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OPERATIONS MANUAL
including
TEST/DIAGNOSTIC PROCEDURES, REFERENCE INFORMATION, & SCHEMATICS

Williams®
ELECTRONICS GAMES, INC.

CYCLONE ROM and Jumper Table

Game	System 11B CPU Rev.	P/N - U15 Game µP	P/N - U27 G. ROM 1	P/N - U26 G. ROM 2	P/N - U21 S. ROM 1	P/N - U22 S. ROM 2	P/N - U24 Sound µP	Jumpers
BIG GUNS	-	5400-09150-00	A-5343-557-2	A-5343-557-1	A-5343-557-4	A-5343-557-3	5400-09150-00	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
SPACE STATION	-	↓	A-5343-552-2	A-5343-552-1	A-5343-552-4	A-5343-552-3	↓	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
CYCLONE	-	↓	A-5343-564-2	A-5343-564-1	A-5343-564-4	A-5343-564-3	↓	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19

CYCLONE Solenoid Table

Sol. No.	Solenoid Description (p = Playfield b = Backglass)	Solenoid Type	Wire [1] Color	Connections CPU Bd.	Connections Playfield/ Cabinet	Driver Trans.	Solenoid Part Number / Flashlamp Type (b = Backbox p = Playfield)
01A [3]	Outhole Kicker	Switched	{Vio-Brn	1P11-1	8P3-1 (via 5J1-9,	Q33	AE-23-800
01C [3]	L F Wheel (p) & Jackpot (b) Flashers	Switched	Blk-Brn}	(Gry-Brn)	Aux Pwr Drvr Bd.)	Q33	#89 flashlamps 2b,1p
02A [3]		Switched	{Vio-Red}	1P11-3	8P3-2 (via 5J1-7,	Q25	
02C [3]	R F Wheel (p) & Teeth (b) Flashers	Switched	Blk-Red}	(Gry-Red)	Aux Pwr Drvr Bd.)	Q25	#89 flashlamps 1b,1p
03A [3]	Ball Shooter Kickbig	Switched	{Vio-Orn}	1P11-4	8P3-3 (via 5J1-6,	Q32	AE-24-900
03C [3]	Top mid (p) & L Eye (b) Flashers	Switched	Blk-Orn}	(Gry-Orn)	Aux Pwr Drvr Bd.)	Q32	#89 flashlamps 1b,1p
04A [3]	Boomerang Kickbig	Switched	{Vio- Yel}	1P11-5	8P3-4 (via 5J1-5,	Q24	AE-26-1500
04C [3]	Cats (p) & lwr Fireworks (b) Flashers	Switched	Blk-Yel}	(Gry-Yel)	Aux Pwr Drvr Bd.)	Q24	#89 flashlamps 1b,2p
05A [3]	Drop Target	Switched	{Vio-Grn}	1P11-6	8P3-5 (via 5J1-4,	Q31	AE-23-800
05C [3]	Ducks (p) & R Fireworks (b) Flashers	Switched	Blk-Grn}	(Gry-Grn)	Aux Pwr Drvr Bd.)	Q31	#89 flashlamps 1b,2p
06A [3]		Switched	{Vio-Blu}	1P11-7	8P3-6 (via 5J1-3,	Q23	
06C [3]	Ferris Wheel (p) Flashers	Switched	Blk-Blu}	(Gry-Blu)	Aux Pwr Drvr Bd.)	Q23	#89 flashlamps 2p
07A [3]	Knocker /Ticket Dispenser (b'box)	Switched	{Vio-Blk}	1P11-8	8P3-7 (via 5J1-2,	Q30	AE-26-1200
07C [3]	Cyclone (p) & R Eye (b) Flashers	Switched	Blk-Vio}	(Gry-Vio)	Aux Pwr Drvr Bd.)	Q30	#89 flashlamps 1b,1p
08A [3]		Switched	{Vio-Gry}	1P11-9	8P3-8 (via 5J1-1,	Q22	
08C [3]	Spook H'se (p) & L F'works (b) Flashers	Switched	Blk-Gry}	(Gry-Blk)	Aux Pwr Drvr Bd.)	Q22	#89 flashlamps 1b,1p
09	Spook House Bonus Flasher (p)	Contrld	Brn-Blk	1P12-1	8P3-9 (via 5J2-9)	Q17	#89 flashlamps 1p
10	Playfield Gen Illumin Relay (p)	Contrld	Brn-Red	1P12-2	8P3-10 (via 5J2-8)	Q9	5580-09555-01 [4]
11	Backglass Gen Illumin Relay (b)	Contrld	Brn-Orn	1P12-4	6J3-1 (via 5J2-6)	Q16	5580-09555-01 [4]
12	Solenoid A/C Select Relay (b)	Contrld	Brn-Yel	1P12-5	8P3-12 (via 5J2-5)	Q8	5580-09555-01 [5]
13	Mystery Wheel (b) Coil B	Contrld	Brn-Grn	1P12-6	6J2-3 (B'box Conn	Q15	14-7948/D-12045
14	Mystery Wheel (b) Coil A	Contrld	Brn-Blu	1P12-7	6J2-4 Bd)	Q7	14-7948/D-12045
15	Boomerang Flashers (p)	Contrld	Brn-Vio	1P12-8	8P3-15 (via 5J2-2)	Q14	#1251 lamps 3p
16	Ferris Wheel Motor/Relay (p)	Contrld	Brn-Gry	1P12-9	8P3-16 (via 5J2-1)	Q6	14-7941-3/5580-12145-01 [6]
17	Left Jet Bumper	Specl #1	Blu-Brn	1P19-7	8P3-17 (via 5J3-7)	Q75	AE-23-800
18	Left Kicker ("sling")	Specl #2	Blu-Red	1P19-4	8P3-18 (via 5J3-6)	Q71	AE-26-1500
19	Right Jet Bumper	Specl #3	Blu-Orn	1P19-3	8P3-19 (via 5J3-3)	Q73	AE-23-800
20	Right Kicker ("sling")	Specl #4	Blu-Yel	1P19-6	8P3-20 (via 5J3-4)	Q69	AE-23-800
21	Bottom Jet Bumper	Specl #5	Blu-Grn	1P19-8	8P3-21 (via 5J3-2)	Q77	AE-26-1500
22		Specl #6	Blu-Blk	1P19-9		Q79	
-	Right Flipper	-	Orn-Vio [Blu-Vio]	1P19-1	7P1-15 [7P1-16,8P3-34] [2]	-	FL11630-50VDC
-	Left Flipper	-	Orn-Gry [Blu-Gry]	1P19-2	7P1-18 [7P1-19,8P3-32] [2]	-	FL11630-50VDC

Notes: 1. Wire colors, except flipper Orn-Vio and Orn-Gry, are ground connections (to coil terminal with unbanded end of diode). Flipper Orn-Vio and Orn-Gry wires connect from CPU Board to flipper switch. 2. Flipper connections shown in braces are from flipper switch to flipper coil. 3. "A" coils are pulsed, when Sol. 12 is de-energized; "B" coils are pulsed, with Sol. 12 energized. Wire colors in brackets are those from respective A and B terminals corresponding to the J1- terminal connection listed for the Aux Power Driver Bd., which controls the device pulsing by Sol. 12. 4. Relay is mounted on Relay Bd. p/n C-11998-1. 5. Relay is mounted on Aux Pwr Driver Bd. D-11813 in the backbox. 6. Relay is mounted on Relay Bd C-11902-1.

