEL AND MONITOR DISPLAY GLASS

1. Open coin door.
2. Release two (2) clamps located below Control Panel on each side of cabinet.
3. Disconnect control panel jack.
4. Remove control panel.
5. Remove monitor display glass.

CREDIT PUSH BUTTON SWITCH

Located in cash box area and is readily accessible by opening coin door. This switch is provided as a test aid and awards one credit without advancing coin meter.

M051-00932-A003

WARNING: This equipment Generates, Uses and can Radiate Radio Frequency Energy and if not installed and used in accordance with the Instructions Manual, may cause interference to Radio Communications. As temporarily permitted by Regulation it has not been tested for compliance to Subpart J or Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a Residential Area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

METHOD OF PLAY

SW. #1	SW. #2		
OFF	ON	1 COIN	1 PLAY
ON	OFF	1 COIN	2 PLAY
OFF	OFF	2 COINS	1 PLAY
ON	ON		FREEPLAY

NUMBER OF PACKMEN PER GAME

SW. #3	SW. #4	
ON	ON	1 PACKMAN
OFF	ON	2 PACKMEN
ON	OFF	3 PACKMEN
OFF	OFF	5 PACKMEN

BONUS PACKMEN

SW. #5	SW. #6	
ON	ON	BONUS PACKMAN AT 10,000
OFF	ON	BONUS PACKMAN AT 15,000
ON	OFF	BONUS PACKMAN AT 20,000
OFF	OFF	NO BONUS

SW. #7	SW. #8	
OFF	OFF	PLAY MODE
ON	OFF	RACK TEST
OFF	ON	LOCKS PICTURE

M051-00932-A035

ELECTRICAL BULLETIN: FOR ALL APPARATUS COVERED BY THE CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD C22.2 NO. 1, WHICH EMPLOYS A SUPPLY CORD TERMINATED WITH A POLARIZED 2-PRONG ATTACHMENT PLUG.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

GAME BOARD TEST

Place test slide switch in "ON" position. If game board is good, the following information will be displayed on the screen:

OK
Coin Adjustment Setting
Bonus Adjustment Setting
Number of PAC-MAN Per Game Setting
Game Version

RAM/ROM TEST

If any of the Rams or Roms are faulty, the following information will be displayed on the screen:

BAD ROM LOCATION CODE

Display	Location
M-Rom-0	6E
M-Rom-1	6F
M-Rom-2	6H
M-Rom-3	6J

BAD RAM LOCATION CODE

Display	Location
Bad V Ram-0	4K
Bad V Ram-1	4N
Bad C Ram-0	4L
Bad C Ram-1	4P
Bad W Ram-0	4M
Bad W Ram-1	4R

CONTROL PANEL AND COIN SWITCH TEST

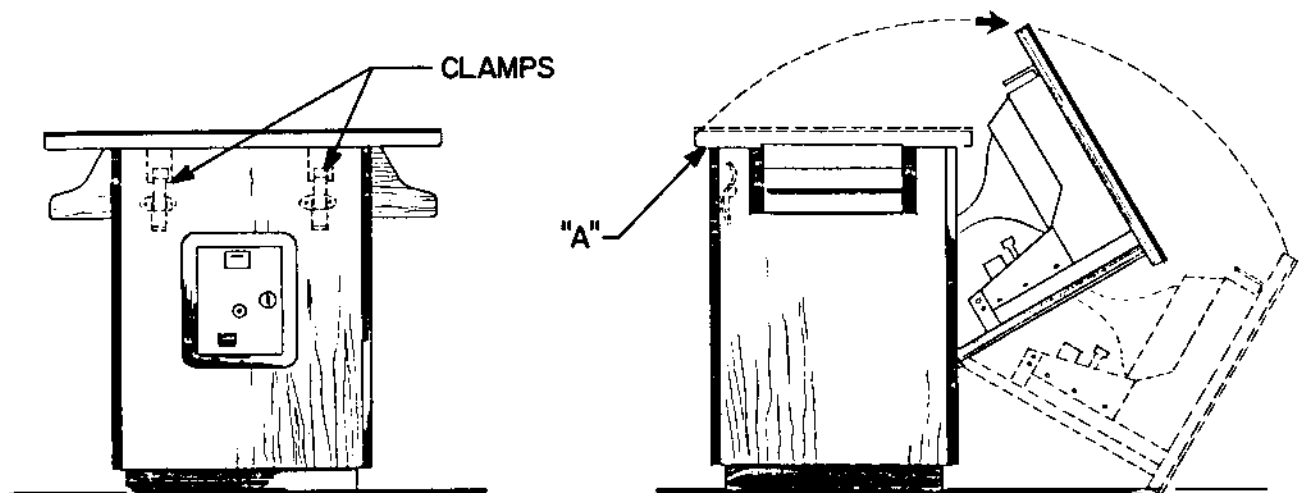
To verify operation of any switch, close switch in question. If switch is operating properly, a game sound will emit when closure is made.

