Williams

NARC
T.M.

SAY NO TO DRUGS!

Service Manual

Programmed Chip Summary (Continued on Inside-Back Cover)

IC	DESCRIPTION	TYPE	BOARD LOC.	PART NO.
CRAM Controller	PLD	EP153A	CPU Board U28	A-5346-3036-1
Local Ctlr	PLD	EP153A	CPU Board U78	A-5346-3036-2
Video RAM Ctlr	PLD	EP153A	CPU Board U79	A-5346-3036-3
Address Decoder	PLD	EP153A	CPU Board U80	A-5346-3036-4
Image ROM Ctlr	PLD	EP153A	CPU Board U83	A-5346-3036-5
Video RAM Seq.	PLD	EP600	CPU Board U12	A-5346-3036-6
Autoerase Ctlr	PLD	EP900	CPU Board U20	A-5346-3036-7
Program ROM	ROM	27512	ROM Board U23	A-5343-3036-7
Program ROM	ROM	27512	ROM Board U24	A-5343-3036-8
Image ROM	ROM	27512	ROM Board U25	A-5343-3036-15
Image ROM	ROM	27512	ROM Board U26	A-5343-3036-16
Image ROM	ROM	27512	ROM Board U27	A-5343-3036-17
Image ROM	ROM	27512	ROM Board U28	A-5343-3036-18
Image ROM	ROM	27512	ROM Board U29	A-5343-3036-19
Image ROM	ROM	27512	ROM Board U30	A-5343-3036-20
Image ROM	ROM	27512	ROM Board U31	A-5343-3036-21
Image ROM	ROM	27512	ROM Board U32	A-5343-3036-22
Image ROM	ROM	27512	ROM Board U33	A-5343-3036-23
Image ROM	ROM	27512	ROM Board U34	A-5343-3036-24
Image ROM	ROM	27512	ROM Board U35	A-5343-3036-25
Image ROM	ROM	27512	ROM Board U36	A-5343-3036-26
Image ROM	ROM	27512	ROM Board U37	A-5343-3036-27
Image ROM	ROM	27512	ROM Board U38	A-5343-3036-28
Image ROM	ROM	27512	ROM Board U39	A-5343-3036-29
Image ROM	ROM	27512	ROM Board U40	A-5343-3036-30
Program ROM	ROM	27512	ROM Board U41	A-5343-3036-9
Program ROM	ROM	27512	ROM Board U42	A-5343-3036-10
Image ROM	ROM	27512	ROM Board U43	A-5343-3036-31
Image ROM	ROM	27512	ROM Board U44	A-5343-3036-32
Image ROM	ROM	27512	ROM Board U45	A-5343-3036-33
Image ROM	ROM	27512	ROM Board U46	A-5343-3036-34
Image ROM	ROM	27512	ROM Board U47	A-5343-3036-35
Image ROM	ROM	27512	ROM Board U48	A-5343-3036-36
Image ROM	ROM	27512	ROM Board U49	A-5343-3036-37
Image ROM	ROM	27512	ROM Board U50	A-5343-3036-38
Image ROM	ROM	27512	ROM Board U51	A-5343-3036-39
Image ROM	ROM	27512	ROM Board U52	A-5343-3036-40
Image ROM	ROM	27512	ROM Board U53	A-5343-3036-41
Image ROM	ROM	27512	ROM Board U54	A-5343-3036-42

Williams® Ⓦ

NARC
SAY NO TO DRUGS!

SERVICE MANUAL

- •operation
- •adjustment
- •bookkeeping
- •diagnostics
- •unique parts

Programmed Chips on the Sound Board

IC	DESCRIPTION	TYPE	BOARD LOC.	PART NO.
Sound ROM	ROM	27512	Sound Board U3	Not Used
Sound ROM	ROM	27512	Sound Board U4	A-5343-3036-1
Sound ROM	ROM	27512	Sound Board U5	A-5343-3036-2
Sound ROM	ROM	27512	Sound Board U35	A-5343-3036-3
Sound ROM	ROM	27512	Sound Board U36	A-5343-3036-4
Sound ROM	ROM	27512	Sound Board U37	A-5343-3036-5
Sound ROM	ROM	27512	Sound Board U38	A-5343-3036-6

Jumper Table

CPU Board	Connected	Not Used
	W3 W4 W6	W1 W2 W5
	W9 W10 W11	W7 W8 W12
	W14	W13
ROM Board	1 / 2 3 / 4	(None)
	5 / 6 7 / 8 9 / 10	
	11 / 12 13 / 14 R1	
CPU Board	W3 W4 W6	W1 W2 W5
	W9 W10 W11	W7 W8 W12
	W14	W13
Sound Board	W1 W9 W4 W15	W2 W13 W3 W14
	W5 W17 W7 W18 W8 W20	W6 W16 W10 W19 W11 W21
		W12

Table of Contents

Chapter 1. Operating Procedures

Examine Your Game

• **INSPECT THE OUTSIDE** of the carton or game cabinet for shipping damage.

• **UNLOCK AND OPEN** the bottom-rear door. Now check circuitry.

• **ARE CONNECTORS SECURELY ATTACHED?** Reconnect any found loose. *Don't force connectors!* They're keyed and only fit one way.

• **ARE PLUG-IN CHIPS FIRMLY SEATED** in their sockets?

• **REMOVE THE BATTERY PAPER** from the round, lithium cell on the CPU Board. This paper prevents the battery from powering the CMOS RAM until the game is installed. With the paper in, the game forgets your adjustments every time you switch it off.

• **UNWRAP THE POWER CORD** coiled inside the cabinet. *Don't plug it in yet!*

• **SCRUTINIZE MAJOR SUBASSEMBLIES,** such as the monitor, player panel, transformer chassis and power supply. Make sure they're securely mounted.

• **UNDO THE CONTROL-PANEL LATCHES.** You can reach these from the coin door by extending your arm upward and to either side. Now check connectors and circuitry as above.

Control Locations

THE ON-OFF SWITCH is above the back *(monitor)* door. Standing before the game, you'll find the switch at the game's top-left corner.

POWER INTERLOCK SWITCH. Your game has two power-interlock switches. These are located at the back of the game, behind the top and middle panels. Imagine that you're standing behind the game. An interlock is

in the upper-right corner of each panel. Each interlock is a spring-loaded DPDT switch. It turns off the game when you remove the panel. For servicing purposes, pull the switch out and the game will power up.

THE VOLUME CONTROL is inside the coin door and to your right.

THE ADVANCE SWITCH is mounted on a bracket behind the coin door. *This switch is useful for many purposes: Accessing Diagnostic Mode Tests, reading the bookkeeping totals or making game adjustments.* See relevant discussions later in this chapter.

THE MEMORY-PROTECT INTERLOCK SWITCH is behind the coin door. This switch must be open when you clear bookkeeping totals or make game adjustments. It automatically opens when the coin door is open.

THE CPU-BOARD RESET SWITCH is on the CPU Board near the +5VDC indicator LED.

Power Turn-On

WHEN THE GAME IS FIRST TURNED ON general illumination should light. A moment later, the game performs Power-Up Diagnostics...

(1) First, a scanning rug pattern appears. During this pattern, Video, Scratchpad and Color RAM chips are tested. The test also demonstrates DMA operation.

(2) While the rug pattern is scanning, the game should sound two tones. These indicate the readiness of the Music and Sound Microprocessors on the Sound Board.

(3) A stationary, striped pattern replaces the scanning rug. This pattern is an artifact of the testing process.

(4) Briefly, an assembly diagram of the CPU Board appears. This diagram indicates test passage by the RAM chips and main microprocessor (GSP) U18. As they test good, the pictorial colors the chips green.

(5) A drawing of the ROM Board replaces the CPU Board diagram. As they test good, the pictorial colors the ROMs green. Untested and not-used ROMs are shown in gray.

(6) In a correctly running game, tests will be followed by the the High Score Table and a repeat of the two Sound Board tones. If failure messages come up on the screen instead, refer to Chapter 2.

DEMAGNETIZE THE GAME with a television degaussing coil. Besides the monitor, remember to degauss large steel parts (for example, the backdoor hinge). Do this whenever you move the game, and also as a regular, monthly procedure. Otherwise residual magnetism may cause color impurities that adversely affect your collections.

Game Operation

GAME START
INSERT COINS. The game allocates an adjustable number of credits per coin. This number appears on the CRT. For example, assume that your settings specify one credit for a quarter *(U.S. factory pricing)*. A player deposits a quarter and presses 1-PLAYER START. On its screen, the game posts one credit. Then a one-player game begins.

Using player-2 controls for a one-player game is also possible: With one credit displayed, press 2-PLAYER START.

For a two-player game, at least two credits must be displayed. To initiate this two-player game, press both 1-PLAYER START and 2-PLAYER START.

PLAYER CONTROLS

On its player panel, your *NARC^{TM}* game has four pushbuttons and a joystick. Players can...

- **FIRE** at evil pushers with the machine pistol.

- **PRESS ROCKET BOMB!** Eliminate several pushers in one blast!

- **JUMP** over broken sidewalks and other obstacles!

- **CROUCH** to duck bullets and garbage cans!

- **MOVE** in eight directions with the joystick.
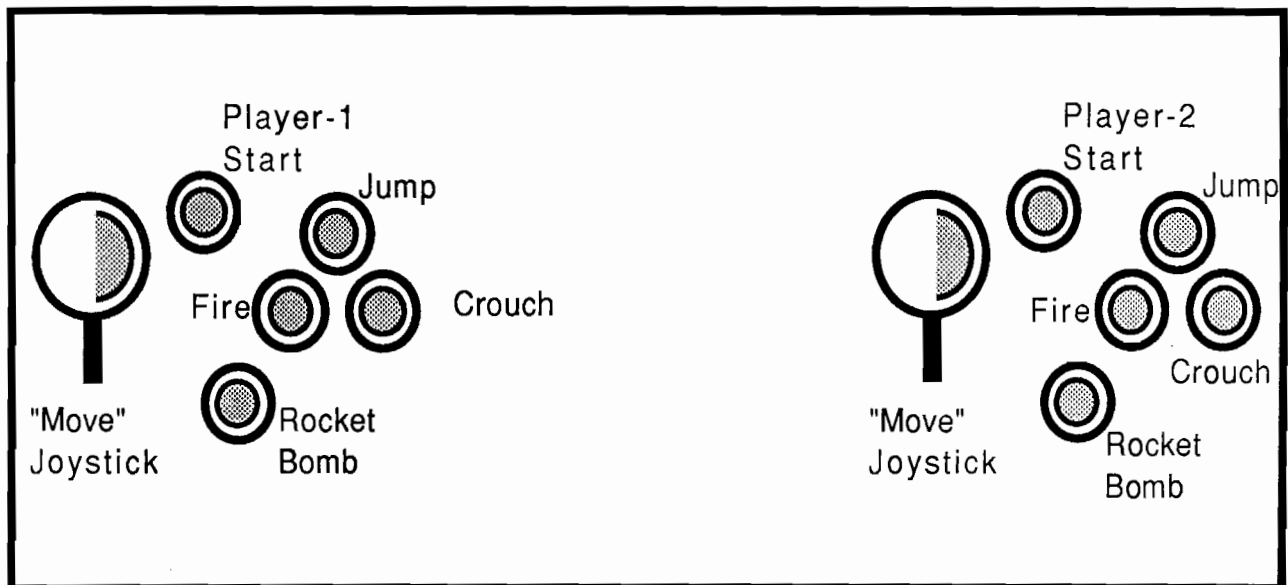
Player Panel

GAMEPLAY

THE CITY'S OVERRUN! Slashers! Gangsters! Pimps! The punks are everywhere! The scum of the earth! And only the player can restore law and

order! Trigger finger spraying hot metal before him... ROCKET BOMB at the ready... The player is a macho urban guerilla, defending our city from the ultimate urban scourge! This is his neighborhood too. He's committed. He says NO to inner city decadence. He carries a badge and a moral code. And he backs them both with screaming lead.

FEARLESS, ALOOF... He blazes away with his machine pistol. Then he launches a devastating ROCKET BOMB to trap several baddies in simultaneous ambush! With JUMP and SQUAT buttons, he dodges bullets, dynamite and other missiles. But the lurking Loaf, death-dealing Dumpster Man, patronizing Pimp and horrible Hypoman are everywhere. And these mangy marauders stop at nothing. This is their turf. So they'll hurl more bombs and deal more corruption. Because they're forever preparing another rendevous with death. Here's a list of the nefarious gangmembers...

- Loaf
- Gangster
- Pimp
- Hypoman

- Psychotic
- Slasher
- Dumpster Man
- Mr. Big *(Public Enemy Number 1)*

THIS JOB DEMANDS GRITTY DETERMINATION, FAST THINKING! The city is a *jungle.* Pushers may lurk in manholes... They may dart by in a heavily armed, pink Cadillac... Or they might even buzz the player with their preemptive pushercopter! But the player laughs at danger. He scores bonus points by seizing contraband *(evidence!)* hidden in the Cadillac. And by busting these parasites on society. Then he blows that manhole. And he downs that pushercopter. Because no pimp is too high... And no gangster's too low to eat hot justice!