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CYCLONE (System 11B) ROM Summary

IC	DESCRIPTION	TYPE	IDENTIFIER	BOARD	PART NUMBER
Game ROM 1	32K x 8 ROM	27256	U27	CPU	A-5343-564-2
Game ROM 2	16K x 8 ROM	27128	U26	CPU	A-5343-564-1
Sound ROM 1	32K x 8 ROM	27256	U21	CPU	A-5343-564-4
Sound ROM 2	32K x 8 ROM	27256	U22	CPU	A-5343-564-3
Music/Speech ROM 1	32K x 8 ROM	27256	U4	Audio	A-5343-564-5
Music/Speech ROM 2	32K x 8 ROM	27256	U19	Audio	A-5343-564-6

NOTICE

To order a replacement ROM from your authorized WILLIAMS ELECTRONICS GAMES distributor, specify: (1) part number (if available); (2) ROM label color; (3) ROM level (number) on the label; (4) which game the ROM is used in.

CONNECTOR IDENTIFICATION

WILLIAMS ELECTRONICS GAMES uses a special technique to identify connectors. Each plug or jack receives a prefix number (which identifies the circuit board), a letter, and a number. J-designations refer to the male part of a connector. P-designations refer to the female part of a connector. For example, 1J1 designates jack 1 of board 1 (a CPU Board jack); 3P6 designates plug 6 of board 3 (a Power Supply Board plug).

Identifying the specific pin number of a connector involves a hyphen, which separates the pin number from the plug or jack designation. For example, 1J1-3 refers to pin 3 of jack 1 on board 1.

CYCLONE CIRCUIT BOARDS

CYCLONE's System 11B Circuit Boards are in the backbox. They are accessible by removing the backbox glass, unlatching the insert board, and swinging it open.

CPU BOARD. The System 11B CPU Board (p/n D-11883-564) must be equipped with the ROMs specified in the *CYCLONE* (System 11B) ROM Summary. For this ROM complement and CPU Board, jumpers W1, W2, W4, W5, W7, W8, W11, W14, W16, W17, and W19 must be connected. (Jumper W7 is cut/removed for West German games.)

AUDIO BOARD. The Audio Board is p/n D-11581-564, as supplied with ROMs and microprocessor.

DISPLAY BOARD. The Alphanumeric Display Unit Board is p/n D-11609.

POWER SUPPLY BOARD. The Power Supply Board is p/n D-8345-557.

AUX POWER DRIVER BOARD. The Aux Power Driver Board is D-11813-564.

Prefix numbers for the System 11B circuit boards and other major assemblies are listed below. A prefix number may precede a component designator to identify the unit (e.g., connector 1J1).

1 - CPU	6 - Backbox	11 - Audio
2 - (not assigned)	7 - Cabinet	12 - (not assigned)
3 - Backbox Power Supply	8 - Playfield	13 - (not assigned)
4 - Alphanumeric Display	9 - Insert Board	14 - (not assigned)
5 - Aux Power Driver	10 - (not assigned)	15 - (not assigned)

CYCLONE GAME CONTROL LOCATIONS

The On-Off switch is on the bottom of the cabinet near the right front leg.

The Volume Control is on the left inner wall of the cabinet on the tilt mechanisms board. It is accessible by opening the coin box door.

The Credit switch is a pushbutton to the left of the coin door on the cabinet exterior.

GAME ADJUSTMENT/DIAGNOSTIC SWITCHES. *CYCLONE* allows the operator to program virtually all game adjustments, obtain bookkeeping information, and diagnose problems, using only three switches mounted on the inside of the coin door and the Credit button beside the coin door.

ADVANCE, AUTO-UP/MANUAL-DOWN, and HIGH-SCORE RESET are the switches located on the inside of the coin door. Refer to the Game Status Displays text and the Text/Diagnostic Procedures for details concerning their operation.

The Memory Protect switch is on the inside frame of the coin door. This interlock switch must be open to clear bookkeeping totals and to make game adjustments. It automatically opens, when the coin door opens.

CYCLONE GAME CONTROL LOCATIONS (Continued)

The CPU Diagnostic switch (SW 2) is the lower switch (of the two switches mounted on the left edge of the CPU Board) near a large, socketed microprocessor chip. This switch initiates the Memory Chip Test explained in the Test/Diagnostic Procedures.

The Sound Diagnostic switch (SW 1) is the upper switch of the two mounted on the left edge of the CPU Board. This switch initiates the Sound Section Test. Refer to the Test/Diagnostic Procedures.

PINBALL GAME ASSEMBLY INSTRUCTIONS

1. Open the shipping container; remove all cartons, parts, and other items, and set them aside.
2. Place cabinet on a support and attach rear legs (after installing leg levellers), using leg bolts. Leg levellers and leg bolts are both provided among the parts in the cash box.
3. Attach the front legs (after installing leg levellers), using leg bolts. See Figure 1 for details.

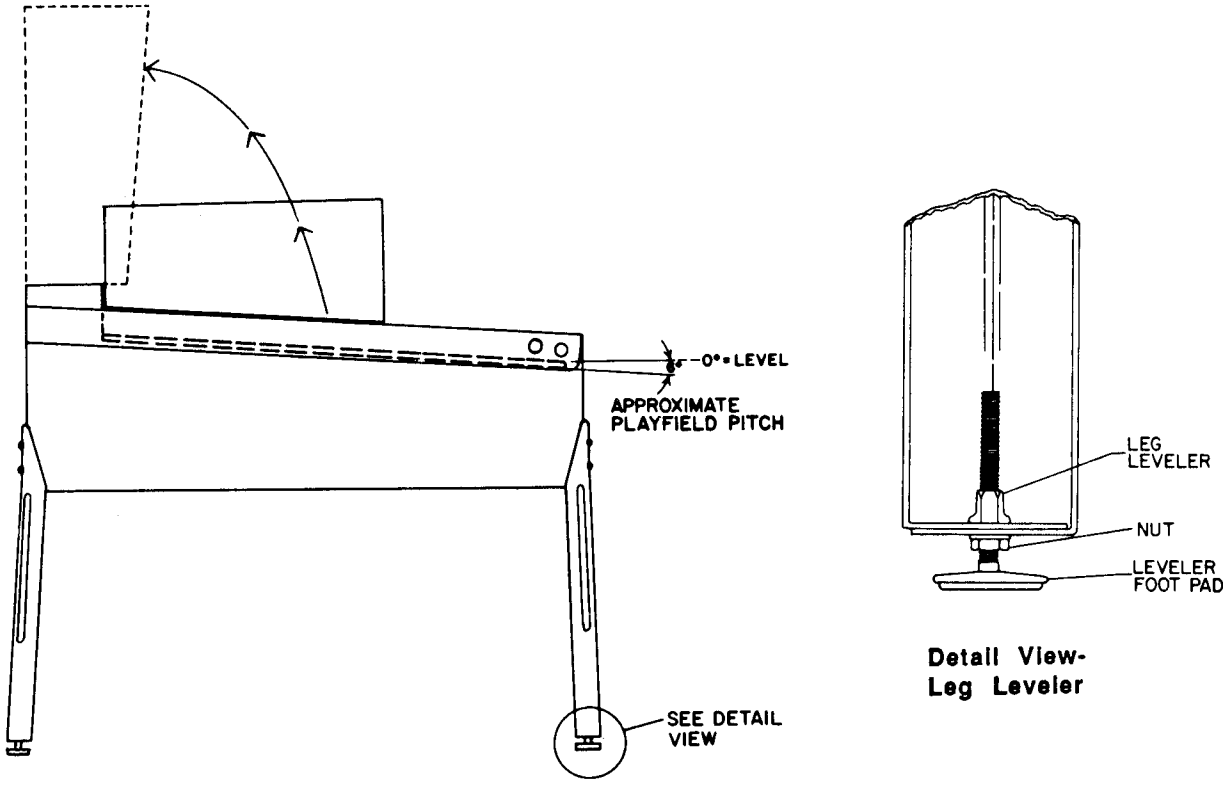

Figure 1. Pinball Assembly, Playfield Pitch Angle, and Leg Leveler Details.