Caution: Be sure to return test switch to game mode when all tests are completed.

TO SERVICE MONITOR, GAME BOARD AND TRANSFORMER ASSY.

1. Open coin box door and release two (2) clamps indicated on sketch below.
2. Grasp monitor mounting panel at "A" and open as indicated in sketch below.

Caution: Due to the weight of the monitor extreme care must be exercised when opening cabinet for service.



PAC - MAN

TROUBLE SHOOTING LOGIC BOARD PC A082-91375-A000

1. CHECK +5VDC AT CPU AND ROMS.
2. RESET LINE PIN #26 OF CPU NORMALLY HIGH AND GOES LOW WITH RESET.
3. 6MHZ CLOCK FREQUENCY AT PIN #13 OF 8-B AND 3MHZ AT PIN #6 OF CPU.
4. CHECK ROM TEST FOR A MEMORY FAILURE.
5. CHECK ALL ADDRESS AND DATA LINES AT CPU.
6. CHECK ALL ADDRESS AND DATA LINES AT 4-A AND 7-F COLOR PROMS.
7. CHECK ALL ADDRESS AND DATA LINES AT 5-E AND 5-F CHARACTER ROMS.
8. WHEN CHARACTER ROM 5-E IS REMOVED GAME PLAYS BUT MAZE IS MISSING.
9. WHEN CHARACTER ROM 5-F IS REMOVED GAME PLAYS BUT PAC - MAN AND GHOST MONSTERS ARE BLOCKS OF COLOR.
10. WHEN ALL PROGRAM ROMS ARE REMOVED THE SCREEN WILL BE ROWS OF BLUE DIAGONAL LINES.
11. CHECK SOUNDS AND SWITCHES USING TEST SWITCH.
12. SWITCHES #7 AND #8 MUST BE OFF FOR NORMAL GAME PLAY.
13. SWITCH #7 ON WILL TEST RACKS.
14. GOOD LUCK!

PAC - MAN
TROUBLE SHOOTING
PC A082-91375-A000

NOTE: All I.C. trouble shooting information is with the I.C. removed from circuit.

POSITION	CHIP	POSSIBLE TROUBLE
1-E	74LS161	All Characters are at top of screen - Characters move horizontally only.
1-F	74LS283	Lines and Squares entire screen - Effects Self Test.
1-H	74LS283	Horizontal lines across screen in color.
1-K	74LS283	No Sounds - Game plays normal.
1-L	74LS174	Same as 1-K
1-M	5623 (Prom)	Same as 1-K
1-N	CD 4066	Same as 1-K
2-A	93415 (Ram)	Effects Color of all Characters - Game plays.
2-B	93415 (Ram)	Same as 2-A
2-C	93415 (Ram)	Same as 2-A
2-D	93415 (Ram)	Effects Color of the Characters - Eyes only two Characters.
2-E	74LS161	Characters top of screen - Characters move horizontally - Effects Game Play - Color & Sound OK.
2-F	74LS283	Effects Self Test - Row of Characters horizontally across screen. Effects Game Play - Color & Sound OK.
2-H	74LS86	All Characters are Squares - Effects Self Test - Horizontal Color Bars across screen.
2-K	74LS89	Effects all Sounds - Game plays & color OK.
2-L	74LS89	Same as 2-K
2-M	74LS273	Same as 2-K
2-P	74LS02	Effects Sync - No Video - No Sound - Moving Diagonal Lines.
2-R	74LS161	Vertical short lines in color - Effects Game Play.
2-S	74LS161	Horizontal Color Bars across screen - Effects Game Play.