ENTER BUILDINGS. The player must seek out and investigate gang strongholds. When enemies dart out of a tenement, the player must enter. If psycho fiends slither in the subway, the player relentlessly pursues them. Not bullets, not bombs, not even mad dogs can deter him. For our hero's sworn duty is to case the hideouts and seize the evidence. Then he can bust another offender!

THE PLAYER STARTS WITH THREE LIVES. Busts and evidence win points. For every 100,000 points earned, the player receives another life. *(The number of lives per game and points per extra life are operator adjustable.)* The game displays a green bar to represent a player's current lifetime. When enemies wound the player, the lifetime and the bar shorten.

THE BIG TARGET. Ultimately the player pursues Public Enemy Number One, Mr. Big. Mr. Big is the shimmering, super slug king of the sleazy, slimy underworld empire. His glitzy, cosmopolitan crib is brimming with evidence. And he's the inevitable prospect for a megabust. But he's wily. He's quick. And he's amply equipped with the latest Hyper-Crimewave Technology. Nevertheless, the player must not permit him to escape! The dragnet must not fail!

Game Adjustments, Bookkeeping, Diagnostics

MENU CONCEPT. For your convenience, game adjustments, bookkeeping, audit totals and diagnostics are *menu-driven* features. Each *menu* is a list of several choices that you may act upon as desired.

LEVELS OF MENUS. Your game has several levels of menus. That is, one menu selection will send the game to another menu. The menus are arranged in outline fashion. That is, a menu of general options selects menus of more specific options.

```
┌─────────────────────────────────────────┐
│                                           │
│   ┌─────────────────────────────────┐    │
│   │    NARC   TEST   MENU           │    │
│   │    NARC · REUISION  H.H         │    │
│   └─────────────────────────────────┘    │
│                                           │
│   ┌─────────────────────────────────┐    │
│   │ SELECT WITH UP/DOWN STICK       │    │
│   │ ACTIVATE WITH ANY BUTTON        │    │
│   └─────────────────────────────────┘    │
│                                           │
│   ┌──────────────────────┐ ┌──────────┐  │
│   │ DIAGNOSTIC TESTS     │ │ VIEW     │  │
│   │ COIN BOOKKEEPING     │ │ GAMEPLAY │  │
│   │ GAME AUDITS          │ │ STATISTICS│ │
│   │ GAME ADJUSTMENT      │ └──────────┘  │
│   │ UTILITIES            │               │
│   │ EHIT TO GAME OUER    │               │
│   └──────────────────────┘               │
│                                           │
└─────────────────────────────────────────┘
```
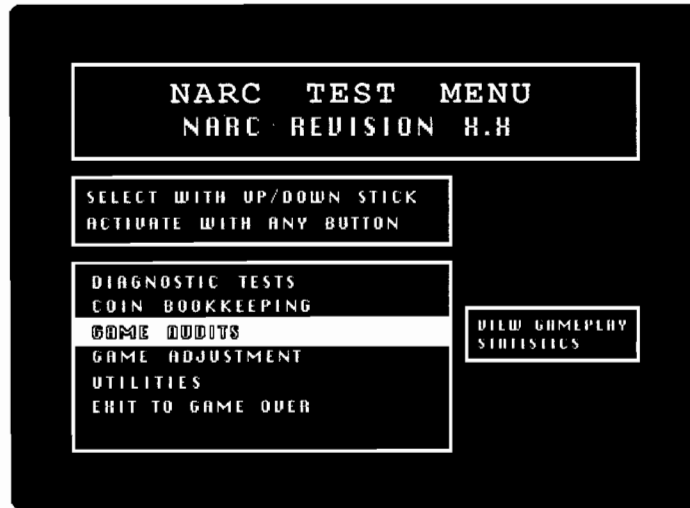
Main Test Menu

PRESS ADVANCE. Adjustments, bookkeeping and diagnostics are available from the main test menu. Enter the main test menu by pressing the white ADVANCE button inside the coin door. ADVANCE is mounted on a bracket a few inches behind the door.

SELECTING AND ENTERING OPTIONS. To select an option you desire to investigate, move the joystick up or down.   Watch the highlighted bar on the screen menu. This bar illuminates the selected option. You can enter the highlighted option by pressing any player panel button.

IF THE PLAYER PANEL EVER FAILS, ADVANCE can operate diagnostic and bookkeeping functions. First press ADVANCE as usual to initiate diagnostics or other modes.   After that, each time you press ADVANCE, the game steps through menu options. ADVANCE isn't as convenient as using player panel controls. For example, it doesn't replace the joystick. However ADVANCE offers a good backup system for the player panel.

RETURN TO MAIN MENU. Normally you may exit the menu you're inspecting and return to the previous menu. In fact, "RETURN TO MAIN MENU" and "EXIT TO GAME OVER" are typical menu options. Suppose that you select

"RETURN TO MAIN MENU": *The game returns to the option where it was before on the previous menu.*
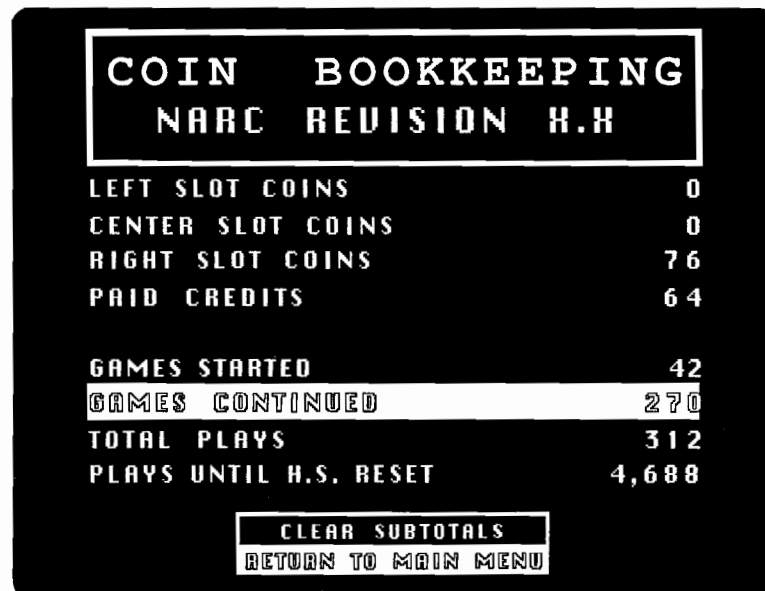
Pressing *and holding* ADVANCE causes the game to exit to Game-Over Mode.

DIAGNOSTIC TESTS

As mentioned earlier, your game performs various tests at power-up. You can repeat any of these tests by entering DIAGNOSTIC TESTS from the main menu. Additional tests are also available. Chapter 2 covers these in detail.

COIN BOOKKEEPING

Two COIN BOOKKEEPING screens are accessible from the main menu. The first screen details the number of coins through each chute. (The screen refers to a center chute, although some games don't have a center chute. See *Installing a Dollar Bill Acceptor,* later in this chapter.)

```
┌─────────────────────────────────────────────┐
│ ┌───────────────────────────────────────┐   │
│ │ COIN      BOOKKEEPING                  │   │
│ │ NARC    REVISION  H.H                  │   │
│ └───────────────────────────────────────┘   │
│   LEFT SLOT COINS                    0       │
│   CENTER SLOT COINS                  0       │
│   RIGHT SLOT COINS                  76       │
│   PAID CREDITS                      64       │
│                                              │
│   GAMES STARTED                     42       │
│   GAMES CONTINUED                  270       │
│   TOTAL PLAYS                      312       │
│   PLAYS UNTIL H.S. RESET         4,688       │
│              ┌──────────────────┐            │
│              │ CLEAR SUBTOTALS   │            │
│              │ RETURN TO MAIN MENU│           │
│              └──────────────────┘            │
└─────────────────────────────────────────────┘
```

Typical Coin Bookkeeping Screen, Page 1

TOTALS AND COLLECTIONS DON'T MATCH? Coins actually collected may not equal the top subtotal on the TOTAL COLLECTION page. A common reason is this: Employees often play by opening the coin door and tweaking coin microswitches for credit. That is, records of collections with the coin door open don't reflect game *sales*. The page 2 feature COLLECTED WITH COIN DOOR CLOSED addresses this issue. This feature presents a second set of coin totals. The new totals permit you to separate "sold games" from "tweaked games." Furthermore, the feature is a means of monitoring employee gameplay.

Both screens are also accessible from the coin vault switch. The vault switch permits collection agents to keep track of *(but not clear)* coin totals. Subtotals may be cleared from the vault switch.

```
┌─────────────────────────────────┐
│  TOTAL      COLLECTION          │
│ LEFT SLOT COINS            432  │
│ CENTER SLOT COINS            0  │
│ RIGHT SLOT COINS           398  │
│ TOTAL COLLECTION       $207.50  │
│ SUBTOTAL               $207.50  │
│                                 │
│ COLLECTED WITH COIN DOOR CLOSED │
│ LEFT SLOT COINS            400  │
│ CENTER SLOT COINS            0  │
│ RIGHT SLOT COINS           325  │
│ TOTAL COLLECTION           725  │
│ SUBTOTAL               $181.25  │
│        CLEAR SUBTOTALS          │
│      RETURN TO MAIN MENU        │
└─────────────────────────────────┘
```

Typical Coin Bookkeeping Screen, Page 2

GAME AUDITS

GAME AUDITS SHOW YOU AT A GLANCE if game settings are bringing you a satisfactory return on your investment! *Only games by WILLIAMS*

ELECTRONICS have this menu-driven feature. Think of it as a unique way to keep your *NARC* game the *leader of the pack when it comes to earnings...*location after location, week in and week out!

ENTERING AUDIT MODE. Open the coin door and press ADVANCE. You'll see the main test menu on the CRT screen. Use either joystick to highlight GAME AUDITS. Now select GAME AUDITS by pressing *any* player panel button.

```
┌──────────────────────────────────────────────┐
│   ┌────────────────────────────────────────┐  │
│   │         GAME    AUDITS                  │  │
│   │      NARC REUISION H.H                  │  │
│   └────────────────────────────────────────┘  │
│   ┌────────────────────────────────────────┐  │
│   │ TOTAL  PLAYS                        0   │  │
│   │ EXTRA  MEN  EARNED                  0   │  │
│   │ HOURS  OF  SINGLE  PLAY           0:00  │  │
│   │ HOURS  OF  DUAL  PLAY             0:00  │  │
│   │ TOTAL  HOURS  OF  PLAY            0:00  │  │
│   │ AUG.  "PLAYER"  GAME  TIME (MIN.) 0:00  │  │
│   │ AUG.  ELAPSED  TIME/PLAY          0:00  │  │
│   └────────────────────────────────────────┘  │
│          ┌──────────────────────────┐          │
│          │    NEXT  AUDIT  PAGE      │          │
│          │  RETURN  TO  MAIN  MENU   │          │
│          └──────────────────────────┘          │
└──────────────────────────────────────────────┘
```
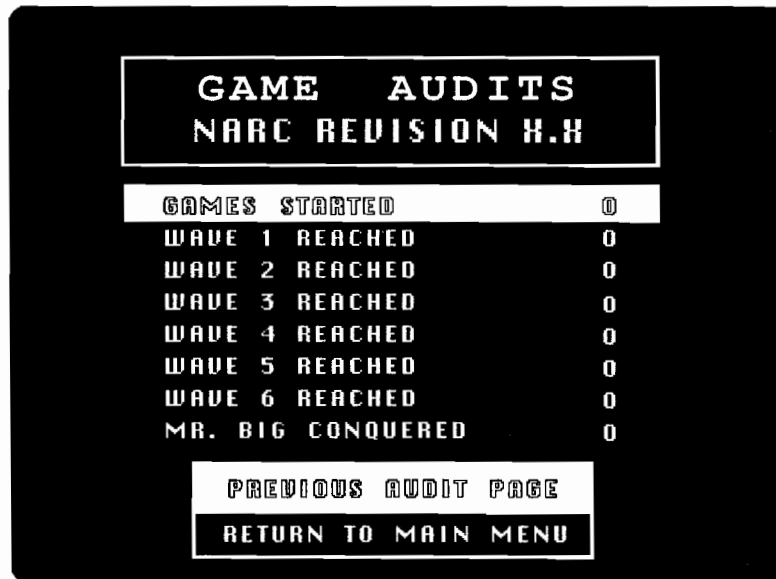
Typical Game Audits Screen, Page 1

The first GAME AUDITS page will appear. Total plays and the number of extra men that players earned are provided here. The remaining entries on this page relate aspects of gameplay to time. The second audit page relates how many times players achieved each *wave* (difficulty level). Now let's examine two audit entries...