4. Reach into the cabinet and backbox and check the mating of the interconnecting cables, matching several wire colors at each connector. Ensure that all connections are properly secure.

> CAUTION
>
> Ensure that the interconnecting cables are free to move (not kinked or pinched). Be careful not to damage wires at any stage of the assembly process.

5. Raise the hinged backbox upright and stabilize it into position, using the clamp on the back of the cabinet and backbox. Unlock the backbox, and remove the backbox glass, storing it carefully to avoid scratches. Remove the shipping block holding the Insert Board. Unlatch the Insert Board and open it, then lift the Speaker/Display Panel up and lay it forward on the playfield cabinet. This allows access to the bolt holes used for securing the backbox upright. Install the mounting bolts and flat washers through the bottom holes of the backbox into the threaded fasteners in the cabinet to secure the backbox.

WARNING

NEVER transport a pinball game with the hinged backbox erect. *Always* lower the backbox forward onto the playfield cabinet on a layer of protective material to prevent marring or damage and possible personal injury.

6. Extend each leg leveler *slightly* below the leg bottom, so that all four foot pads are extended about the same distance. Remove the cabinet from its support and place it on the floor.
7. Adjust the leg levelers for proper playfield level (side-to-side) *and* playfield pitch angle (incline) of approximately 6 degrees. (Again, it is recommended that these measurements be made ON the playfield, not the cabinet nor the playfield cover glass.) Tighten the nut on each leg leveler shaft to maintain this setting, as shown in Figure 1.

CAUTION

Playfield pitch angle adjustments can affect the operation of the plumb bob tilt, inside the cabinet. The operator should adjust this tilt mechanism for proper operation, after completion of the desired playfield pitch angle setting.

8. Move the game into the desired location; recheck the level and pitch angle of the playfield.
9. Verify that the ***required number*** of balls are installed in the game. (*CYCLONE:* 1 ball.)
10. Clean and re-install the playfield cover glass. Prepare the game for player operation.

GAME OPERATION

WARNING

After assembly and installation at its site location, this game must be plugged into a properly grounded outlet to prevent shock hazard, and to assure proper game operation. DO NOT use a 'cheater' plug to defeat the ground pin on the line cord. DO NOT cut off the ground pin.

POWERING UP. With the coin door closed, plug the game in, and switch it ON, using the On-Off switch. In normal operation, the player 1 score display initially shows 00. Then, the game goes into the Attract Mode (playfield and backbox lamps flashing, sounds being heard, etc., if the operator does not change the Factory Setting).

Open the coindoor and press the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN. Press the ADVANCE button to begin the game test routine. Return to AUTO-UP and perform the entire test to verify that the game is operating satisfactorily.

NOTE

CYCLONE's SYSTEM 11B game program has a great capability to aid the operator and service personnel: At game Turn-On (and also at the beginning of the Test/Diagnostic Procedures), the Player 1 display now signals, with a decimal point by the rightmost character, that at least one switch has NOT been actuated during ball play for 120 balls (≈ 40 games). [Note: Only one dot appears, although more than one switch may be affected.] Moreover, *CYCLONE* compensates the game play requirements affected by each disabled switch to allow 'nearly normal' play. This helps keep *CYCLONE* earning good profits! More information is available in the Test/Diagnostic Procedures text describing the Switch Testing.

ATTRACT MODE*. Playfield and backbox lamps blink. All player score displays exhibit a series of messages informing the player concerning:

A. Recent highest scores*;
B. A "custom message"
("**TAKE A CHANCE ... AND RIDE... THE CYCLONE**")*;
C. The score to achieve to obtain a Replay award*;

These (or similar) displays reappear occasionally, accompanied by sounds and music, until a player initiates game play by inserting a coin or, when credits are available, pressing the Credit button.

CREDIT POSTING. Insert coin(s). A sound is heard for each coin, and the player score displays show the number of credits purchased. So long as the number of maximum allowable credits* are *NOT* exceeded by coin purchase or high score, credits are posted correctly. However, after this maximum credits value is reached, posting of additional credits won (not purchased) by the player does *not* occur. ONLY posting of *purchased* credits occurs beyond the maximum credits value.

STARTING A GAME. Press the Credit button once. A startup sound plays, and the Credit amount shown in the player score display decreases by one. Player display 1 flashes 00 (until the first playfield switch is actuated), and the Player 4 display shows **ball 1**, except for 4-player games where the **ball #** shows in the individual player's display. Additional players may enter the game by pressing the Credit button once for each player, before the end of play on the first ball.

TILT. Actuating the Slam Tilt switch on the coin door inside the cabinet ends the current game; *CYCLONE* then proceeds to the Game Over Mode. With the actuation of the playfield tilt switch, or the third closure* of the plumb bob tilt switch, the player loses the remaining play of that ball, but can complete the game.

END OF GAME. All earned scores and bonuses are awarded. If a player's final score exceeds the specified value, the player receives a designated award for achieving the current highest score. A random digit set* appears in the Match display. Credit* may be awarded, when the last two digits of any player's score display (1 through 4) match the random digits of the Match display. Match, high score, and game over sounds are made, as appropriate.

GAME OVER MODE. The GAME OVER display shows in the player score displays. Then, the high scores flash on the appropriate player score displays. The game proceeds to the Attract Mode.

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* - operator-adjustable feature

CYCLONE GAME STATUS DISPLAYS

CYCLONE provides the game owner/operator with a display of information concerning the game's bookkeeping and game play feature adjustments. Basically, three classes of information now become available in this status display mode: Id (Identification); Au (Audit); Ad (Adjustment). Each of the underscored two-letter abbreviations for these classes appears in the Player 3 score display, while the system microprocessor for the *CYCLONE* game is displaying the items within each class.

Identification Information--Id

With the game turned on, the coin door open, and the AUTO-UP/MANUAL-DOWN switch in the AUTO-UP position, the operator can press the ADVANCE switch once, briefly. *CYCLONE's* displays immediately change from the Attract Mode to the Game Status Display Mode. This is evident by the following display, shown in columnar form. The column headings refer to the various backbox displays.

Player 1	Player 2	Player 3	Player 4
CYCLONE	**Id 00**	**564**	**L-x***

* x - indicates ROM revision level; e.g., 1 is initial issue; 2, 3, etc. for later revisions.

The game is named in the Player 1 score display. The game's identification number shows in the Player 2 score display and the ROM revision level appears in the Player 4 display. The Player 3 score display shows the status display mode in abbreviated form, *Id.* The Player 3 score display also shows the status display mode item (**00**) for this particular display.

Pressing ADVANCE once more causes the **Id 01** display to appear. This display describes which of the "Install" options is currently in effect. For example, if the YES option of the INSTALL FACTORY Adjustment Item (Ad 70) was last selected, *FACTORY SETTING* appears on the player score displays. Changing the setting of any other game adjustment item, after selecting the YES option for Ad 70 causes the display to change to *FACTORY ALTERED.* Similarly, if the operator selects the YES option for INSTALL HARD (Ad 65), the display indicates *HARD SETTING.* Changing a game adjustment item later then causes the display to show *HARD ALTERED.*

Audit Information--Au

While the AUTO-UP switch remains in the Up position, the operator can press the ADVANCE switch once, briefly, to begin the backbox displays of Audit (sometimes called "bookkeeping") Information. Forty-four audit entries are now available. Calculation of the various factors is no longer necessary because the System 11B game program now performs all the mathematical factor computations. This information is intended to aid the owner/operator in evaluating how the game is performing in each location, by providing knowledge about which game features are receiving the most play. With this information, the owner/operator can determine whether adjusting the game features to other settings will contribute to increased game earnings.