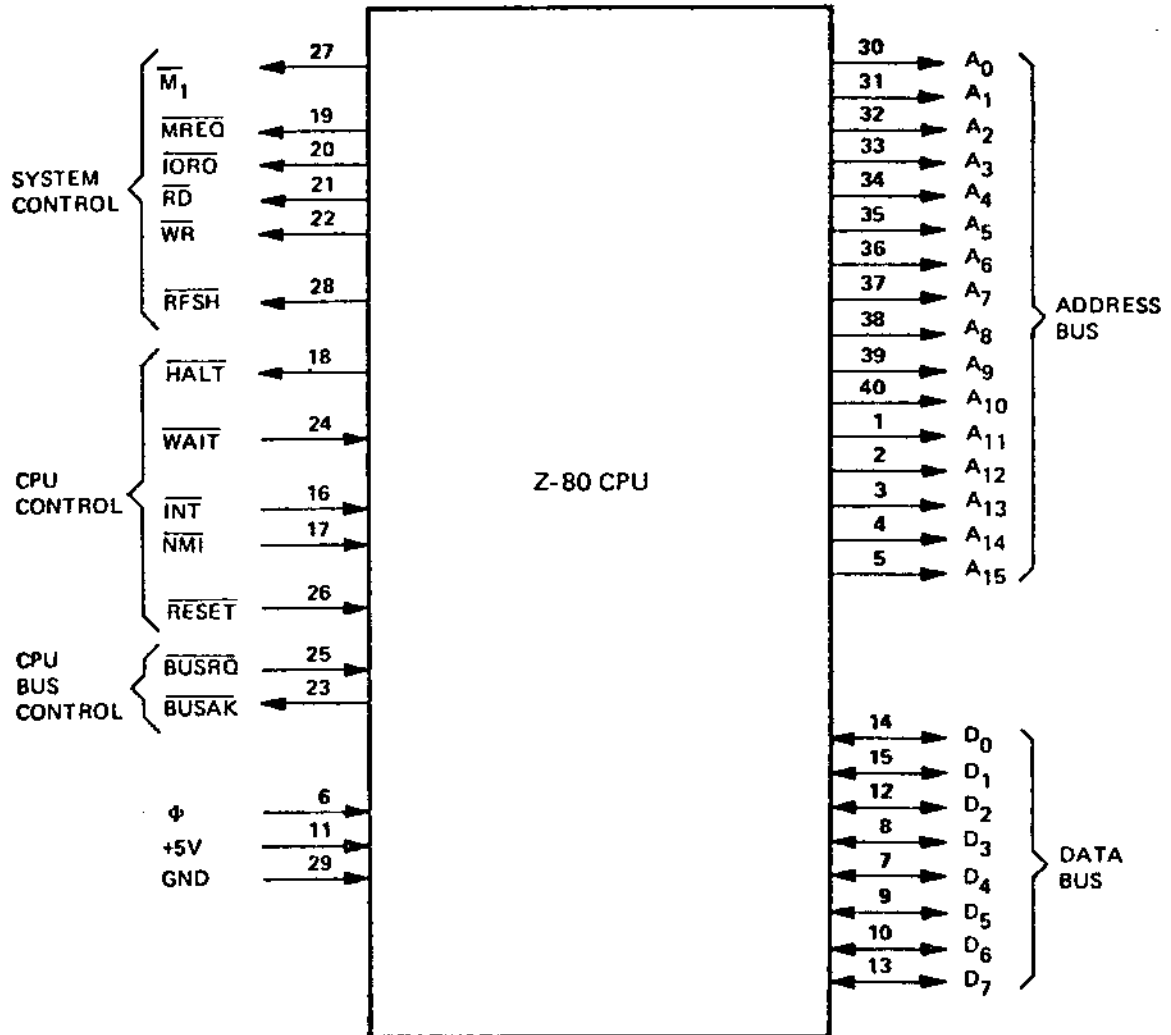
POSITION	CHIP	POSSIBLE TROUBLE
3-A	74LS158	No Characters in maze.
3-B	74LS157	No Video (Dead)
3-D	74LS75	Characters missing in maze - Game plays without seeing Characters.
3-E	74LS20	No Video (Dead)
3-F	74LS89	Same as 3-D
3-H	74LS89	All Characters move jerking - Characters do not stay in maze.
3-K	74LS158	No Sounds - Game Plays.
3-L	74LS157	Same as 3-K
3-M	1M5623	Same as 3-K
3-N	74LS74	Effects Sync - Color Diagonal Lines.
3-P	74LS10	No Video (Dead)
3-R	74LS161	No Video (Dead)
3-S	74LS161	Effects Sync - Diagonal Lines.
4-A	1M5623 (Prom)	No Video (Dead)
4-B	74LS377	Distorted Letters - No Color - Maze is White - Effects Game Play.
4-C	74LS00	No Video (Dead)
4-D	74LS273	No Maze - Screen covered with Number Fives - No Letters - Characters moving about.
4-E	74LS157	Distorted Maze - Letters Upside Down - Characters Distorted.
4-F	74LS86	Distorted Characters - Letters and Sound.
4-H	74LS245	Flashing White Dots - No Color.
4-K	2114 (Ram)	All White Zeros on screen.
4-L	2114 (Ram)	Flashing Numbers and Letters in Color.
4-M	2114 (Ram)	Blank screen with a Single Zero at top of screen - Two Red Characters Only.
4-N	2114 (Ram)	Same as 4-K
4-P	2114 (Ram)	Flashing Self Test - Flashes continuous.