AVERAGE TIME PER CREDIT: TWO MINUTES. Your most important figure on the AUDITS pages is AVG. PLAYER GAME TIME (MIN.). You'll want to

pay special attention to this figure every day for this reason: Thorough field and factory research has shown that *two-minute games both satisfy players and keep the quarters flowing.*

```
┌─────────────────────────────────────────┐
│  ┌─────────────────────────────────┐     │
│  │     GAME    AUDITS              │     │
│  │     NARC REVISION H.H           │     │
│  └─────────────────────────────────┘     │
│                                           │
│  ┌─────────────────────────────────┐     │
│  │ GAMES  STARTED              0   │     │
│  └─────────────────────────────────┘     │
│    WAVE  1  REACHED            0          │
│    WAVE  2  REACHED            0          │
│    WAVE  3  REACHED            0          │
│    WAVE  4  REACHED            0          │
│    WAVE  5  REACHED            0          │
│    WAVE  6  REACHED            0          │
│    MR. BIG  CONQUERED          0          │
│                                           │
│    ┌───────────────────────────────┐     │
│    │ PREVIOUS  AUDIT  PAGE         │     │
│    ├───────────────────────────────┤     │
│    │ RETURN  TO  MAIN  MENU        │     │
│    └───────────────────────────────┘     │
└─────────────────────────────────────────┘
```

Typical Game Audits Screen, Page 2

If games aren't running about two minutes long, then collections probably aren't at their peak. You'll want to tailor your game to your game-playing public. It's easy, *and we'll talk about that subject in a moment.*

Meanwhile, another very useful figure is AVG. ELAPSED TIME/PLAY. You'll find this figure on the first GAME AUDITS page. This number tells you approximately how long your game must operate before earning a quarter. (There's a trick to AVG. ELAPSED TIME/PLAY: Simultaneous two-player games cause this figure to be smaller than AVERAGE "PLAYER" GAME TIME.)

EXCLUSIVE GAME ADJUSTMENTS

Profitable games are adjusted to their playing public. *NARC* games provide you with numerous gameplay options. Like Audits and Game Bookkeeping, Game Adjustment selections are menu driven. This technique is

quick, effective, practical. It permits you to make the regular adjustments your location needs. Here's the easy, step-by-step procedure...

[ ] 1. Press ADVANCE to enter the main test menu *(described earlier)*.

[ ] 2. Using either joystick, move the selection arrow down to GAME ADJUSTMENT.

[ ] 3. To select GAME ADJUSTMENT, press any player panel button. Now you'll see the adjustment screen.

[ ] 4. Use either joystick to highlight the feature you desire to adjust.

[ ] 5. To select that feature, press any player panel button.

[ ] 6. Use either joystick to alter the value of an adjustment. (The joystick causes YES-NO settings to *toggle* between YES and NO.)

[ ] 7. To return to Game-Over Mode, follow menu selections on your screen.

```
GAME      ADJUSTMENT
NARC REUISION H.H

SELECT WITH UP /DOWN STICK
PRESS A BUTTON TO MODIFY

RETURN TO MAIN MENU
STANDARD PRICING
CUSTOM PRICING
GAME DIFFICULTY
EASY BUY-IN
LIUES PER PLAY
ROCKETS PER PLAY
EXTRA MAN EUERY
LAST EXTRA MAN
ATTRACT-MODE SOUND
AUTO HIGH SCORE RESET
UIOLENCE LEUEL
RETURN TO MAIN MENU
```
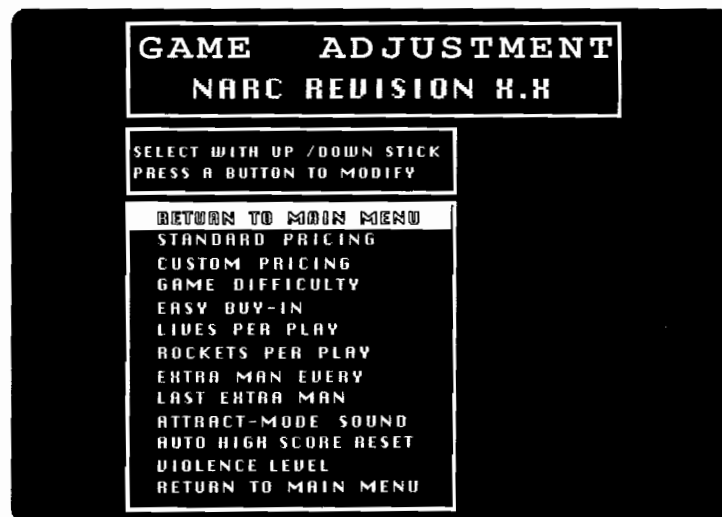
Typical Game Adjustment Screen

GAME-TAILORING SUGGESTIONS

Here are some game-tailoring suggestions. Please remember this: Easy settings tend to prolong game time, while conservative settings tend to reduce it. Try to provide players with a two-minute game. These selections appear on the GAME ADJUSTMENT menu...

•**GAME DIFFICULTY.** Choose the appropriate GAME DIFFICULTY level for your location.   For longer games, make gameplay easier. For shorter games, elect more challenging play. *(1 = easiest or extra liberal, 5 = factory setting, 10 = hardest or extra conservative.)*

•**LIVES PER PLAY.** For shorter games, decrease the number of LIVES PER PLAY. For longer games, increase it. *(7= easiest or extra liberal, 3= factory setting, 1= hardest or extra conservative.)*

•**ROCKETS PER PLAY.** For shorter games, decrease the number of ROCKETS PER PLAY. For longer games, increase it. *(10 = easiest or extra liberal, 5 = factory setting, 1 = hardest or extra conservative.)*

•**EXTRA MAN EVERY.** This value is the score players must achieve before the game awards an extra man.   For shorter games, increase EXTRA MAN EVERY. For longer games, reduce this value. *(50,000 = easiest or extra liberal, 100,000 = factory setting, 500,000 = hardest or extra conservative.)*

•**LAST EXTRA MAN.** Pick the appropriate LAST EXTRA MAN level. *(Off = factory setting, 5,000,000 = average, 100,000 = hardest or extra conservative.)*
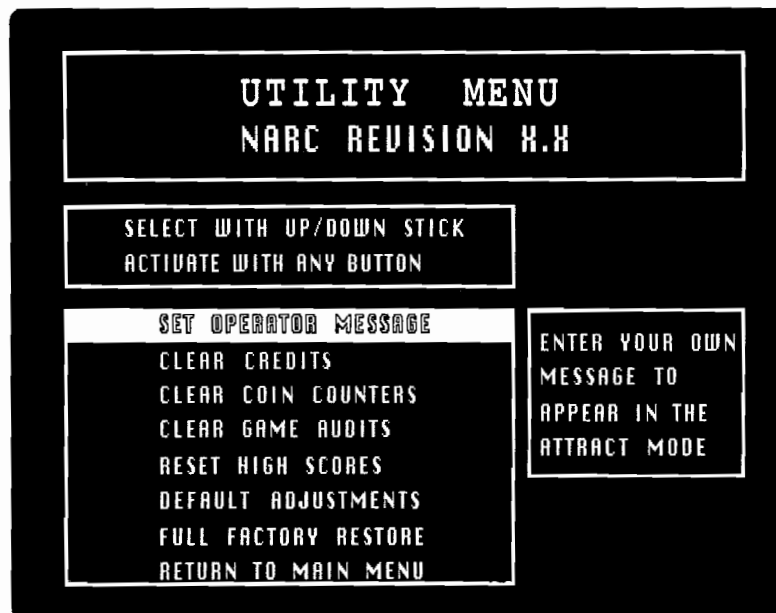
•**SELECT GAME PRICING** and specify standard or custom settings.

•**SELECT AUTO HIGH SCORE RESET.** This feature allows new players to display their initials on the High Score Table. Note: Initials entered within 750 games of table reset remain for 750 *extra* games.

GAME UTILITIES

OPERATOR MESSAGE. As observed, some adjustments affect your game's profits. There are others that make your location run smoother. These are the *NARC* Utilities. From the same efficient menu system, you can enter an advertising message for the game to display. (Your message replaces the player coin message.) Also, you can clear credits, coin counters or audit totals, or reset high scores. You can return all options to their factory settings. Or you can restore factory settings and simultaneously clear and reset.

The Utility menu is available from the main test menu. Follow the screen prompts *(or review procedures offered previously in this manual)*.

```
┌─────────────────────────────────────────────────┐
│  ┌─────────────────────────────────────────────┐ │
│  │         UTILITY   MENU                      │ │
│  │       NARC  REVISION  X.X                   │ │
│  └─────────────────────────────────────────────┘ │
│  ┌─────────────────────────────────────┐          │
│  │ SELECT WITH UP/DOWN STICK           │          │
│  │ ACTIVATE WITH ANY BUTTON            │          │
│  └─────────────────────────────────────┘          │
│  ┌───────────────────────────┐ ┌───────────────┐  │
│  │  SET OPERATOR MESSAGE     │ │ ENTER YOUR OWN│  │
│  │  CLEAR  CREDITS           │ │ MESSAGE TO    │  │
│  │  CLEAR  COIN  COUNTERS    │ │ APPEAR IN THE │  │
│  │  CLEAR  GAME  AUDITS      │ │ ATTRACT MODE  │  │
│  │  RESET  HIGH  SCORES      │ └───────────────┘  │
│  │  DEFAULT  ADJUSTMENTS     │                    │
│  │  FULL  FACTORY  RESTORE   │                    │
│  │  RETURN TO MAIN MENU      │                    │
│  └───────────────────────────┘                    │
└─────────────────────────────────────────────────┘
```

Typical Utility Menu Screen

Game Pricing

  NARC software includes a choice of standard or custom pricing methods. Standard settings are very easy to choose and use. In less than a minute, you can reprogram game pricing. Your game provides over 40 standard settings. Screen prompts assist you and the game's computer sets eight different functions simultaneously. Custom settings offer more flexibility, but you must adjust the eight functions yourself. If you want to invent your own a pricing scheme, use custom settings.

  Tables in this section list standard pricing schemes and suggest custom schemes. If you opt for custom pricing, please consult the formulas provided later.

STANDARD SETTINGS

  STANDARD PRICING allows a shorthand method of setting the pricing functions. This option is available from the main menu by selecting GAME ADJUSTMENT. When the GAME ADJUSTMENT screen appears, you'll see the listing for STANDARD PRICING. This option presents an easy, abbreviated method of setting pricing functions.

  HOW TO USE STANDARD SETTINGS. Just follow these steps...

  [ ] 1. On the GAME ADJUSTMENT screen, move the highlighted bar to STANDARD PRICING.

  [ ] 2. Enter STANDARD PRICING by pressing any player panel button.

  [ ] 3. To modify the pricing scheme, use the joystick and browse through standard selections. Later in this chapter, standard selections also appear in a table.

  [ ] 4. When you locate the desired pricing scheme, enter it by pressing any player panel button. The game responds by installing a

corresponding standard setting. *Eight pricing functions are automatically set to produce that standard.*

[ ] 5. To return to Game-Over-Mode, follow the screen prompts.

Standard Pricing Table

COIN MECH	GAMES/PRICE	COUNTRY
Twin Quarter	1/25¢, 4/$1	USA 1
	1/50¢, 2/$1	USA 2
	1/50¢, 3/$1	USA 3
	1/50¢, 4/$1	USA 4
Quarter, Dollar, Quarter	1 play/1 coin	USA 5
	1 play/2 coins	USA 6
	1/50¢, 3/$1	USA 7
	1/50¢, 4/$1	USA 8
1/5DM	1/1, 6/5DM	Germany 1
	1/1, 7/5DM	Germany 2
	1/1, 8/5DM	Germany 3
	1/1, 5/5DM	Germany 4
5 Franc, 10 Franc	2/5, 5/10F	France 1
	2/5, 4/10F	France 2
	1/5, 3/10F	France 3
	1/5, 2/10F	France 4
	2/5, 5/10F, 11/2x10F	France 5
	2/5, 4/10F, 9/2x10F	France 6
	1/5, 3/10F, 7/2x10F	France 7
	1/5, 2/10F, 5/2x10F	France 8
	1/3x1F, 2/5F	France 9
1 Franc, 5 Franc	1/2x1F, 3/5F	France 10
	1/3x1F, 2/5F, 5/2x5F	France 11
	1/2x1F, 3/5F, 7/2x5F	France 12
1 Franc, 5 Franc	1/1F, 6/5F	Switzerland 1
	1/1F, 7/5F	Switzerland 2
	1/1F, 8/5F	Switzerland 3
500/500 Lire 20p/50p	1/500L	Italy
	1/20p, 3/50p	UK 1
	2/20p, 5/50p	UK 2

Standard Pricing Table, Continued

COIN MECH	GAMES/PRICE	COUNTRY
25 Peseta/ 100 Peseta	1/2x25P, 5/100P 1/25P, 4/100P	Spain 1 Spain 2
20¢/$1	1/3x20¢, 2/$1	Australia 1
	1/5x20¢, 1/$1, 3/$2	Australia 2
100/100/ 100Y	1/100Y	Japan 1
	2/100Y	Japan 2
5 Schilling/ 10 Schilling	1/5Sch, 2/10Sch 1/2x5Sch, 3/2x10Sch	Austria 1 Austria 2
20 Franc/ 20 Franc	1/20F	Belgium 1
	3/20F	Belgium 2
	2/20F	Belgium 3
1/5 Krona	1/3x1Kr, 2/5Kr	Sweden
20¢/20¢	1/3x20¢	New Zealand 1
	1/2x20¢	New Zealand 2
1 HFl/2.5 HFl	1/1HFl, 3/2.5HFl	Netherlands
1/1 Markka	1/1Mka	Finland
1/1 Krone	1/2x1Kr, 3/5x1Kr	Norway
1/5 Krone	1/2x1Kr, 3/5Kr, 7/10Kr	Denmark
25¢/1 G	1/25¢, 4/1G	Antilles

CUSTOM SETTINGS

HOW TO USE CUSTOM SETTINGS. Custom pricing is a bit more involved than standard pricing. For that reason, if your pricing scheme is listed on the *Standard Pricing Table,* use standard pricing.