The operator can press the ADVANCE button once to view each Audit Information display item. To proceed more rapidly through this information, the operator only has to press and hold the ADVANCE button. If a desired item is passed, the operator can use the MANUAL-DOWN switch position with the ADVANCE button to back up to the desired item.

The ***CYCLONE* Audit Table** lists the 49 items of the Audit Information portion of the *CYCLONE* Game Status Displays. Presentation of this Audit Information again utilizes the player score displays; however, the Player 1 and 2 displays are combined as a descriptive phrase. The light type below the table's column headings names the respective backbox displays where the information appears. Because the Player 4 display contains information which depends on game play, only a few example entries are shown in the table. The Credits display shows *Au* for all 49 audit items, so its entry is omitted from the tabular listing. Detection of erroneous data affecting any of the counters used in these audit items causes the message, ERROR, to be displayed in the Player 3 display, during display of any audit item associated with that particular counter. (The program does not analyze the cause of the error; it merely alerts the operator of the error's existence by the message.)

CYCLONE GAME STATUS DISPLAYS (Continued)

CYCLONE Audit Table

Audit Item (Player 3)	Descriptive Phrases (Player 1 and 2 Displays)	Audit Factor [1] Value (Player 4)
AU 01	LEFT COINS [chute next to coin door hinge]	432
02	CENTER COINS	0
03	RIGHT COINS	398
04	PAID CREDITS	830
05	TOTAL PLAYS	
06	TOTAL FREE (Total Free Plays)	
07	PERCENT FREE (% Free Plays)	
08	REPLAY AWARDS	
09	PERCENT REPLAY (% Replay Awards)	
10	SPECIAL AWARDS	
11	PERCENT SPECIAL (% Special Awards)	
12	MATCH AWARDS	
13	HSTD (High Score to Date) CREDITS	
14	PERCENT HSTD (% HSTD Credits)	
15	EXTRA BALLS	
16	PERCENT EX. BALL (% Extra Balls)	
17	AV. BALL TIME (Average Time in Seconds)	
18	MIN. OF PLAY (Minutes of Play)	
19	BALLS PLAYED	
20	REPLAY1 AWARDS	
21	REPLAY2 AWARDS	
22	REPLAY3 AWARDS	
23	REPLAY4 AWARDS	
24	1 PLAYR. GAMES	
25	2 PLAYR. GAMES	
26	3 PLAYR. GAMES	
27	4 PLAYR. GAMES	
28	BURN IN CYCLES	
29	JACKPOT AWARDS (# of times Gate Bonus Jackpot awarded)	
30	1 MILL. AWARDS (# of times 1 Million shot achieved)	
31	FERRIS AWARDS (# of times Ferris Wheel Bonus awarded)	
32	SHUTTLE 100K'S (# of times 100K plunger shot achieved)	
33	M. WHEEL SPINS (# of times Mystery Wheel spun)	
34	CYCLONE SHOTS (# of times Cyclone lit value awarded)	
35	COMET SHOTS (# of times Comet lit value awarded)	
36	OUTLANE EX. BALL (# of Ex. Balls via Outlane)	
37	X SPECIAL (# of Specials via Bonus Mult.)	
38	L/R DRAINS (# of times ball drained via L/R outlane)	
39	H.S.RESET COUNTER	
40	0.0-0.4 M. SCORE (# of games <500K)	
41	0.5-0.9 M. SCORE (# of games ≥500K, <1M)	
42	1.0-1.4 M. SCORE (# of games ≥1M, <1.5M)	
43	1.5-1.9 M. SCORE (# of games ≥1.5M, <2.0M)	
44	2.0-2.4 M. SCORE (# of games ≥2.0M, <2.5M)	
45	2.5-9.9 M. SCORE (# of games ≥2.5M or more)	
46	H.S.T.D. 1> ??? (1st in HSTD Table, w/Initials)	
47	H.S.T.D. 2> ??? (2nd in HSTD Table, w/Initials)	
48	H.S.T.D. 3> ??? (3rd in HSTD Table, w/Initials)	
49	H.S.T.D. 4> ??? (4th in HSTD Table, w/Initials)	

NOTE:

1. The numbers shown in this column for Items 1 through 4 are examples. Entries for all items depend on the amount of play; thus, they will vary from location to location.

Adjustment Information--Ad

At end of the Audit Information presentation, with the AUTO-UP switch in the Up position, the operator can press the ADVANCE button to proceed to the Adjustment Information portion of the *CYCLONE* Game Status Displays, as listed in the ***CYCLONE* Game Adjustment Table**.

CYCLONE GAME STATUS DISPLAYS (Continued)

The operator can press the ADVANCE button once to view each Adjustment Information display item. To proceed more rapidly through this information, the operator only has to press *and hold* the ADVANCE button. If a desired item is passed, the operator can use the MANUAL-DOWN switch position with the ADVANCE button to back up to the desired item.

CYCLONE Game Adjustment Table

Adjustment Item (Player 3)	Descriptive Phrases (Player 1 and 2 Displays)	Factory Setting (Player 4)
Ad 01	AUTO REPLAY [1] [5% - 25%] or FIXED REPLAY [1]	10 (%) SCORES [1]
02	REPLAY START (or REPLAY LEVEL 1) [1]	2,000,000
03	REPLAY LEVELS (or REPLAY LEVEL 2) [1]	01 (or OFF)
04	(REPLAY LEVEL 3) [1]	(see text)
05	(REPLAY LEVEL 4) [1]	(see text)
06	REPLAY AWARD	Credit
07	SPECIAL AWARD	Credit
08	MATCH FEATURE [Off, 1 - 50%]	10 (%)
09	BALLS / GAME	03
10	TILT WARNING	03
11	EX. BALL / B. I. P. { [00 = NO Ex. Ball; 1-9 E. B. /Ball; 1-9 E. B. /B. I. P.; 1-9 E. B. /Game] }	2/BIP
12	MAXIMUM CREDITS	10
13	HIGHEST SCORES [On; off; auto=prgmd change]	On
14	BACKUP HI. SCR.1	3,200,000
15	BACKUP HI. SCR. 2	3,000,000
16	BACKUP HI. SCR. 3	2,800,000
17	BACKUP HI. SCR. 4	2,500,000
18	HI. SCR.1 CREDITS	01
19	HI. SCR.2 CREDITS	01
20	HI. SCR.3 CREDITS	01
21	HI. SCR.4 CREDITS	01
22	H. S. RESET EVERY (3,000 PLAYS) [2]	
23	FREE PLAY	NO
24	U.S.A. 1 COINAGE (1 COIN 1 PLAY) [2,3]	
25	LEFT UNITS	01
26	CENTER UNITS	04
27	RIGHT UNITS	01
28	UNITS/ CREDIT	01
29	UNITS/ BONUS	00
30	MINIMUM UNITS	00
31	COMET TIMER [Untimed; 1-99 sec for lit COMET shot]	20 sec
32	DOUBLE SCORE T. [Untimed; 1-99 sec duration for Dbl Scores]	20 sec
33	SPOOK H. TIMER [Untimed; 1-99 sec for Spookhouse]	15 sec
34	ADVANCE X TIMER [Untimed; 1-99 sec for ADV. X shot]	Off
35	CYCLONE TIMER [Untimed; 1-99 sec for lit CYCLONE shot]	15 sec
36	FERRIS W. TIMER [Untimed; 1-99 sec for Ferris Wheel shot]	15 sec
37	MILLION TIMER [Untimed; 1-90 sec for Million shot]	10 sec
38	CYCLONE MEMORY [ball st. lit=lit at start of each ball; mem lit= lit at game start & stored; mem unlit=off at game start & stored; no mem lit=lit at game start/not stored;no mem unlit=off & not stored]	Mem Lit
39	COMET MEMORY [ball st. lit=lit at start of each ball;mem lit=lit at game start & stored; mem unlit=off at game start & stored; no mem lit=lit at game start/not stored;no mem unlit=off & not stored]	Mem Lit
40	MILLION IN _ SHOTS [3 - 6;# of Comet ramp shots for 1M score]	5 Shots
41	FERRIS BON. ADV. [100-9900; J. Bumper score increase for Ferris Wheel Bonus]	3,000

CYCLONE GAME STATUS DISPLAYS (Continued)

The ***CYCLONE* Game Adjustment Table** lists the 70 items of the Adjustment Information portion of the *CYCLONE* Game Status Displays. Presentation of the displays is similar to that for the Audit Information (that is, the player 1 and 2 displays combine as a descriptive phrase; the light type below the column headings names the respective backbox displays where the information appears, etc.). The Player 3 display shows *Ad* for all 70 adjustment items, so its entry is omitted from the tabular listing.