POSITION	CHIP	POSSIBLE TROUBLE
4-R	2114 (Ram)	Screen is blank with a Number One flashing - A single Character can be seen.
5-A	74LS157	Blue Screen - All Characters are Squares - No Letters or Numbers.
5-B	74LS194	Color Squares around each Character - All maze dots are blue.
5-C	74LS194	Effects Maze - Characters have Squares around them - Self Test in Red.
5-E	9332 (Prom)	Blue screen with Horizontal Squares - No Maze - No Letters or Numbers random Characters.
5-F	9332 (Prom)	Effects Characters in Maze which are Squares - Everything else normal.
5-L	74LS139	Red screen flashing with all Letter F's.
5-M	74LS74	Screen covered with Garbage in Color.
5-N	74LS08	Effects Sync - Moving Diagonal Lines in Color.
5-S	NVC 284 (Custom)	Flashing White Dots - Game plays.
6-B	Z80 CPU	Screen covered with Garbage in Color.
6-D	NVC 285 (Custom)	Same as 6-B
6-E	9332-B (Prom)	Flashing blue Zeros and Garbage - Continuous Meter Pulses.
6-F	9332-B (Prom)	Blank screen with a Flashing Number One - Bad Rom One.
6-H	9332-B (Prom)	Screen covered with Garbage.
6-J	9332-B (Prom)	Blank screen with random Characters.
6-R	74LS367	Screen flashing with Garbage in Color.
6-S	74LS367	Same as 6-R
7-F	7603	No Video (Dead)
7-H	74LS08	Eleven Horizontal rows of Zeros across screen.
7-J	74LS138	No Video (Dead)
7-K	74LS138	No Video (Dead)
7-L	74LS02	Same as 7-J
7-M	74LS139	Screen covered with Garbage in Color.
7-N	74LS42	Same as 7-J

POSITION	CHIP	POSSIBLE TROUBLE
8-A	74LS107	No Video (Dead)
8-B	74LS368	Same as 8-A
8-C	74LS74	Effects Sync - Diagonal Lines flashing.
8-D	74LS367	Effects Dip Switch settings.
8-E	74LS367	No Coin - No Up & Down Controls - 1st Player.
8-F	74LS367	No Controls - 2nd Player.
8-H	74LS367	No Test Switch - 1 & 2 Player Select.
8-K	74LS259	Stays in Self Test - Shows Memory OK.
9-C	74LS161	Screen covered with Garbage in Color.
10-A	LM377 — LM1877	No Sounds.
ADDITIONAL DEVICES		
10-A	Dip Switch	Effects Coin Play - Number of Pac-Man Bonus Pac-Man.
B-7	Crystal (18.432)	No Video (Dead)
P-8 (IR1)	78GVIC (Regulator)	Effects +5 VDC
R-9	D44VM4	Pass Transistor - Effects +5 VDC
L-9	D40K1	Transistor - Effects Coin Counter
C-9	2N3391	Transistor - Effects Power Reset

Z-80 CPU PIN DESCRIPTION

The Z-80 CPU is packaged in an industry standard 40 pin Dual In-Line Package. The I/O pins are shown in figure 3.0-1 and the function of each is described below.