However, the *Custom Pricing Table* also provides numerous examples that you might want to try. Read down the table to find an appropriate selection. Then, reading across the selection, enter the values. You can also create your own settings. Formulas provided later should simplify your work.

```
┌─────────────────────────────────────────┐
│   ┌───────────────────────────────────┐  │
│   │      CUSTOM    PRICING            │  │
│   │      NARC REVISION X.X            │  │
│   └───────────────────────────────────┘  │
│   ┌───────────────────────────────────┐  │
│   │  SELECT WITH UP/DOWN STICK        │  │
│   │  PRESS A BUTTON TO MODIFY         │  │
│   └───────────────────────────────────┘  │
│   ┌───────────────────────────────────┐  │
│   │  LEFT CHUTE UNITS                 │  │
│   │  CENTER CHUTE UNITS               │  │
│   │  RIGHT CHUTE UNITS                │  │
│   │  UNITS/CREDIT                     │  │
│   │  UNITS/BONUS                      │  │
│   │  MINIMUM UNITS REQUIRED           │  │
│   │  CREDITS TO START                 │  │
│   │  CREDITS TO CONTINUE              │  │
│   │   COIN PAGE HELP                  │  │
│   │  SHOW CREDIT FRACTIONS            │  │
│   │  COINS PER DOLLAR °               │  │
│   │  FREE PLAY                        │  │
│   │  MAXIMUM CREDITS                  │  │
│   │  RETURN TO ADJ. MENU              │  │
│   └───────────────────────────────────┘  │
└─────────────────────────────────────────┘
```
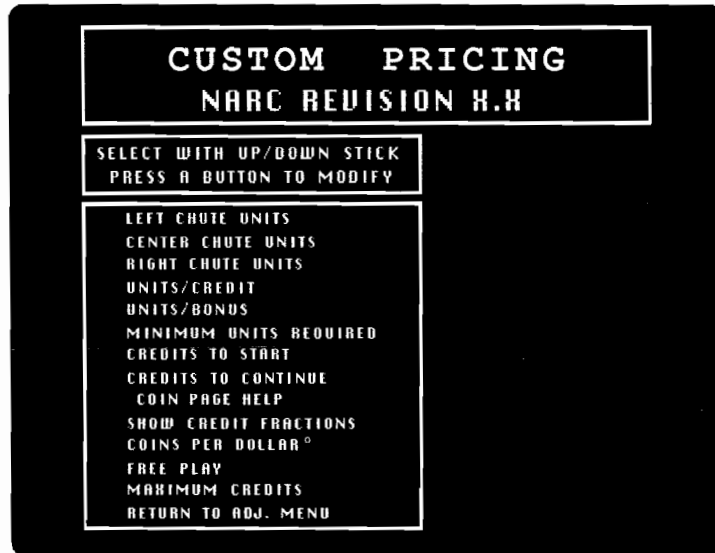
Typical Custom Pricing Menu

[ ] 1. On the GAME ADJUSTMENT screen, move the highlighted bar to
       CUSTOM PRICING.

[ ] 2. Enter CUSTOM PRICING by pressing any player panel button. The
       game responds by displaying the CUSTOM PRICING screen.

[ ] 3. Now you can modify any of eight pricing functions. The first of
       these is LEFT CHUTE UNITS, and the last is CREDITS TO CONTINUE.

       Use the joystick to move the highlight bar down to first function
       you want to change. Notice that as you select a function, its
       definition appears on the screen. *(Function definitions also
       appear later in this manual.)*

[ ] 4. To enter the function, press any player panel button.

[ ] 5. Select a new value with the joystick.

[ ] 6. To enter the new value, press any player panel button.

[ ] 7. Set the remaining values as desired.

[ ] 8. To return to Game-Over Mode, follow the screen prompts.

[ ] 9. Check your work! Anyone can make a calculation error. But if you don't do your homework, that error could be expensive. Feed a handful of coins into the game and verify that game pricing performs satisfactorily.

PRICING FORMULAS

Use this section to help you determine new custom pricing schemes. A simple ratio is the key. With this ratio, you can translate your scheme into entries for the CUSTOM PRICING menu.

THE PRICE OF ONE GAME can be derived from the *number of games per price.* The games per price relationship is equivalent to the ratio S : VC, where...

S = CHUTE COIN UNITS *(left, right or center)*
V = COIN VALUE *(for example, 25¢)*
C = UNITS REQUIRED FOR CREDIT

CUSTOM PRICING EXAMPLES. At factory settings with quarter chutes, the variables produce 1 : 25 x 1 or one game for a quarter.

If an operator wants to allow one play for a quarter but wishes to encourage multiple game-playing, he may enter:

• "1" in the LEFT CHUTE COIN UNITS function
• "4" in the CENTER CHUTE COIN UNITS function
• "1" in the RIGHT CHUTE COIN UNITS function
• "1" in the UNITS PER CREDIT function
• "0" in the UNITS/BONUS function

• "2" in the MINIMUM UNITS REQUIRED function

These values allow one game to be played for a quarter, but ONLY when two or more games are paid for at a time. Incidentally, the "4" in CENTER CHUTE COIN UNITS allows four games per dollar coin. *(Use this setting when you have a dollar bill acceptor connected to the center chute wiring. Connection instructions appear later in this chapter.)* See "2/50¢, 4/$1" in the *Custom Pricing Table.*

Custom Pricing Table

COIN-DOOR MECH	GAMES/PRICE	LEFT CHUTE COIN UNITS	CENTER CHUTE COIN UNITS	RIGHT CHUTE COIN UNITS	UNITS/ CREDIT	UNITS/ BONUS	MIN. UNITS REQ'D
Twin	1/25¢, 5/$1	1	4	1	1	4	0
Quarter	1/25¢, 3/50¢, 6/$1	1	4	1	1	2	0
or	2/50¢, 4/$1	1	4	1	1	0	2
Quarter,	2/50¢, 5/$1	1	4	1	1	4	2
Dollar,	1/50¢, 3/$1, 4/$1.25	3	12	3	4	15	0
Quarter	2/25¢, 5/$1	2	8	2	1	0	0
	1/50¢, 3/$1, 7/$2	12	48	12	14	96	24
25¢, 1 G	1/25¢, 5/1G	1	0	4	1	4	0
Twin Coin	1/2 Coins	1	0	1	2	0	0
	1/1 Coin	1	0	1	1	0	0
	1/4 Coins	1	0	1	4	0	0
	1/2 Coins, 3/4 Coins	1	0	1	2	4	0
1 Unit,	1/1, 5/5	1	0	5	1	0	0
5 Unit	1/3, 2/5 Coins	5	0	6	15	0	0

CUSTOM PRICING TERMINOLOGY

•**LEFT, CENTER, RIGHT CHUTE UNITS.** Abbreviations for Left, Center or Right Chute Coin Units. Coins don't buy games directly. Instead, the game exchanges each inserted coin for a number of chute coin units. "CHUTE UNITS" specifies the value of a coin in chute coin units. The game tallies chute coin units for each chute separately *(left, right or center)*. That is, LEFT CHUTE UNITS is a separate adjustment from CENTER CHUTE UNITS.

•**UNITS/CREDIT.** Coins buy units, and units buy games. UNITS/CREDIT is the price of one credit *(game)* in coin units.

•**UNITS/BONUS.** The number of units that must be purchased before a free *(bonus)* credit is awarded.

•**MINIMUM UNITS REQUIRED.** The smallest quantity of coin units that can be converted into credits. No games will be awarded until the minimum units have accumulated. *(See the second Custom Pricing Example, above.)*

•**CREDITS TO START.** The number of credits each player needs before he can begin a game.

•**CREDITS TO CONTINUE.** The number of credits each player needs to continue playing a game.

•**COIN PAGE HELP.** When you use standard pricing, a message appears on the credits screen. Setting COIN PAGE HELP to NO disables the message. The operator message *overrides the pricing message.* (You can compose an operator message by employing the Utility Menu. That menu is accessible from the Main Menu. See *Game Utilities.*)

•**SHOW CREDIT FRACTIONS.** This display function may be set to yes *(enabled)* or no *(disabled).* If YES, when the display of credits *(games)* purchased appears, purchased game *fractions* also appear. If such fractions make coin calculations easier for your players, then enable the feature. Where coins or custom pricing present complex fractions, we recommend that you disable this feature. (Your game creates the fraction by dividing chute coin units into purchased UNITS/CREDIT.)

•**COINS PER DOLLAR.** The TOTAL COLLECTIONS (COIN BOOKKEEPING) screen is based on this coins-per-dollar function. (For example, you might specify here that a dollar is worth five of your tokens. That way, the game computer can even figure total collections for tokens!) *To disable the display of money totals, set this function to zero.*

•**FREE PLAY.** Setting FREE PLAY to "YES" allows unlimited play without inserting coins. The factory setting is "NO."

•**MAXIMUM CREDITS.** This is the coin counter limit. If inserted in the coin chutes, additional coins will be lost. The factory setting is 30.

Installing A Dollar Bill Acceptor

On U.S. *(2-slot)* coin doors, wiring for the absent center coin chute is provided. You can use this wiring to connect your dollar bill acceptor to the game's Interface Board. Here's the step-by-step procedure...

[ ] 1. Locate connector 8P2/8J2. You'll find this 15-pin connector just inside and above the coin door.

[ ] 2. Find the white-green wire on the plug (female, 8P2) side of the connector. This wire is connected to pin 9.

[ ] 3. Crimp a pin onto the positive switch lead from your bill acceptor.

[ ] 4. Insert the pin into the pin 9 hole on jack (male) 8J2.

[ ] 5. Find the ground switch lead from your bill acceptor. Splice this lead to a green-brown wire from either of the other two acceptors. Any of the green-brown wires will suffice.

[ ] 6. Set the bill acceptor to one pulse per dollar.

[ ] 7. *ROWE* brand $1/$5 acceptors: Turn on DIP Switch 4 ("Slow Pulse Train"). Other brand acceptors: Output pulse width should fall between 16 and 300 milliseconds. Distance between pulses should exceed 200 milliseconds.

[ ] 8. Set your game's STANDARD PRICING to one of the USA options, 5 through 8.

[ ] 9. Test time! Run coins through the quarter chutes and bills through the new bill acceptor.

Chapter 2. Service Procedures

Introduction
Operating the
Diagnostic Mode Tests

Built-In Test Procedures
Troubleshooting Tables

Introduction

Your *NARC* video game is equipped with numerous diagnostic features. These features are designed to aid you in maintaining top game performance. Your game offers two types of tests: First, whenever you turn it on, the game performs Power-Up Tests. Second, you may initiate Diagnostic Tests with the game's controls. Tests include the following...

1. Switch Test
2. ROM Board Test
3. CPU Board Test provides a board image, showing major chips:
   - Video RAM
   - Scratchpad RAM
   - DMA Custom chip
   - Color RAM
   - CMOS RAM and Battery
   - GSP Microprocessor
4. Sound Test
5. Monitor Patterns
   - Bar/Dot Crosshatch Test
   - RGB Purity Screens
   - Colors Bars, indicating gun levels
6. Burn-In Test *(Automatic, repeating sequence of other tests)*

Power-Up Tests

CPU BOARD TEST

RUG PATTERN. At power-up, a scanning "rug" pattern appears on the game's screen. During this display, the game checks Video RAM chips. These include Video RAMs U42 through U49 and U68 through U75. A stationary, striped pattern replaces the scanning rug. This pattern is an artifact of the testing process. *(It reproduces the last two lines of the rug pattern stored in Palette Latch U13/U30.)* Since DMA U77 loads the Video RAM, the test also demonstrates DMA condition.

CPU BOARD DRAWING. Following the stripe pattern, an assembly diagram of the CPU Board appears very fleetingly. This diagram indicates test passage by Video RAM chips checked during the rug pattern *(above)*. Also tested is main microprocessor (GSP) U18. Other tested components include Scratchpad RAM (U60 through U63) and Color RAM (U7/U41). The game checks CMOS RAM U65 too. As they check good, the screen depicts the chips in green. Bad chips appear in red.