CYCLONE Game Adjustment Table (Continued)

Adjustment Item (Player 3)	Descriptive Phrases (Player 1 and 2 Displays)	Factory Setting (Player 4)
42	GATE BON. ADV. [1K-99K; Gate Bon. increase via 1-2-3 lanes]	5,000
43	EX. BALL AUTO AD. [Off; 1-99 % for all Ex. Balls]	33%
44	DUCKS EX. BALL [3-5; # of compl of 3 Duck Tgt for Ex Ball]	3 Sets
45	SPECIAL AUTO AD. [Off; 1-90 % for all Specials]	5%
46	SPECIAL _X [Off;1X-7X=flashing #X for Special]	5X
47	CONSOL. TIME [Off, 1-99 sec; min. game time]	67 sec
48	A. MODE SOUNDS [ALOT; LESS; NONE]	ALOT
49	CUSTOM MESSAGE [4]	ON
50	SW. ALARM KNOCKER [yes=knock for inop switch; no=no knock]	NO
51	ENGLISH TEXT	
52	BON. MULT MEMORY [Yes-No; yes=2x-7x lamps stored for next ball play; no=not stored]	YES
53 [5]	INSTALL GERMAN 1 [6]	
54 [5]	INSTALL GERMAN 2 [6]	
55 [5]	INSTALL GERMAN 3 [6]	
56 [5]	INSTALL GERMAN 4 [6]	
57 [5]	INSTALL GERMAN 5 [6]	
58 [5]	INSTALL GERMAN 6 [6]	
59 [5]	INSTALL ADDABALL	NO
60 [5]	INSTALL 5-BALL	NO
61 [5]	INSTALL NOVELTY	NO
62 [5]	INSTALL EX. EASY	NO
63 [5]	INSTALL EASY	NO
64 [5]	INSTALL MEDIUM	NO
65 [5]	INSTALL HARD	NO
66 [5]	INSTALL EX. HARD	NO
67	AUTO BURN-IN	NO
68	CLEAR COINS	NO
69	CLEAR AUDITS	NO
70	INSTALL FACTORY	NO

NOTES:

1. Automatic Replay percentage value range is adjustable from 5 to 25%, via the Credit button. Item 02 permits changing the factory setting value for Replay Start Level (valid for next 50 games played). Item 03 permits setting up to four replay levels, with values as detailed in text describing item 03.
   For Fixed Replay Scores set Auto Replay value to 1 less than 5(%) via the Credit button. Go to items 02, 03, 04, and 05; install their replay level scores. Turn off any replay level by setting 00 as its value.
2. Phrase in parentheses is Factory Setting. Phrase appears in player 3 and 4 displays. Press Credit button to change setting of item 22, or the game pricing of item 24.
3. To change country OR coinage setting, press Credit button to obtain 16 Standard settings, followed by a Custom Setting. The Custom Setting activates items 25 through 30. When a Standard Setting is used, items 25 through 30 are set automatically, and cannot be changed.
4. To install Custom Message, press flipper button for alphabet and special characters. Press Credit button for next message letter or character.
5. Special Preset Adjustment, whose effects are noted in the Game Adjustment text.
6. Refer to **Pricing Table** and text describing these items.
7. Approximates Ad 64, yet includes all factors listed in Factory Setting column, not just Ad 31 through 46 and 52 provided by Ad 64.

GAME ADJUSTMENT PROCEDURE

Adjustment Items 01 through 70

The coin door must be open to access the Game Adjustment/Diagnostic switches. All readings and setting changes require operation of these coin door switches. Some setting changes utilize the Credit button; some also use the flipper button(s). *Additional text describing the game adjustment items follows this procedure; the value of the Factory Setting for each Game Adjustment item is in the preceding* ***CYCLONE*** **Game Adjustment Table.**

1. Use AUTO-UP and press ADVANCE. The Id 00 display initially appears. Press ADVANCE until the Player 3 display indicates **Ad 01.** If the factory setting has not changed, the Player 1 and 2 Score displays indicate AUTO REPLAY, and the Player 4 display shows10%, indicating a 10% replay percentage. (The game program adjusts itself automatically, as discussed in the following text concerning the 'details' about Adjustment Item 01.)

2. To reach a higher item number (in the Player 3 display), use AUTO-UP and press ADVANCE. To return to a previous item number, use MANUAL-DOWN and press ADVANCE.

3. With the desired Game Adjustment Item number showing in the Player 3 display, increase the setting value (or select another option) shown in the Player 4 display by using AUTO-UP and pressing the Credit button. Repeat this step for each item, until all changes to the factory settings for the Game Adjustment Items have been made. The preceding Game Adjustment Table consolidates the Factory Settings into one grouping.

   (The same procedure can be used for Audit Items. To zero **Au 01 - 04** (concerning the coin chutes and the total coins), the operator can proceed to item 68, Clear Coins, and press the Credit button to obtain the YES option. The operator then presses the ADVANCE button and notes the "COINS CLEARED" display, which verifies that the entry values for items 01 through 04 of the Audit Items are now reset to zero.)

   For example, the operator may desire to change the degree of game play difficulty from the Factory Setting (equivalent to the Install Medium [Ad 64] difficulty, along with a number of other automatically installed settings, as shown in the right column of the Game Adjustment Table) to another difficulty more suitable for the players at a particular game site. Four other 'automatic' play difficulty settings (Ad 62 - Ad 66) are available, each of which, if selected, installs all the adjustments listed for that difficulty in the Game Adjustment Setting Comparison Table, which follows the 'details' text.

4. To proceed rapidly through the entire adjustments series, press *and hold* ADVANCE, until **Ad 70** shows in the Player 3 display. From item 70, you can: (A) return to the Game-Over Mode; or (B) restore factory settings and zero audit (bookkeeping) totals. Perform either of the following, as desired:

   A. To reach Game-Over Mode, use AUTO-UP and press ADVANCE once. *CYCLONE* now goes to the Game-Over Mode.

   B. To restore the Factory Settings for Game Adjustment Items (as listed in the Game Adjustments Table), zero all audit (bookkeeping) totals, *and* return to Game-Over Mode, use AUTO-UP or MANUAL-DOWN to display Ad 70 in the Player 3 display. Press the Credit button to display the YES option in the Player 4 display. Using AUTO-UP, press ADVANCE once. *CYCLONE* now zeroes ALL Audit Item totals and changes ALL Game Adjustment Items back to those originally selected as Factory Settings. It then shows the operator a message ("FACTORY SETTING") that this has occurred. (A problem in the Memory Protection circuit or closing the coin door will cause the message "ADJUST FAILURE" to appear.) Press ADVANCE once more to return to the Game-Over Mode.