Z-80 PIN CONFIGURATION
FIGURE 3.0-1

PAC - MAN

PC A082-91375-A000

CHIP NUMBER	FUNCTION
74LS00	Quad 2 Input Nand
74LS02	Quad 2 Input Nor
74LS08	Quad 2 Input And
74LS10	Triple 3 Input Nand
74LS20	Dual 4 Input Nand
74LS42	BCD to Decimal Decoder
74LS74	Dual "D" Flip-Flop
74LS75	Quad Latch
74LS86	Quad 2 Input Exclusive or
74S89	64 Bit Ram 16 x 4
74LS107	Dual "JK" Flip-Flop
74LS138	3 to 8 Line Decoder
74LS139	Dual 2 to 4 Line Decoder
74LS157	Quad 2 to 1 Line Multiplexer
74LS158	Quad 2 to 1 Line Multiplexer Inverting
74LS161	4 Bit Binary Counter
74LS174	Hex "D" Flip-Flop
74LS194	8 Bit Shift Register
74LS245	Octal Bus Transceiver
74LS259	8 Bit Addressable Latch
74LS273	Octal "D" Flip-Flop
74LS283	4 Bit Full Adder
74LS367	Hex Bus Driver
74LS368	Hex Bus Driver Inverting
74LS377	Octal "D" Flip-Flop
Z80	CPU
LM377 - LM1877	Dual Audio Amplifier
NVC284	Custom V Ram Addresser
NVC285	Custom Z80 Sync Buss Controller
CD4066	Quad Bilateral Switch

CHIP NUMBER	FUNCTION
2114	Ram 1K x 4
1M5623	Prom 256 x 4
7603	Prom 32 x 8
MCM 2532	Prom 4K x 8
SL 4239	Ram 1K x 1
93415	Ram 1K x 1
27LS00	Ram 1K x 1
MB 8125	Ram 1K x 1
CD 4099	8 Bit Addressable Latch
N8T245	Octal Bus Transceiver
54LS174	Hex 'D' Flip-Flop
MB7052	Prom 256 x 4
MB7051	Prom 32 x 8
8304	Octal Bus Transceiver

ADDITIONAL DEVICES

18.4320	Crystal
78GVIC	Voltage Regulator
D44VM4	Transistor NPN
D40K1	Transistor NPN
2N3391	Transistor NPN
1N4004	Diode
A15	Diode
1N914B	Diode
1N4737	6.2V Zener Diode

SERVICE BULLETIN

GAME: PAC-MAN
SUBJECT: Custom Chips 6-D and 5-S

When the custom chips are not available due to a supply problem the following alternate plug in units will be used.

1. At location 6-D PC 082-91383-B000 Z80 sync buss controller.
2. At location 5-S PC 082-91384-B000 V-Ram Addresser.

PAC - MAN

V - RAM ADDRESSER (284)

A082-91384-B000

CHIP NUMBER	FUNCTION
74LS02	Quad 2 Input Nor
74LS86	Quad 2 Input Exclusive or
74LS157	Quad 2 to 1 Line Multiplexer
74LS257	Quad 2 to 1 Line Multiplexer-Tri State

Z - 80 SYNC BUSS CONTROLLER (285)

A082-91383-B000

74LS02	Quad 2 Input Nor
74LS74	Dual "D" Flip-Flop
74LS139	Dual 2 to 4 Line Decoder
74LS244	Octal Buffers - Tri State
74LS374	Octal "D" Flip-Flop-Tri State

**SELF-TEST DISPLAY
AND BOARD LOCATION COORDINATES**

MEMORY OK or (M-Rom-1 / Bad C Ram-0 / Bad W Ram-1 / etc.)