BAD CHIP NUMBERS DISPLAYED. If the game finds an error, you'll see the message "RAM ERRORS DETECTED. PRESS ANY KEY TO RETURN TO MENU." Normal games display the message "NO RAM ERRORS DETECTED. PRESS ANY KEY TO RETURN TO MENU."
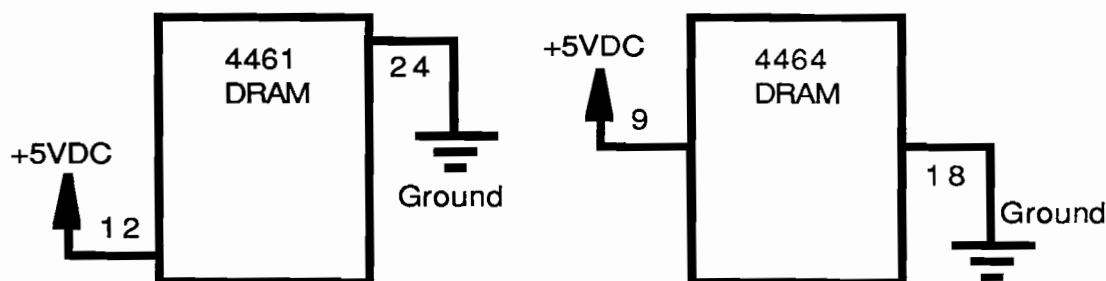
LED INDICATOR. If RAM damage is extensive enough to prevent a screen display, examine the CPU-Board LED-indicator. The game attempts to display bad chip numbers *(digit by digit)* here too. The error code on the indicator corresponds to RAM chip number. This code appears one character at a time. The code begins with "E" for error. The next two digits refer to the chip number of the first bad chip detected. Corresponding chip numbers are screened on the game's CPU Board. (*NARC* games display these letters and numbers upside-down.)

If the game displays a RAM error, check the indicated RAM's DC power voltage...

• 4461 DRAMs: Positive five volts on pin 12 (ground at pin 24).

• 4464 DRAMs: Positive five volts on pin nine (ground at pin 18).

None of these pins should have more than a few millivolts of AC on it. *Never replace a RAM chip until you prove that these voltages are normal!*

RAM Power Pins

```
      ┌──────────┐              +5VDC   ┌──────────┐
      │  4461    │  24                  │  4464    │
      │  DRAM    │──┐            ↑       │  DRAM    │
+5VDC │          │  │          9 │       │          │
      │          │  │  ─┴─               │          │  18
   ↑  │          │     ───              │          │──┐
12 │  │          │    Ground             │          │  │  ─┴─
   └──│          │                       │          │  │  ───
      └──────────┘                       └──────────┘  Ground
```

SOUND TEST

TWO TONES. While the rug pattern is scanning, the game normally sounds two different tones. These indicate readiness of Music System U1/U2/U5, etc. and Sound Effect System U33/U34/U38, etc. The Music System's readiness indication is a "gong" note. The Sound Effect System employs an "electric guitar" note. (The gong occurs first.) The two systems reside on the Sound Board. If you don't hear two different tones, your game probably has a Sound Board problem. Here's a rundown of what you might hear and what it means...

• **No sound:**	Sound Power Supply fuse F2/F3, broken cable, dead clock CR1, dead amp U32/U41, etc.
• **1 gong sound:**	Slave *(Sound Effect)* System U1, etc. okay; fault in Master *(Music)* System
• **1 guitar sound:**	Master *(Music)* System U1, etc. okay; fault in Slave *(Sound Effect)* System
• **2 different sounds:**	Master System U1 and Slave *(Sound-Effect)* System U33, etc. okay
• **2 identical sounds:**	Sound ROM or RAM errors. (Run Diagnostic Mode Sound Test.) *More than two identical sounds may occur.*

ROM TEST

TEST PROCESS. The game compares numbers stored in Program ROMs U23 and U41 with calculated ROM checksums. Each chip has its own checksum. If the corresponding number from Program ROM matches, the chip passes the test.

ROM BOARD DRAWING. A ROM Board drawing appears. Initially all the chips are shown in gray. Then as they test good, checked ROMs are depicted in green. Bad chips appear in red. *Unused chip locations remain gray.* These unused locations include U25, U43, U61 and U79. Tested chips include U23 through 40 and U41 through U58. Also tested are U59 through U76 and U77 through U94.

If the game finds an error, you'll see the message "ROM ERRORS DETECTED. PRESS ANY KEY TO RETURN TO MENU." Normal games display the message "NO ROM ERRORS DETECTED. PRESS ANY KEY TO RETURN TO MENU."

LED INDICATOR. The game's LED indicator on the CPU Board presents a backup display of failure messages. The error code on the indicator corresponds to ROM chip number. This code appears one character at a time. The code begins with "E" for error. The next two digits refer to the chip number of the first bad chip detected. Corresponding chip numbers are screened on the game's ROM Board. (*NARC* games display these letters and numbers upside-down.) *Power down and replace bad chips.*

ROMS U23 AND U41. The ROM Test can operate if only ROMs U23 and U41 are good. This feature is useful in troubleshooting. For instance, an unknown ROM may be pulling bus lines low. If so, you can remove all the ROMs except U23 and U41 and rerun the test.

If the test now runs normally, the bus itself is okay. But one or more ROMs must be bad. Replace the top row of ROMs (U23 through U40) and retest. If these ROMs test good, replace the next row (U41 through U58) and retest.

(Proceed one row at a time until you find the bad row.) If a row brings down the bus, remove all but one chip. Chip by chip, rerun the test until you locate the chip that brings the bus down. If the bus is bad, use a logic probe to check other devices on the bus. Likely culprits include address decoders, buffers, latches and transceivers.

CMOS BATTERY TEST

DEFAULT ADJUSTMENTS RESTORED. Your game includes a CMOS RAM that stores temporary data such as scores and adjustments. If CMOS contains spurious data or the battery fails, the game prompts: "INVALID GAME SETTINGS." Then you must open the coin door so that CMOS can be cleared. At that point, the system displays the message "DEFAULT ADJUSTMENTS RESTORED." Now, step the game into Game-Over Mode: First, press ADVANCE. Then use the joystick and player panel buttons to enter Game-Over Mode. If the game displays "INVALID GAME SETTINGS" whenever you power it up, suspect the battery.

If you suspect a bad battery, power down and replace it. Otherwise the game won't remember pricing and game adjustments you've entered. *NARC* games employ a three-volt, round lithium cell (*RAYOVAC* BR2325). This battery resides on the CPU Board, with the "+" terminal facing upward. (That is, with minus toward the board). With power off, CMOS RAM U65, pin 28 should measure 3VDC *(at least 2.8V)*. With game power *off,* you can check this voltage with a multimeter. After you replace the battery, step the game into Game-Over Mode one more time. The game should retain your next settings.

GAME-OVER MODE

WATCH FOR THE HIGH SCORE TABLE. In a correctly running game, tests will be followed by the the High Score Table and a repeat of the two Sound Board tones. When you see the High Score Table, your game has entered Game-Over Mode. This is a normal mode of operation. If failure messages come up on the screen instead, initiate Diagnostic Mode Tests.
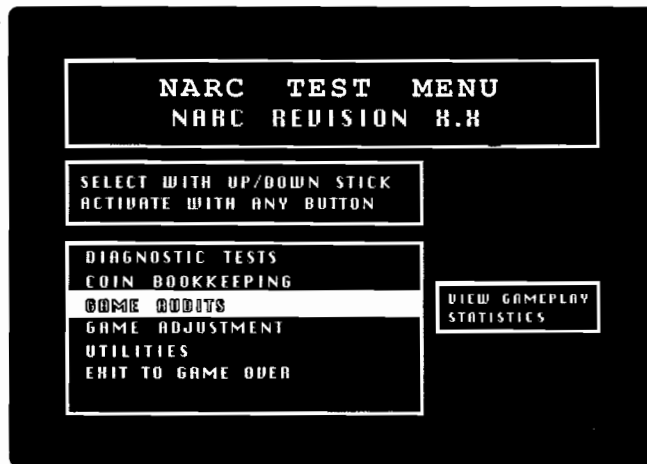
Diagnostic Mode Tests
INITIATING DIAGNOSTIC MODE TESTS

You can initiate Diagnostic Tests from the game's coin door: First, open the coin door. Then locate the white ADVANCE button. It's mounted on a bracket a few inches behind the door. Press ADVANCE. The game responds by displaying the main menu. Now using the joystick, move the highlighted bar to DIAGNOSTIC TESTS. Press any player panel button. This time, the game displays its diagnostic menu.

SELECTING AND ENTERING OPTIONS. To select an option you desire to investigate, move the joystick up or down.   Watch the highlighted bar on the screen menu. This bar illuminates the selected option. You can enter the highlighted option by pressing any player panel button.

IF THE PLAYER PANEL EVER FAILS, ADVANCE can operate diagnostic and bookkeeping functions. For details, see the Chapter 1 section entitled *Game Adjustments, Bookkeeping, Diagnostics.*


```
            NARC   TEST   MENU
            NARC  REVISION  X.X


      SELECT WITH UP/DOWN STICK
      ACTIVATE WITH ANY BUTTON


      DIAGNOSTIC TESTS
      COIN BOOKKEEPING
      GAME AUDITS                    VIEW GAMEPLAY
      GAME ADJUSTMENT                STATISTICS
      UTILITIES
      EXIT TO GAME OVER
```

Typical Main Test Menu

SWITCH TEST

The monitor displays 21 circles in the approximate positions of game switches. Near each circle is a switch name. When you close a working

switch, the game highlights that switch's circle. Highlight colors match player button colors. Check for switches that are stuck open or closed.

```
DIAGNOSTIC    TESTS
NARC  REVISION  X.X

SELECT  WITH  UP/DOWN  STICK
ACTIVATE  WITH  ANY  BUTTON

SWITCH  TEST
ROM  BOARD  TEST
CPU  BOARD  TEST
SOUND  BOARD  TEST
MONITOR  PATTERNS
RUN  BURN-IN  TEST
RETURN  TO  MAIN  MENU
```

Typical Diagnostic Menu

Each joystick has four switches *(one in each compass direction)*. As necessary, clean or replace malfunctioning parts.

"CUT FOR GERMAN" and "CUT FOR FRENCH" jumpers on connector 3P2 are depicted as switches. These will normally remain closed for U.S. games. If the German or French jumper is cut, it will appear as open.

To exit the Switch Test, press ADVANCE.

ROM TEST
This test is equivalent to the Power-Up ROM Test. Refer to *ROM Test* above. Chip errors are displayed on the CRT and the LED readout on the CPU Board. If a chip is bad, the LED error code corresponds to its chip number. Chip numbers are screened on the game's circuitboards.

CPU BOARD TEST
This test is equivalent to the Power-Up CPU Board Test. Refer to *CPU Board Test* above. Chip errors are displayed on the CRT and the LED readout

on the CPU Board. If a chip is bad, the LED error code corresponds to its chip number. Chip numbers are screened on the game's circuitboards.

SOUND TEST

Tested chips include RAM U34, ROMs U35 through U38, CVSD U30, DACs U10 and U20. Also checked are Yamaha Synthesizer chip set U7/U8 and microprocessors U1 and U33.

SYNTHESIZER AND DIGITIZER. The *NARC* Sound Board includes two 68B09E microprocessors, U1 and U33. Microprocessor U1 controls the Master or Music System. This system includes Yamaha Synthesizer U7/U8. Microprocessor U1 also supervises communications with the GSP. *(The GSP is the main game system on the CPU Board.)* Tests refer to the first sound system or its components as the *Synthesizer*. The second Sound Board microprocessor (U33) controls the Slave or Sound Effect System. This includes a type 7224 Sound Effect DAC and a type 55536 CVSD *(speech)* chip. Tests refer to this second sound system or its components as the *Digitizer*.

SYNTHESIZER AND DIGITIZER TROUBLESHOOTING. Note that the GSP directly controls only the Music System. Meanwhile, the Music System controls the Sound System. Only the Music System (Synthesizer) communicates directly with the GSP. That is, if the Synthesizer's down, the Digitizer can't respond to GSP sound calls. Consequently, if the Digitizer doesn't work, be sure the Synthesizer's okay before troubleshooting the Digitizer!

SYNTHESIZER TEST. The Synthesizer Test indicates that the Synthesizer is "OK" or "SYNTHESIZER DOES NOT RESPOND." The game also provides the status of other chips *(see below).* Synthesizer response depends on a good connection to the main microprocessor (GSP). If you receive the message "SYNTHESIZER DOES NOT RESPOND," interboard wiring might be at fault. Check the cable between the CPU and Sound Boards. Also check bus buffer chips connected to both ends of the cable.

```
┌─────────────────────────────────────────┐
│  ┌───────────────────────────────────┐   │
│  │  SOUND   BOARD   TEST             │   │
│  │  NARC  REUISION  H.H              │   │
│  └───────────────────────────────────┘   │
│  ┌───────────────────────────────────┐   │
│  │  SELECT WITH UP/DOWN STICK        │   │
│  │  ACTIUATE WITH ANY BUTTON         │   │
│  └───────────────────────────────────┘   │
│  ┌───────────────────────────────────┐   │
│  │  SYNTHESIZER TEST                 │   │
│  │  DIGITIZER TEST                   │   │
│  │  PLAY SYNTHESIZER                 │   │
│  │  PLAY DIGITIZER                   │   │
│  │  BACK TO DIAGNOSTICS MENU         │   │
│  │  RETURN TO MAIN MENU              │   │
│  └───────────────────────────────────┘   │
└─────────────────────────────────────────┘
```

Typical Sound Test Menu

The game also employs the Synthesizer for other tests. For that reason, running the Synthesizer Test first may save you some troubleshooting steps.