Details of Adjustment Items 01 through 70

01 Auto Replay (or Fixed Replay)
Of the two options, AUTO REPLAY is the percentage of replays automatically awarded per game. The game program aids a pinball's initial installation by causing a comparison of the value of the Replay Level to the value of all players' scores every 50 games for the first 1,000 games. At each comparison, the program increases (or decreases) the Replay Level by an amount necessary to achieve the replay percentage specified either via the factory setting (or later operator selection). (After the first 1,000 games, the comparison occurs after every 500 games. The adjustment value is 100K, for this (and each subsequent) comparison.) Use the Credit button to change the percentage within the range of *5* to *25* (%), with the value increasing using AUTO-UP (or decreasing using MANUAL-DOWN). The next Credit button change below 5%, selects the FIXED REPLAY option.

For AUTO REPLAY, Ad 02 provides the Starting Replay Level (Player 1 and 2 displays show REPLAY START). Ad 03 provides the number of replay levels (01, 02, 03, or 04). *CYCLONE* then proceeds to Ad 06 automatically.

For FIXED REPLAY, Ad 02 is the first replay level (REPLAY LEVEL 1). Ad 03, 04, and 05 are the other replay levels.

02 Starting Replay Level (or Replay Level 1)
For AUTO REPLAY (refer to Ad 01), the initial Factory Setting is listed in the Game Adjustment Table, but this will change when the game compares the players' scores with this adjustment's value during its auto adjustment activity. The range of settings is *800,000* through *4,000,000* (by increments of 100,000 with AUTO-UP or decrements of 100,000 with MANUAL- DOWN).

For FIXED REPLAY, the operator can enter the value to be used for the first fixed replay score level via the Credit button. The range of settings is: *OFF; 100,000* through *9,900,000* (by increments of 100,000 with AUTO-UP, or decrements of 100,000 with MANUAL-DOWN).

03 Replay Levels (or Replay Level 2)
For AUTO REPLAY (refer to Ad 01), this is the number of replay levels in a game. The option range is *one, two, three, or four* replay level(s). When the operator chooses two replay levels, *CYCLONE* automatically adjusts the second replay level to be twice the value selected for Ad 02, the starting replay level. Choosing three or four replay levels automatically adjusts their replay levels to three times or four times the Ad 02 value.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

04 (Replay Level 3)
For AUTO REPLAY, this Adjustment Item is not applicable. *CYCLONE* automatically bypasses this adjustment.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

05 (Replay Level 4)
For AUTO REPLAY, this Adjustment Item is not applicable. *CYCLONE* automatically bypasses this adjustment.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

06 Replay Award
For either AUTO REPLAY or FIXED REPLAY (Ad 01), the operator can select the form of the award automatically provided when the player exceeds any Replay Level (Automatic or Fixed). The choices are:

Credit - Reaching each replay level obtains a credit (free game).
Ball - Reaching each replay level obtains an extra ball.
Audit - Reaching each replay level obtains nothing to the player; it does increase the entry value of the Audit Item(s) maintaining a tally of these awards (Au 08, and Au 20 through 23, as applicable).
Coil - Reaching each replay level causes the Knocker coil to activate once per free game won (instead of awarding a credit for each level exceeded). **NOTE:** A ticket dispenser or token dispenser, if installed, can be activated by the Knocker coil driver to provide an alternative award for each free game achieved by the player.

07 Special Award
The operator can select the form of the award automatically provided when the player scores a Special. The choices are:

Credit - Scoring each Special, when lit, obtains a credit (free game). A variation to this award occurs, when the setting of Ad 06 is Coil. (This permits a ticket or token dispenser to provide the award, when applicable.)
Ball - Scoring each Special, when lit, obtains an extra ball.
Score - Scoring each Special, when lit, obtains a score advance of 100,000 points to the player.

08 Match Award
The operator can select (via the Credit button) the desired percentage for the Match action occurring at the completion of each game. The choices are:

1%-50% - 1% is 'hard'; 50% is 'extremely easy'. During Match action, the game selects a random two-digit number at end of game and compares each player's score for an identical two digits in the rightmost two positions. A matching of the two digits results in the award of a credit (or a ticket/token, if a dispenser is attached, and the setting of Ad 06 is Coil).
Off - The MATCH display does not operate at completion of the game; no award is given.

09 Balls / Game
The operator can define a "game" by specifying the number of balls to be played. The range of this setting is *1* through *9.*

10 Tilt Warning
The operator can specify the number of total actuations of the plumb bob and playfield tilt mechanisms that can occur before the game is "tilted". The range of this setting is *1* through *5.*

11 Extra Ball/Ball In Play
The operator can choose (via the Credit button) the number of Extra Balls to be awarded to a player. The range of this setting is:

11 Extra Ball/Ball In Play (Continued)

00 - NO extra ball play; displays a message, NO EX. BALL. A score is awarded in lieu of the Extra Ball.

1 -9 E. B./Ball - 1 through 9 Extra Balls per ball (i.e., all balls including Extra Balls) are awarded.

1-9 E. B./B.I. P. - 1 through 9 Extra Balls per Ball In Play (B. I. P.) (i.e., all balls NOT including Extra Balls) are awarded.

1-9 E. B./Game - 1 through 9 Extra Balls per game.

12 Maximum Credits

The operator can specify the maximum number of credits the game can accumulate, either through game play awards or coin purchases. The range of settings is *5* through *99.* Reaching the specified setting prevents the award of additional credits by game play. Coin purchases do continue to accumulate and are displayed.

NOTE

Whenever the number of credits is less than the specified maximum credits, any credits obtained by coin purchase or game awards (High Score, Match, Replay Levels, etc.) will be accumulated even though they exceed the maximum value. Thereafter, no additional credits can be accumulated, until the credit total is reduced below the specified maximum setting.

13 Highest Scores

The operator can specify (via the Credit button) whether the game is to maintain a record of the four highest scores achieved to date. The choices are:

Off - NO high scores are recorded.

On - The four highest scores are stored in memory for use by Game Adjustment 22.

Auto - The four highest scores are stored in memory for use in a game program subroutine associated with Game Adjustment 22.

14 Backup High Score 1

The operator can set the Backup High Score value in the Player 1 Score display, using the Credit button. The game automatically restores this value, when the operator presses, and holds, the HIGH SCORE RESET switch, or when an automatic High Score Reset event (Ad 22) occurs.

15 Backup High Score 2

This adjustment is similar to Ad 14, except that this applies to the Player 2 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.

16 Backup High Score 3

This adjustment is similar to Ad 14, except that this applies to the Player 3 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.

17 Backup High Score 4

This adjustment is similar to Ad 14, except that this applies to the Player 4 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.

18 Credits for Highest Score 1
The operator can select the number of credits to be awarded, by using the Credit button, whenever a player exceeds the previous Highest Score. The range of this setting is *00* through *10.* A variation to this award occurs, when the setting of Ad 06 is Coil. (This permits a ticket or token dispenser to provide the award, when applicable.)

19 Credits for Highest Score 2
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the second highest score. The Credit button adjustment technique is the same as for Ad 18. The range of this setting is *00* through *03.*

20 Credits for Highest Score 3
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the third highest score. The Credit button adjustment technique is the same as for Ad 18. The range of this setting is *00* through *03.*

21 Credits for Highest Score 4
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the fourth highest score. The Credit button adjustment technique is the same as for Ad 18. The range of this setting is *00* through *03.*

22 Automatic High Score Reset
The operator can specify (via Credit button) that the game will provide an automatic reset of the displayed "Highest Scores", and the number of games to be played before the reset occurs. (Audit item 39 displays the games remaining before the reset.) The values provided upon reset are those selected by the operator in Ad 14 through 17, the Backup High Scores. The range of this setting is *Off* (to disable this adjustment), and *1,000* to *24,750* games (in increments of 250).