*1 COIN *1 CREDIT
BONUS *15000
MS. PACK-MEN *3
UPRIGHT or (TABLE)

* = switch selectable

If a bad ROM or Ram chip is found by the games internal check system during the Self-Test, the game indicates this to you by showing the location code of the bad chip(s) in place of the "MEMORY OK" message. The following table translates the chip location codes into actual positions on the game logic P.C. Board.

DISPLAY	DESCRIPTION
MEMORY OK	All RAMs are good.
BAD V RAM-0	RAM located on Logic PC board at position 4K is bad.
BAD V RAM-1	RAM located on Logic PC board at position 4N is bad.
BAD C RAM-0	RAM located on Logic PC board at position 4L is bad.
BAD C RAM-1	RAM located on Logic PC board at position 4P is bad.
BAD W RAM-0	RAM located on Logic PC board at position 4M is bad.
BAD W RAM-1	RAM located on Logic PC board at position 4R is bad.
MEMORY OK	All ROMs are good.
M-ROM-0	ROM located on Logic PC board at position 6E is bad.
M-ROM-1	ROM located on Logic PC board at position 6F is bad.
M-ROM-2	ROM located on Logic PC board at position 6H is bad.
M-ROM-3	ROM located on Logic PC board at position 6J is bad.

The detection of bad components on the Auxillary Logic PC Board is not quite as simple as is the case for the Main Logic PC Board. The following table lists the components that are on this Auxillary PC Board and what symptoms they will cause to appear on the monitor when each is bad.

---BAD COMPONENT/SYMPTON TABLE---

BAD COMPONENT	SYMPTOM DISPLAYED ON MONITOR (GAME IS NOT IN SELF-TEST)
Z-80 CPU	<u>STATIONARY color garbage (parts of pictures)</u> CPU located on Auxillary PC board at position U4
E-ROM-0	<u>Game goes through warm-up routine over & over & over---</u> ROM located on Auxillary PC board at position U5
E-ROM-1	<u>Game goes through warm-up routine over & over & over---</u> ROM located on Auxillary PC board at position U6
E-ROM-2	<u>FLASHING color garbage (parts of pictures)</u> ROM located on Auxillary PC board at position U7

---BAD COMPONENT/SYMPTON TABLE CONTINUED---

BAD COMPONENT	SYMPTOM DISPLAYED ON MONITOR (GAME IS NOT IN SELF-TEST)
CUSTOM CHIP CG-820	Monitor screen reads out "ROM 0" With game in Self-Test — Screen reads "BAD ROM-0" CG-820 located on Auxillary PC board at position U0
CUSTOM CHIP CG-821	Monitor screen displays FLASHING color garbage (parts of pictures) CG-821 located on Auxillary PC board at position U1
CUSTOM CHIP CG-822	Screen display is same as for CG-821. With game in Self-Test — Screen reads out UPSIDEDOWN "BAD W RAM-0" CG-822 located on Auxillary PC board at position U2
CUSTOM CHIP CG-823	Screen display is same as for CG-821 CG-823 located on Auxillary PC board at position U3

To check your game function switches and buttons (coin counter switches, TEST CREDIT button, 1 PLAYER and 2 PLAYER buttons): active each one while the game is in the Self-Test mode. You should hear a game sound for each activation. If you do not hear it, the switch/button is either not working, miswired, or disconnected. Check it out thoroughly.

When finished with the Self-Test mode, slide the Self-Test switch back to the "OFF" position.

- A cross hatch pattern appears on the monitor screen for about 1 to 2 seconds.
- If you wish to keep this test pattern on the monitor screen for further use, slide Self-Test switch to the "ON" position **after** the cross hatch pattern appears and **before** it disappears.
- When finished with the cross hatch pattern, set the Self-Test switch to the "OFF" position.
- Normal game functions will now return to the monitor screen.

OPTION SWITCH SETTINGS:

To change the option switch settings, you DO NOT have to take the Main Game Logic Board out of the game. They can be easily reached through the rear access door on the Upright and Mini models. On the Cocktail Table model, you do have to open the table top to reach them.

When changing any options, ALWAYS put the game into the Self-Test mode, make your changes, check the results on the monitor screen, take the game out of the Self-Test mode, and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

The option switch settings and what they will make the game do, are shown in the following Figure.