The Synthesizer Test causes your game to produce "electric guitar" tones. These tones may indicate chip failures. Consult the list below.

- •0 Tones: Synthesizer MPU U1 not responding or ROM U5 bad
- •1 Tone: Synthesizer OK. Error message? Check 10P2/J2 *(handshake)* cable.
- •2 Tones: RAM error U2
- •3 Tones: ROM error U5
- •4 Tones: ROM error U4

DIGITIZER TEST. The Digitizer can't communicate directly with the GSP. For that reason, the Synthesizer handles the Digitizer Test's GSP-to-Sound Board communications. The Digitizer Test has its own menu. "Gong" tones indicate failure of the test by various devices...

•0 Tones: Check ROM U38
or Synthesizer *(Music)* System
•1 Tone: Digitizer *(Sound Effect)* System OK
•2 Tones: RAM error U34
•3 Tones: ROM error U38
•4 Tones: ROM error U37
•5 Tones: ROM error U36
•6 Tones: ROM error U35

PLAY SYNTHESIZER allows you to test the game's sound lines by triggering game sounds. Pressing a player panel button activates each next sound. For diagnostic purposes, the game also provides a ramp wave and a sinewave. Here's the entire list..

•Narc Rap	•Windshield Smash
•Driving Music	•Car Horn
•Narc Theme	•Bug Squash
•The "Stick"	•Sizzle
•Helicopter	•U10 DAC Ramp wave
•Kinky Pinky	•U7/U8 YM2151 Sinewave

When you press a button, the system pulses sound and strobe lines low. The result is a sound. Each sound represents a combination of low sound and strobe lines *(sound call)*. If a sound is missing, one or more lines are probably *stuck high or stuck low.* If two lines produce the same sound, they're shorted together.

If all sounds are missing, the strobe signal might be absent. Whenever the system pulses a sound line, it must also pull down a strobe line. Otherwise you won't hear any sound. The strobe lines select either the Sound or the Music Microprocessor. The game employs other bits on the Sound-Selection Bus for communications. For instance, the CPU Board's GSP *(main system)* can reset the Sound Board. Over a separate line, the Music Microprocessor can send a handshake signal to the GSP. *NARC* games only employ this handshake signal during tests.

PLAY DIGITIZER allows you to test the game's sound lines by triggering game sounds. Pressing a player panel button activates each next sound. For diagnostic purposes, the game also provides a ramp wave and a waveform from CVSD U30. Here's the entire list..

•Gunshot	•Dog
•Dumpster Man	•You die, Cop!
•Oh no, the Narcs Man	•Mr. Big Laugh
•Dr. J Scream	•U20 DAC Ramp Wave
	•U30 CVSD Waveform

USING "PLAY SYNTHESIZER" AND "PLAY DIGITIZER" TESTS

NO SOUND: Check the sound-select inputs at chip U6 on the Sound Board. (Pins 3, 4, 7, 8, 13, 14, 17 and 18.) During the "Play Synthesizer" or "Play Digitizer" Test, look for pulsing. Also check for shorts between sound lines. If two sound lines produce the same sound, you have a short.
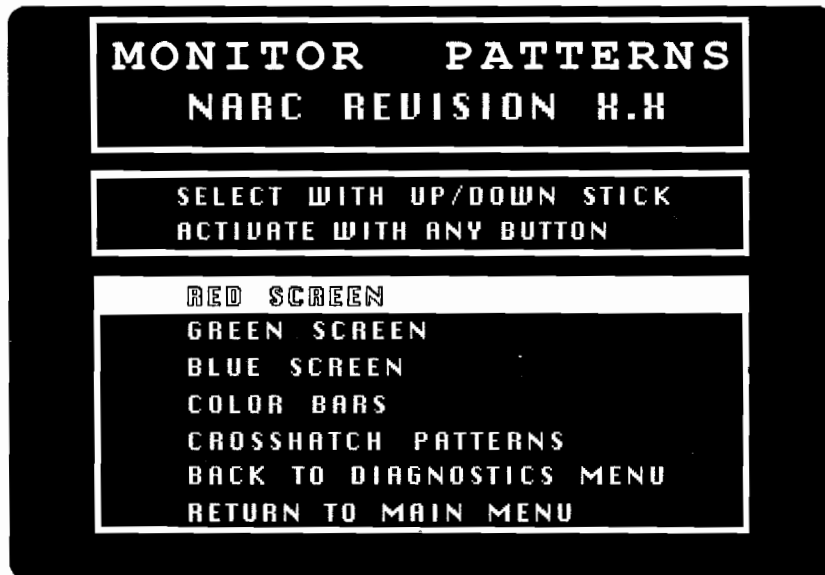
STILL NO SOUND: Turn the volume control all the way up and turn on the game. Momentarily run your fingers around the pins of preamplifer chips U1, U21 and U39. Also use your fingers to probe the quarter-watt resistors near these chips.

• If you hear a click or hum, the amplifiers, volume control and speaker are okay.

• If you don't hear anything, turn the volume control halfway up. Now repeat the test.

MONITOR PATTERNS

Monitor Patterns assist you in isolating problems to the game computer or its analog monitor. Furthermore these patterns are useful in setting up new monitors, or in troubleshooting old ones.

```
┌─────────────────────────────────┐
│ ┌─────────────────────────────┐ │
│ │ MONITOR   PATTERNS          │ │
│ │ NARC  REVISION  H.H         │ │
│ └─────────────────────────────┘ │
│ ┌─────────────────────────────┐ │
│ │ SELECT WITH UP/DOWN STICK   │ │
│ │ ACTIVATE WITH ANY BUTTON    │ │
│ └─────────────────────────────┘ │
│ ┌─────────────────────────────┐ │
│ │ RED  SCREEN                 │ │
│ │ GREEN  SCREEN               │ │
│ │ BLUE  SCREEN                │ │
│ │ COLOR  BARS                 │ │
│ │ CROSSHATCH  PATTERNS        │ │
│ │ BACK  TO  DIAGNOSTICS  MENU │ │
│ │ RETURN  TO  MAIN  MENU      │ │
│ └─────────────────────────────┘ │
└─────────────────────────────────┘
```

Typical Monitor Patterns Menu

RED, GREEN AND BLUE SCREENS *(three solid-color patterns)* are intended for monitor purity adjustments. You can also use these patterns for checking Color RAMs *(ICs U7 and U41 on the CPU Board)*. If these screens show contaminated colors, degauss the monitor. If purity is still flawed, adjust the purity magnets. *(For the adjustment procedure, consult your monitor manual.)*

A purity screen may be missing some colors or may have vertical lines through it. If so, your game might have a faulty Color RAM U7 or U41. See the illustration below. *(Please don't confuse the purity screens with the crosshatch pattern or color bars pattern. These last two patterns are supposed to have vertical lines!)* Before pursuing monitor adjustments or RAM replacement, degauss your monitor.
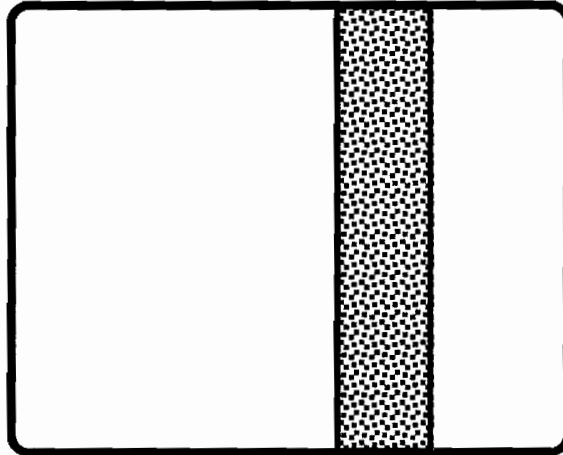
COLOR BARS. Use the Color Bars for monitor adjustments and for checking Color RAMs. Each bar shows a color in 32 levels of intensity *(brightness).* That is, the bars serve as both a color *and* brightness reference. This reference eases adjustment of color drives and cutoffs, screen and black-level controls.

If colors are missing or the wrong colors are displayed, you may have a bad Color RAM. From the left side of the CRT, here are the colors you should see: *Red, green, blue, black, white, yellow, cyan and magenta.*
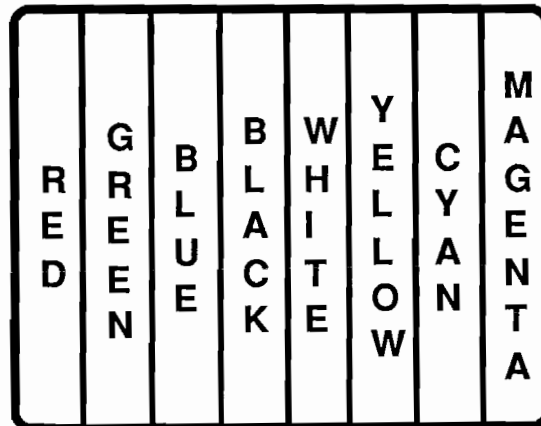
As observed, each color bar is composed of 32 hue segments. The brightest hues should be at the top of the screen. The darkest hues should be

at the bottom.   Adjacent hues should have the same brightness.

Before pursuing monitor adjustments or RAM replacement, degauss your monitor. Then as necessary, adjust your monitor for best brightness and contrast.

THE CROSSHATCH PATTERN aids the technician in converging your game monitor.

RUN BURN-IN TEST

BURN-IN MODE permits continuous ROM, RAM and CMOS RAM tests. To detect failures that only appear after numerous checksum comparisons, such repetition is necessary. If game software locates an error, Auto-Cycle Mode aborts and a failure message appears. Here's the procedure for initiating Burn-In Mode...

1. Enter the Diagnostic Menu by displaying DIAGNOSTIC TESTS.
2. Move down to RUN BURN-IN TEST.
3. Press any player panel button.
4. The game prints "ARE YOU SURE?" Select "YES" by moving up.
5. Press any player panel button.
6. To enter Game-Over Mode, turn the game off and on.

TROUBLESHOOTING TABLES

Troubleshooting procedures for most types of malfunctions are covered below. Our troubleshooting algorithm begins with Power-Up and continues until Game-Over Mode. Procedures can be performed with minimal test equipment or merely by observing the game. Note: Certain malfunctions may inhibit the game's diagnostic or display faculties.

POWER-UP TESTS

NO VIDEO OR GENERAL ILLUMINATION	NO INITIAL VIDEO (RUG PATTERN)	CHECK SWITCHING POWER SUPPLY
(1) Check fuse 6F1 on transformer chassis. (2) Check +5VDC on CPU Board. On: Proceed with step 3. Off: Check Switching Power Supply. (3) Check power connectors: 1P1/J1, 2P3/J3, 3P1/J16P1/J1, 6P2/J2, 6P3/J3, 6P4/J4 (4) If all the above don't turn up the problem, check Switching Power Supply.	(1) Press the RESET button on CPU Board. (2) Try CPU Board and ROM Diagnostic-Mode Tests (see below). (3) If these tests don't turn up the problem, check Switching Power Supply. check Power Supply Board.	(1) Swap Power Supply with one from known-good game. (2) If game plays, problem is in Power Supply. (3) If game doesn't play, check power transformer with voltmeter. (4) If known-good power supply is unavailable for tests above, check +5V output on game supply. Output must be within 5% of rated 5V, with less than 0.1% AC hum.

TESTED PART	CPU BOARD LED INDICATION	VIDEO	YOUR REACTION SHOULD BE...
General	3 blinking, horizontal segments (Power-up tests passed)	(1) Scanning rug pattern (2) Stripe pattern (3) CPU Board drawing (very briefly) (4) ROM Board drawing (4) Game-Over Mode	If any video (see left) is missing or error message is displayed, proceed to Diagnostic Mode Tests.
CMOS, Test A	3 blinking, horizontal segments (Power-up tests passed)	"INVALID GAME SETTINGS"	(1) Open coin door.
CMOS, Test B		"DEFAULT ADJUSTMENTS RESTORED" "COIN COUNTERS CLEARED" "GAME AUDITS CLEARED" "HIGH SCORE TABLE RESET"	(2) Press ADVANCE. (3) CMOS is OK. Use joystick and a game button to step game into Game-Over Mode. (4) Other messages: Perform DiagnosticTests.
Battery	3 blinking, horizontal segments (Power-up tests passed)	"INVALID GAME SETTINGS"	(1) Turn power off. (2) Check or replace 3V lithium cell on CPU Board. (3) If problem persists, proceed with CPU Board Test by putting the game into its Diagnostic Mode. (See DIAGNOSTIC MODE TESTS.)
Memory-Protect Interlock	3 blinking, horizontal segments (Power-up tests passed)	"INVALID GAME SETTINGS"	(1) Making and breaking Memory Protect Interlock switch, check with VOM. (2) If faulty, replace switch. (3) Replace if faulty: Reset/Watchdog U55 or CMOS RAM U65 on CPU Board.
DMA	E75 (Spurious indication of RAM failure 75)	(1) Scanning rug pattern (2) All ROMs test bad (3) Program crash	(1) Turn power off. (2) As test, temporarily replace DMA U77 with good part. U77 is on CPU Board. (CAUTION: Use chip-extraction tool.) (3) Run Power-Up Tests.