23 Free Play
The operator can select (via the Credit button) whether a player can operate the game without a coin (free play) or with a coin. The choices are:

No - A coin is necessary for game play.
Yes - Game play is free; no coin is required.

24 Coinage Selections
The operator can specify (via the Credit button) any of the 16 Standard Settings for game pricing, each of which exhibits a message identifying the country and the number of coins required and the number of games that the coin requirement purchases. Choosing a Standard Setting permits the game to omit items Ad 25 through 30, which are adjustments allowing for a special custom coinage setting.

Following the last Standard Setting is a Custom Coinage Setting, which allows the operator to utilize Ad 25 through 30 in establishing a special coinage setting. A message, CUSTOM COINAGE, indicates that the operator can enter the appropriate values into the Ad 25 through 30 adjustment items.

The values for Ad 25 through 30 of each Standard Setting, as well as other possible values for the Custom Coinage Setting are shown in the **Pricing Table.**

25 Left Chute Coin Units
The operator can specify (via the Credit button) the number of coin units purchased by a coin passing through the left coin chute.

26 Center Chute Coin Units
The operator can specify (via the Credit button) the number of coin units purchased by a coin passing through the center coin chute.

27 Right Chute Coin Units
The operator can specify (via the Credit button) the number of coin units purchased by a coin passing through the right coin chute.

28 Units Required for Credit
The operator can define (via the Credit button) the number of coin units required to obtain 1 Credit. A coin unit counter in the game program totals the number of coin units purchased through all coin chutes prior to each game. If the total number of coin units purchased exceeds the 1 Credit factor by a multiple (or more, coin units) of the specified Units per Credit value, the Credits display shows the proper number of Credits. The coin unit counter retains any remaining coin units, until the start of a game; then, the coin unit counter is cleared (its contents are zeroed).

29 Units Required for Bonus
The operator can specify (via the Credit button) that 1 additional Credit is to be indicated in the Credits display, when a certain number of coin units are accumulated.

30 Minimum Units Required for any Credits Posted
The operator can specify that NO Credits are to be posted (indicated in the Credits display), until the credit units counter reaches a particular value.

31 COMET Timer
The operator can choose (via the Credit button) the time period for display of the COMET Score lamps (20K, 40K, ...100K). The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal). Note that, when the time period elapses and either the 80K, 100K, or 'Lites 1 Million' lamp is blinking, all lamps go off. If either the 20K, 40K, or 60K lamp is blinking when the time elapses, the 40K lamp remains lit.

32 Double Scores Timer
The operator can choose (via the Credit button) the time period for the Double Scores feature, which begins upon completion of the 1 - 2 - 3 "Gate" Lanes. During Double Scores, all playfield scoring, except the Ferris Wheel Bonus, 'Gate Bonus', and Shuttle Bonus, is double the usual scoring. The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal).

33 Spook House Timer
The operator can choose (via the Credit button) the time period for display of the Spook House lamp, which controls how often a player spins the Mystery Wheel for scores, Zilch, Extra Ball, or Special. (Extra Ball and Special awards are related to the settings of Adjustments 43 through 46. The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal).

34 Advance X (Bonus Multiplier) Timer
The operator can choose (via the Credit button) the time period for display of each of the lighted Bonus Multipliers (2X - 7X). This adjustment mostly affects scoring, but it also affects the 'flashing Special' lamp. (Special awards are related to the settings of Adjustments 45 and 46. The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal).

GAME ADJUSTMENT PROCEDURE (Continued)

35 CYCLONE Timer
The operator can choose (via the Credit button) the time period for display of each of the lighted Cyclone Score lamps (50K, 100K, 'Gate Bonus'). The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal). Note that, when the time period elapses and the 'Gate Bonus' lamp is blinking, all lamps go off. If the 50K or 100K lamp is blinking when the time elapses, only the 50K lamp remains lit.

36 Ferris Wheel Timer
The operator can choose (via the Credit button) the time period for display of the lighted Ferris Wheel Bonus lamp. (The value of each player's Ferris Wheel Bonus increases with Jet Bumper play.) The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal).

37 Million Timer
The operator can choose (via the Credit button) the time period for display of the lighted 1 Million lamp (on the Cyclone, but lighted by COMET play). The range of this setting is *01 second* (Conservative) through *99 seconds* (Liberal), or *Off* (Extremely Liberal).

38 CYCLONE Memory
The operator can choose (via the Credit button) whether the lighted Cyclone Score lamp (50K, 100K, 'Gate Bonus') is stored in memory for 'next ball' play (continues from ball to ball) or is reset at Game Start or at Ball Start. The choices are:

Ball St. (start) Lit - (Liberal) Lamp is turned on at ball start.
Memory Lit - Lamp is turned on at Game Start (stored in memory).
Memory Unlit - Lamp is turned off at Game Start (stored in memory).
No Mem. Lit - Lamp is turned on at Game Start (not stored in memory).
No Mem. Unlit - (Conservative) Lamp is turned off at Game Start (not stored in memory).

39 CYCLONE Memory
The operator can choose (via the Credit button) whether the lighted Comet Score lamp (20K... 100K, 1 Million) is stored in memory for 'next ball' play (continues from ball to ball) or is reset at Game Start or atBall Start. The choices are:

Ball St. (start) Lit - (Liberal) Lamp is turned on at ball start.
Memory Lit - Lamp is turned on at Game Start (stored in memory).
Memory Unlit - Lamp is turned off at Game Start (stored in memory).
No Mem. Lit - Lamp is turned on at Game Start (not stored in memory).
No Mem. Unlit - (Conservative) Lamp is turned off at Game Start (not stored in memory).

40 Million in ___ Shots
The operator can choose (via the Credit button) how many consecutive shots up the Comet Ramp are necessary to obtain the 1 Million score *for the 1st time.* (After the first 1 Million shot, six consecutive Comet Ramp shots are necessary for each subsequent1 Million award.) The range of this setting is 3 (Liberal) to 6 (Conservative). Note that the setting of this Adjustment can affect the Replay Level value, if too Liberal a setting is selected, allowing high scores.

41 Ferris Wheel Bonus Advancement
The operator can choose (via the Credit button) the point value for Jet Bumper play (directly increasing the value of each player's Ferris Wheel Bonus). The range of this setting is 100 (Conservative) to 9900 (Liberal), by increments of 100. **NOTE:** Each player affects only his individual Ferris Wheel Bonus, which starts at 50K and builds to a maximum of 500K.

42 'Gate Bonus' Advancement

The operator can choose (via the Credit button) the point value for completing each set of 1-2-3 "Gate" Lanes. The 'Gate Bonus' starts at 500K and builds to a maximum of 4 Million (backglass lamps display the value). The range of this setting is 1,000 (Conservative) to 99,000 (Liberal), by increments of 1000. Note that the setting of this Adjustment can affect the Replay Level value (if too Liberal a setting is selected) allowing high scores.

43 Extra Ball Auto Adjustment

The operator can choose (via the Credit button) the percentage value for *ALL* Extra Balls. The range of this automatic adjustment setting is *Enabled 1%* (Hard) through *99%* (Extremely easy); it can also be turned off (disabled), via a setting of *Off.* When the automatic adjustment is turned on (enabled), the game program adjusts the setting, at the end of a game, after 50 games, except when the current value is within 2% of the setting. Then, no auto adjustment occurs.