DIAGNOSTIC MODE TESTS		
TEST & PROCEDURES	**VIDEO**		**YOUR REACTION SHOULD BE...**
(1) **Switch** • No LED indications are made for this test. • U.S. Games: CRT should indicate no switches closed. • Clear stuck switches. • Operate each switch and check for display of switch name. • Check for joystick switch closures in all four compass directions.	CRT indicates stuck switches. This chart relates switches and their Interface Board connectors.			(Refer to CABINET WIRING Diagram. Jacks 3J2 through 3J6 are on the Interface Board.) (1) INTERFACE BOARD SWITCH STUCK: Disconnect appropriate Interface Board plug 3P2, 3P3, 3P4 or 3P6. (Refer to chart at left). (2) INTERFACE BOARD SWITCH DOES NOT OPERATE: Ground corresponding pin of 3J2, 3J3, 3J4 or 3J6. (Refer to Cabinet Wiring Diagram). [ ] SYMPTOM REMAINS SAME: Faulty Interface Board. [ ] SYMPTOM CLEARS UP: Switches or wiring are faulty.
	3J2 SWITCHES	**3J3 SWITCHES**	
	PLAYER-1 START PLAYER-2 START FRENCH BIT GERMAN BIT MEMORY PROTECT	PLAYER 2 UP PLAYER 2 DOWN PLAYER 2 LEFT PLAYER 2 RIGHT PLAYER 2 FIRE PLAYER 2 ROCKET PLAYER 2 JUMP PLAYER 2 CROUCH	
	3J4 SWITCHES	**3J6 SWITCHES**	
	PLAYER 1 UP PLAYER 1 DOWN PLAYER 1 LEFT PLAYER 1 RIGHT PLAYER 1 FIRE PLAYER 1 ROCKET PLAYER 1 JUMP PLAYER 1 CROUCH	ADVANCE VAULT SWITCH LEFT COIN CENTER COIN RIGHT COIN SLAM SWITCH	

TEST	CPU BOARD LED INDICATION	VIDEO	YOUR REACTION SHOULD BE...
(2) **ROM**	Three characters flash (one at a time): "E" means chip error. Then two-digit chip no. of first bad device detected.	"ROM ERRORS DETECTED" and bad chip shown in red.	(1) Turn power off. (2) Replace suspected chip. (3) Power up and retest game.
(3) **CPU** **Board**	Three characters flash (one at a time): "E" means RAM error. Then two-digit chip no. of first bad device detected.	"RAM ERRORS DETECTED" and bad chip shown in red. With multiple RAM failures, this display may not appear.	(1) Check for these normal voltages on indicated RAM chip: On 4461 chips, +5/pin 12; ground/pin 24. On 4464 chips, +5/pin 9; ground/pin 18. Wrong voltages: Check Switching Power Supply, power cables at 1P1/J1. Correct Voltages: Proceed. (2) Turn power off. (3) Replace suspected chip. (4) Multiple RAM failures: Check Switching Power Supply first. See POWER-UP TESTS.
(3A) **CMOS** **RAM**	"E65" means CMOS RAM error.	"INVALID GAME SETTINGS. ATTEMPT TO RESTORE FACTORY SETTINGS HAS FAILED."	(1) With power off, check pin 28 of U65 CMOS RAM for 2.8VDC minimum. Present: Check or replace CMOS chip. Absent: Replace lithium cell. (2) With new lithium cell and power off, check for 3.0V (2.8V minimum) at pin 28. Still absent: Check for 3.0V at pins 1 and 2 of Reset/ Watchdog U55. Present at 1, absent at 2: Replace U55. (3) Power up and reenter diagnostics. If CMOS error message persists, check CMOS RAM memory protect and address decoding circuits. Use a logic probe.

DIAGNOSTIC MODE TESTS

Tests 4 and 5 feature sequential subtests. To step through subtests, follow menus displayed on your monitor. For these tests, no LED indications are provided.

(4) SOUND TEST | AUDIO INDICATIONS | YOUR REACTION SHOULD BE...

•PLAY SYNTHESIZER, DIGITIZER: If two sounds are the same, try a new sound cable. Two sound lines may be shorted together...

SOUND LINE	CPU/SOUND BD
0	1P8/10P1 pin 3
1	1P8/10P1 pin 4
2	1P8/10P1 pin 5
3	1P8/10P1 pin 6
4	1P8/10P1 pin 7
5	1P8/10P1 pin 8
6	1P8/10P1 pin 9
7	1P8/10P1 pin 10
STROBE.M	1P8/10P1 pin 13
NMI.M	1P8/10P1 pin 18
RESET	1P8/10P1 pin 14
All	Perform further tests (see below).

AUDIO INDICATIONS

Follow screen prompts to check major parts indicated below.

•SYNTHESIZER TEST (MUSIC): Bad part...

0 Tones	Synth U1 or ROM U5
1 Tone	OK;msg?10J1 cable
2 Tones	RAM U2
3 Tones	ROM U5
4 Tones	ROM U4

•DIGITIZER TEST (SOUND EFFECTS, VOICES): Bad part...

0 Tones	ROM U38/Synth
1 Tone	Digitizer OK
2 Tones	RAM U34
3 Tones	ROM U38
4 Tones	ROM U37
5 Tones	ROM U36
6 Tones	ROM U35

YOUR REACTION SHOULD BE...

•Replace bad parts.
•Problem remains? Then check these related parts...

| PART SPECIFIED	RELATED PARTS
Synth U1/ROM U5	Xtal CR2, Inv U17, Decdr U14, AND U15, Latch U12
RAM U2	MPU U1, NOR U13
ROMs U5, U4	Decoder U14, Latch U12, SIP resistor SR1
ROM U38/Synth	MPU U1, RAM U2
RAM U34	MPU U33, NOR U24
ROMs U35, U36, U37, U38	Decoder U25, Latch U23, SIP resistor SR2

(5) MONITOR PATTERNS TEST & PROCEDURES | YOUR ACTION SHOULD BE...

Checking Your Color RAM

• The CRT produces a pattern of vertical color bars. Each color is shown in 32 hues.

• Missing or repeated hues in the same bar: Color RAM fault.

• Adjacent hues in different bars should have the same brightness. If not, adjust the gun drives on your monitor.

Color Bars as RAM Check
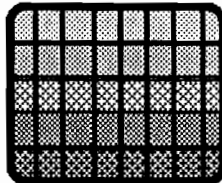
(Note: Color order is shown at Test 7)

YOUR ACTION SHOULD BE...

(1) ARE SOME HUES MISSING? Do you see two identical hues? Check your CPU Board's Color RAM circuit. Failed parts may include these chips: Latch U3 or U23, Color RAM U7 or U41, buffer U2 or U22.

(2) CHECK THE COLOR ANALOG CIRCUIT: CPU-Board resistors R2 through R16. Also monitor input transistors Q1, Q2, Q3, Q4 and associated passive circuitry.

(3) ANALYZE BY COLOR: •RED PROBLEMS: Check U7, U3, U2, R2 through R6. •GREEN PROBLEMS: Check U7, U41, U3, U23, U2, U22, R7 through R11. •BLUE PROBLEMS: Check U41, U23, U22, R12 through R16. (All on CPU Bd.)

Monitor and Color RAM (As you watch these screens, adjust your monitor)

Color Bars

RED	GREEN	BLUE	BLACK	WHITE	YELLOW	CYAN	MAGENTA
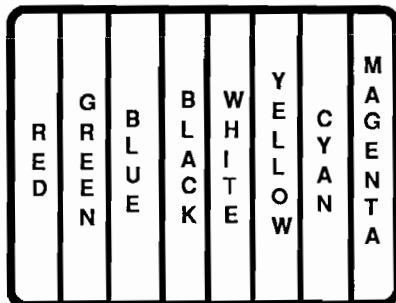
Crosshatch Pattern	For monitor setup: linearity, convergence and focus.
Red Screen **Green Screen** **Blue Screen** **Color Pattern**	Optimize purity. •Contaminated colors: Degauss monitor. If necessary, adjust purity magnets. •Missing color: Color RAM error.
Color Bars (shown) • Double width • Half width • Transposed • Missing	Adjust monitor drive, cutoff, screen and black-level controls. Symptoms at left suggest a fault in one of these: U3/U23, U2/U22, R2 through R16.

TROUBLESHOOTING YOUR SOUND BOARD			
SYMPTOM	**TEST AND PROCEDURES**		
Missing Sounds; No Sound--Step 1 *(Assumption: Input Section Failure)*	**[ ] Check sound-select inputs on Sound Board**		
	Test	**Tool**	**Condition and Your Action**
	Reset pulse -RESET at 1 or U33, pin 37	Logic probe (Game on and in Test 4, "Play Synthe-sizer" subtest)	•HIGH (except first second after turn-on)--proceed •LOW--Stuck reset line. Unplug 10P1, power down and up and retest. •STILL LOW--To isolate the bad chip, remove reset pins from sockets, one at a time (below). Retest after each removal... U1-pin 37, U33-37, U10-17, U20-17, U7-3, U8-7; replace bad chip and reinsert pins
	•At flip-flop U26, pins 3, 8 •Address decoder U16, pin 10 •Latch U6, pins 3, 4, 7, 8, 13, 14, 17, 18	Logic probe (Game on and in Test 4, "Play Synthe-sizer" subtest)	•PULSING--proceed •SOME LOW--check connectors 10P1/J1, 1P8/J8, foils •STILL LOW--perform CPU Board checkbox below •CPU Board OK--replace the Sound Board IC with the stuck-low pin •PINS OK, NO SOUND--Check resistor pack SR5-2, R32: Each resistor should measure 4.7K ohms
Missing Sounds; No Sound--Step 2 *(Assumption: Off-board Failure)*	**[ ] Check CPU-Board outputs**		
	Test	**Tool**	**Condition and Your Action**
	CPU Board latch U39/U59, pins 12 through 19	Logic probe (Game on and in Test 4, "Play Synthe-sizer" subtest)	•PULSING--replace the sound data cable •ANY LOW--unplug 1P8 and retest •PULSING NOW--bad Sound Board: per-form Sound Board checkbox above •STILL LOW--replace latch that has stuck bits (U39 or U59) •ALL PINS LOW OR HIGH--dead clock function (U39 or U59, pin 11 or U78, pin 12): replace bad latch U39 or U59, or PLD U78
No Sound *(Assumption: Power Section Failure)*	**[ ] Check the power sources** 1. With the power on, use a VOM to check DC voltages at jack 10J3: +5V at pin 1; +12V at pins 5 and 6; -12V at pin 3; ground at pins 2, 7 and 8. Also +8V at transistor Q1's emitter. The +5V line may be open or ripply: Test for AC! No more than 0.005VAC is normal. Other power lines may be low (for example, overloaded by bad 100 uF capacitors). A shorted +5V line brings down the main system. 2. If +5, +12 or -12V are absent or low, turn off game. Check associated cables and electrolytic capacitors. Start with 100 uF capacitors C2, C6 and C16. 3. If +8 is absent or low, check regulator ZR3/Q1/C15, etc.		

TROUBLESHOOTING YOUR SOUND BOARD	
SYMPTOM	**TEST AND PROCEDURES**
Still No Sound *(Assumption: Audio Section Failure)*	**[ ] Check the Audio (Analog) Section** (1) Turn the power on. Turn up the volume control. (2) Rub your fingertips over the preamplifier pins (U19, 21 and U39). U19 is the synthesizer preamp. U39 is the preamp for the CVSD. U21 is the DAC preamp. Check each chip separately. (3) A low hum indicates that the audio amplifiers, volume pot and speaker are okay. A problem may still exist in the attenuator stages before the preamps. (If desired, use this technique to increase the volume of the hum: While rubbing the analog inputs, lay a finger on the pins of nearby digital chips.) •MISSING OR DISTORTED SOUNDS--check Power Supply voltages at the analog chips (see Power Sources checkbox above) •MISSING SOUNDS FROM ONE SOURCE--Check the appropriate preamplifier and both power amplifier chips. Preamps: For missing music (synth)--U19; missing sound effects (DAC)--U21; missing voices (CVSD)--U39. Power amps: U32 and U41. All chips OK? Check electrolytic capacitors C20, C34, C48, C55, C67, C68.
Missing Sounds; No Sound *(Assumption: Digital Failure)*	**[ ] Check the Sound ROM Section and related circuitry** (1) Turn the power on. (2) What if you have no sound but power supply voltages are nominal (ripple-free +5VDC)? Then check the clock oscillator. Using a VOM or logic probe, test for pulsing AC across crystal CR1. Also test for pulsing DC across flip-flop U11. If the clock signal's absent, replace oscillator CR1. (3) Turn the power off. (4) As a test, try replacing the ROM chips we specify below: Replacements should be made one at a time. Don't discard the original chips! •If MUSIC is missing or absent, replace Sound ROMs U3 through U5. Still missing? Swap RAMs U2 and U34. If music now works, but sound doesn't, replace bad RAM at U34. •If SOUNDS (other than music) are missing or absent, replace Sound ROMs U3 through U6. Only substitute known-good chips. After each replacement, perform step 5. Still missing? Swap RAMs U2 and U34. If sound now works, but music doesn't, replace bad RAM at U2. (5) Power-up and test the Sound Board after each swap. Use Diagnostic Test 4. (6) As a test, replace first microprocessor U1 and then U33 with known-good chips. After each replacement, perform step 7. (7) Power-up and test the Sound Board after each swap. Use Diagnostic Test 4.

Chapter 3. Unique Parts

Electrical Parts
Semiconductors
Hardware

Major Assemblies and Subassemblies
Programmed Chip Summary--Part 2
Warnings and Notices

Unique Parts

CATEGORY	TYPE	DESCRIPTION	PART NUMBER
Electrical Parts	Battery	Lithium Battery, 3V	5880-11056-00
	Cables	20-Pin, 6" Ribbon Cable	5795-10937-06
		3036-U Main Harness	H-12105
		Coin Door Cable	H-12555
		Control-Panel Cable	H-12106
		Line Voltage Cable	H-12104
		Power Chassis Jumper Cbl	H-12481
		Power Supply Cord Assy	A-10084
		Speaker Cable	H-12335
		Switcher Power Cable	H-10217-3
		Transformer Sec'y Jpr Cbl	H-12334
		Video PCB Power Cable	H-12119
		Video Signal Cable (48")	H-9784-4
	Dual Inline Pkgs (DIPs)	4.7K and 470pF x 8	5060-10396-00
		270 Ohms x 8	5019-10501-00
		100 Ohms x 8	5019-10849-00
	Electrolytic Capacitors	15,000 uF at 25V +/- 20%	5040-12313-00
		2,200 uF at 25V +/- 20%	5040-12314-00
		1,000 uF at 16V +/- 20%	5040-12006-00
		470 uF at 25V +50-10%	5040-09776-00
		100 uF at 35V	5040-10974-00
		100 uF at 10V +/- 20%	5040-08986-00
		47 uF at 25V +/- 20%	5040-12283-00
		10 uF at 20V +/- 20%	5040-09343-00
		2.2 uF at 50V +/- 20%	5040-12294-00
		1 uF at 50V +/- 20%	5040-12293-00
		1 uF at 25V +/- 20%	5041-09031-00
	Fluorescent Lamp Parts	Ballast (replacement)	20-8749-8
		Fluorescent Lamp 18"/15W	24-8809
		Fluorescent Lamp Fixture	20-9590
		Starter (replacement)	20-8748-1
	Inductors	4.7 uH, 3A Coil	5551-09822-00
		Power Transformer Assy	5610-12291-00
	Line Filter	Line Filter, 5A	5102-08895-00

CATEGORY	TYPE	DESCRIPTION	PART NUMBER
Electrical Parts, continued	Pots and Switches	ADVANCE-SPST Switch	5643-09268-00
		DPDT, 100V, 5A	5641-09312-00
		DPST, 227V, 15A (On/Off)	5640-10932-00
		Interlock-Cheater Switch	5643-09556-00
		Memory Protect Switch	17-1042
		Player-Panel Switch	03-7614
		Pot, 10K, 1W	5014-12363-00
	Single Inline Pkgs (SIPs)	4.7K Ohms x 5	5019-09786-00
		4.7K Ohms x 9	5019-09362-00
		470 Ohms x 9	5019-10143-00
	Speakers	Four-Ohm, 6" Round, 10W	5555-12015-00
		4" Piezo, 50W	5555-12068-00
Semiconductors	Analog ICs	2002 Audio Power Amp	5370-09156-00
		3303 Op Amp (Preamp)	5370-10968-00
		3340 Active Attenuator	5370-12260-00
	Oscillators	8 MHz Oscillator	5521-10931-00
		48 MHz Oscillator	5521-10421-00
	RAM ICs	2064 150nS SRAM	5340-12278-00
		4461 DRAM (64K x 4)	5340-12213-00
		4464 DRAM (64K x 4)	5340-12014-00
		5564PL 8K x 8 CMOS SRAM	5340-12079-00
		62256 8K x 8, 55nS SRAM	5340-12242-00
	Random Logic	74ALS138 3/8 Line Decoder	5317-12023-00
		74HC138 3/8 Line Decoder	5311-10948-00
		74LS138 3/8 Line Decoder	5281-09745-00
		74LS139 2/4 Line Decoder	5281-09246-00
		74ALS245 Transceiver	5317-12208-00
		74ALS541 Octal Buffer	5317-12211-00
		74HC541 Octal Buffer	5311-12287-00
		74HC573 Octal Latch	5311-12285-00
		74ALS574 Octal Flip-Flop	5317-12212-00
	Transistors	TIP122 NPN Darlington	5162-09410-00
	Varistors and Zener Diodes	Varistor, 130V, 10J	5017-09044-00
		Zener, 1N6000, 10V, 1/2W	5075-12364-00
		Zener, 1N5231, 5.1V, 1/2W	5075-09313-00
		Zener, 1N5227, 3.6V	5075-12276-00

CATEGORY	TYPE	DESCRIPTION	PART NUMBER
Semiconductors, continued	VLSI Chips	Custom DMA (ASIC)	5410-12239-00
		TMS34010 GSP	5400-12220-00
		68B09E Microprocessor	5400-10320-00
		YM2151 Yamaha Synthesizer	5370-11086-00
	Misc. Electronic Parts	Crystal, 3.58 MHz	5520-09020-00
		MAX691 IC: Reset/Watchdog	5434-12255-00
		55536 CVSD	5370-09691-00
		7224 D/A Converter IC	5371-12262-00
Hardware	Metal and Wooden Misc. Parts	Cabinet Base	11-872-2
		Cam Lock (For Door)	20-6542-TB
		Coin Door, U.S.A. 25/25¢	09-13000-V-1
		Control Panel Hinge	20-9578
		Door Lock Retainer	01-7264
		Door, Lower Rear	11-877
		Door, Monitor Box (Rear)	11-875
		Door, Upper Rear	11-876
		Handle, 6.5"	20-9267
		Hinge for Rear Door	01-7224
		Interlock Switch Bkt	A-9958
		Joystk, 8-way (Blu, w/Cbl)	C-12140-1
		Joystk, 8-way (Red, w/Cbl)	C-12140
		Leg Adjuster (3")	08-7377
		Monitor Box	11-873
		Pwr Supply PCB Mtg Plate	01-8883
		Pwr Xformer Chassis Assy	C-12356
		Toggle Latch	20-9347
		Trunk Latch Bracket	01-6994
		Two-Speaker Grill	01-8899
		Venthole Cover, 14"	03-7839
		Venthole Cover, 20"	03-7602
		Volume Pot Bracket	01-6858

CATEGORY	TYPE	DESCRIPTION	PART NUMBER
Hardware, continued	Rubber, Glass and Plastic Parts	Control Panel Cover	31-1450-3036-U1
		CRT Bezel (24.5" High)	03-8180
		Marquee/CRT Glass Window	31-1460-3036-U1
		Marquee Top Extrusion	20-9573
		Neopr Gasket, 3/4"Lx1/4"Th	23-6618
		Neopr Gasket,3/4x22" L	23-6550-4
		Neopr Gasket,3/4x26-3/4"L	23-6550-5
Major Assemblies and Subassemblies	General	Control Panel Assembly	D-12202
		Contr Panel Module (No cov)	11-872-1
		CPU PCB Assembly	C-11879-3036
		CPU PCB Subassy (no PLDs)	C-11878
		Interface Bd Subassy	C-12037
		Lwr Rear Door Assy (w/Bds)	D-12266
		Main Harness Assembly	C-12403
		Monitor, 19", 24 kHz Hor.	5675-12264-00
		Power Supply Assy, Sound	C-12218
		Power Supply, Switching	C-12401
		ROM Bd Assy (w/ROMs)	C-12260-3036
		ROM Bd Subassy (no ROMs)	C-12261
		Sound PCB Assembly	C-12350
		Sound Bd Subassy (no ROMs)	C-12349
		Switching Supply Subassy	20-9574
		Transformer Pwr Pack, USA	D-12446

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Programmed Chip Summary

(Continued from Inside-Front Cover)

IC	DESCRIPTION	TYPE	BOARD LOC.	PART NO.
Image ROM	ROM	27512	ROM Board U55	A-5343-3036-43
Image ROM	ROM	27512	ROM Board U56	A-5343-3036-44
Image ROM	ROM	27512	ROM Board U57	A-5343-3036-45
Image ROM	ROM	27512	ROM Board U58	A-5343-3036-46
Program ROM	ROM	27512	ROM Board U59	A-5343-3036-11
Program ROM	ROM	27512	ROM Board U60	A-5343-3036-12
Image ROM	ROM	27512	ROM Board U61	A-5343-3036-47
Image ROM	ROM	27512	ROM Board U62	A-5343-3036-48
Image ROM	ROM	27512	ROM Board U63	A-5343-3036-49
Image ROM	ROM	27512	ROM Board U64	A-5343-3036-50
Image ROM	ROM	27512	ROM Board U65	A-5343-3036-51
Image ROM	ROM	27512	ROM Board U66	A-5343-3036-52
Image ROM	ROM	27512	ROM Board U67	A-5343-3036-53
Image ROM	ROM	27512	ROM Board U68	A-5343-3036-54
Image ROM	ROM	27512	ROM Board U69	A-5343-3036-55
Image ROM	ROM	27512	ROM Board U70	A-5343-3036-56
Image ROM	ROM	27512	ROM Board U71	A-5343-3036-57
Image ROM	ROM	27512	ROM Board U72	A-5343-3036-58
Image ROM	ROM	27512	ROM Board U73	A-5343-3036-59
Image ROM	ROM	27512	ROM Board U74	A-5343-3036-60
Image ROM	ROM	27512	ROM Board U75	A-5343-3036-61
Image ROM	ROM	27512	ROM Board U76	A-5343-3036-62
Program ROM	ROM	27512	ROM Board U77	A-5343-3036-13
Program ROM	ROM	27512	ROM Board U78	A-5343-3036-14
Image ROM	ROM	27512	ROM Board U79	A-5343-3036-63
Image ROM	ROM	27512	ROM Board U80	A-5343-3036-64
Image ROM	ROM	27512	ROM Board U81	A-5343-3036-65
Image ROM	ROM	27512	ROM Board U82	A-5343-3036-66
Image ROM	ROM	27512	ROM Board U83	A-5343-3036-67
Image ROM	ROM	27512	ROM Board U84	A-5343-3036-68
Image ROM	ROM	27512	ROM Board U85	A-5343-3036-69
Image ROM	ROM	27512	ROM Board U86	A-5343-3036-70
Image ROM	ROM	27512	ROM Board U87	A-5343-3036-71
Image ROM	ROM	27512	ROM Board U88	A-5343-3036-72
Image ROM	ROM	27512	ROM Board U89	A-5343-3036-73
Image ROM	ROM	27512	ROM Board U90	A-5343-3036-74
Image ROM	ROM	27512	ROM Board U91	A-5343-3036-75
Image ROM	ROM	27512	ROM Board U92	A-5343-3036-76
Image ROM	ROM	27512	ROM Board U93	A-5343-3036-77
Image ROM	ROM	27512	ROM Board U94	A-5343-3036-78

Warnings and Notices

WARNING

FOR SAFETY AND RELIABILITY, substitute parts or modifications are not recommended.

USE OF NON-*WILLIAMS* PARTS or circuit modifications may cause injuries or equipment damage.

SUBSTITUTE PARTS OR MODIFICATIONS may void FCC Type Acceptance.

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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. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause intereference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

WARNING

FCC STICKER. Check the back of your game for an FCC sticker. When *WILLIAMS* ships a game, the game has been found to comply with FCC Rules. *The sticker is proof.* If the sticker is missing, *legal repercussions to the owner and distributor of the game* may result. If your game (manufactured after December 1982) has no FCC sticker, call *WILLIAMS* for advice. Or write us a note on your game-registration card. *Be sure the card bears your game's serial number.*

WARNING

THREE-WIRE PLUG. Prevent shock hazard and assure proper game operation! Only plug this game into a properly grounded outlet. DO NOT use a "cheater" plug to defeat the power cord's ground pin. DO NOT cut off the ground pin.

CAUTION

When removing GSP or Custom DMA chips, use the proper chip extraction tool. Otherwise, chip damage is likely.

RF-INTERFERENCE NOTICE

YOUR GAME'S CABLE-HARNESS PLACEMENT and ground-strap routing are very important. They are designed to keep RF radiation and conduction within levels accepted by FCC Regulations.

MAINTAIN THESE LEVELS. Servicing may require that you disconnect harnesses or ground straps. When you're finished, reposition and reconnect them as they were.

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