44 Ducks Extra Ball

The operator can choose (via the Credit button) the degree of difficulty for lighting the Extra Ball lamp (left and right Return lanes) via the 3 Duck Targets; that is, how many times the player must hit all three Duck Targets. The range of this setting is *3 Sets of completions of all 3 Duck Targets* (Liberal) through *5 Sets of completions of all 3 Duck Targets* (Conservative). Note that, if Adjustment 43 (Extra Ball Auto Adjustment) is Enabled, it can change the setting within the range of 3 Sets to 5 Sets.

45 SPECIAL Auto Adjustment

The operator can choose (via the Credit button) the percentage value for all Specials per game. The range of this automatic adjustment setting is *Enabled 1%* (Hard) through *99%* (Extremely easy); it can also be turned off (disabled), via a setting of *Off.* When the automatic adjustment is turned on (enabled), the game program adjusts the setting, at the end of a game, after 50 games, except when the current value is within 2% of the setting. Then, no auto adjustment occurs.

46 SPECIAL ___X

The operator can choose (via the Credit button) the point at which the Bonus Multiplier turns on the Special lamp. The range of choices is *2X* through *7X.* Note that, if Adjustment 45 (Auto Adjustment) is Enabled, this Auto Adjustment has a range from 3X through 7X.

47 Consolation Time

The operator can choose (via the Credit button) the minimum game time below which a form of 'Consolation' becomes effective. This compensates for less skilled players to encourage them to continue playing the game. (Less skilled players are those whose game time is less than the selected setting, and who did not get a Special, an Extra Ball, or other type of 'specialty' shot. For these players, the game program lights the left Outlane Extra Ball lamp, to give them an additional chance to increase their score, but they must drain through that lane to obtain this assistance.) The range of this setting is *1 second* (Very Conservative) through *99 seconds* (Very Liberal), or *Off.*

48 Attract Mode Sounds

The operator can select (via the Credit button) the amount of sounds occurring during the Attract Mode. The choices are:

ALOT - Sounds occur for approximately 8 minutes during the Attract Mode sequence.
LESS - Sounds occur for approximately 2 mintues during only the Attract Mode.
NONE - No sounds occur during the Attract Mode.

49 Custom Message

The operator can choose (via the Credit button) whether to display a message during the Attract Mode. (When display of a message is selected, the operator can either utilize the message provided or change the message.) Three choices are available:

1 - Display a message during the Attract Mode. The Player 4 display shows this choice as ON. The 3-line message provided is:

TAKE A CHANCE ... AND RIDE ... THE CYCLONE

2 - Do NOT display a message during the Attract Mode. (Player 4 shows OFF.)

3 - The Player 4 display shows this choice as CHANGE. The operator can enter a special ("custom") message, as follows:

A. Press ADVANCE once. The operator can now enter as many as three 14-character lines for display during the Attract Mode.

B. Use the flipper button(s) to select each message character (alphabet, numbers, and special symbols are available). In case of error, enter a "back arrow" (just before "space") to correct, followed by correct character. For a period after any letter, use letters with periods (following the special symbols). The entire character set is the following:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 0 1 2 3 4 5 6 7 8 9 < > ? - / * '
A. B. C. D. E. F. G. H. I. J. K. L. M. N. O. P. Q. R. S. T. U. V. W. X. Y. Z. _

C. Move to the next character via the Credit button. No entirely blank lines will be displayed.

50 SW. ALARM KNOCKER

The operator can choose (via the Credit button) whether the knocker operates, sounding an alarm to signal a switch problem, at the time of game Turn-On and at the beginning of the Test/Diagnostic Procedures. Two choices are available:

YES - The knocker sounds, signalling a switch problem, at game Turn-On and at the beginning of the Test/Diagnostic Procedures.

NO - The knocker does NOT sound. (Player 4 shows NO.)

51 ENGLISH TEXT

The operator can choose to display the message, audit, adjustment, and Test /Diagnostic information in English or German (Deutsch) via the Credit button.

52 Bonus Multiplier Memory

The operator can choose (via the Credit button) whether the lighted Cyclone Bonus Multiplier Lamps (2X ... 7X) are stored in memory for 'next ball' play (continues from ball to ball) or are reset at Ball Start. The choices are:

Yes - (Liberal) Lighted lamps are stored for 'next ball' play.

No - Lighted lamps are not stored and are turned off at each Ball Start.

GAME ADJUSTMENT PROCEDURE (Continued)

SPECIAL PRESET ADJUSTMENTS CAUTION

Adjustments 53 through 66 are Special Preset Adjustments to enable the operator to perform the setting of multiple adjustments at once. They permit the operator to: (1) modify a game for a specific area (special German coinage settings, for example, Ad 53 through 58); (2) change a group of adjustments to conform with laws of certain localities (Ad 59 through 61); and (3) to change the degree of difficulty of game play (Ad 62 through 66). A list of the preceding individual Adjustments affected accompanies each of these Special Preset Adjustments. Whenever the operator chooses to use any Special Preset Adjustment, the operator can later access any or all of the individual Adjustments affected by that Special Adjustment for subsequent changes.

A similar technique is recommended in the event of error or uncertainty concerning any Special Preset Adjustment, after the operator selects it: The operator can restore the factory setting of each individual Adjustment, then select the desired Special Preset Adjustment, and then return to any of the preceding individual adjustments to determine whether use of the Special Adjustment has had the desired effect.

The Backbox displays for each Special Preset Adjustment indicate whether the operator has selected it, by identifying the Adjustment in the Player 1 and 2 displays by name and the selection choice of NO, meaning Not Selected (this is the Factory Setting), or YES, meaning Selected, in the Player 4 display. Operator installation of the 'selected' Preset Adjustment occurs by using the Credit button to choose YES and then pressing the ADVANCE switch. The displays then show the name of the Adjustment again, with DONE to show that the installation is now in effect.

Note that, when an operator installs any of the Special Preset Adjustments, Adjustment Items using the automatic adjust feature of the game program reset to the auto adjust value listed for that Adjustment Item.

NOTE

Games in which the CPU jumper W7 is cut ("German games") automatically have certain Adjustment Items preset:

Ad	Name	New Setting	Ad	Name	New Setting
01	Auto Replay	15 (%)	18	Hi Scr 1 Credits	03
02	Replay Start	2,500,000	19	Hi Scr 2 Credits	00
03	Replay Level 2	03	20	Hi Scr 3 Credits	00
12	Maximum Credits	30	21	Hi Scr 4 Credits	00
14	Backup Hi Scr 1	5,500,000	22	Hi Scr Reset	750 games
15	Backup Hi Scr 2	5,000,000	24	German 2 Coinage	7 Plays/5DM
16	Backup Hi Scr 3	4,500,000	47	Consol. Time	60 sec
17	Backup Hi Scr 4	4,000,000	51	Deutsch Text	Deutsch

53 Install German 1

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Credit Award play with 10 games for 5 DM. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Credit	17	Backup Hi Scr 4	4,000,000
07	Special Award	Credit	18	Hi Scr 1 Credits	03
08	Match Feature	10 %	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	5,500,000	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	5,000,000	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	4,500,000	24	German 1 Coinage	10 Plays/5DM

54 Install German 2

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Ticket/Token operation with 10 games for 5 DM. Individual Adjustments are affected, as follows:

54 Install German 2 (Continued)

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Coil	17	Backup Hi Scr 4	4,000,000
07	Special Award	Ball	18	Hi Scr 1 Credits	03
08	Match Feature	10 %	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	5,500,000	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	5,000,000	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	4,500,000	24	German 1 Coinage	10 Plays/5DM

55 Install German 3

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Keyset Mode operation with 10 games for 5 DM. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Audit	17	Backup Hi Scr 4	00
07	Special Award	Score	18	Hi Scr 1 Credits	00
08	Match Feature	Off	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	00	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	00	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	00	24	German 1 Coinage	10 Plays/5DM

56 Install German 4

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Credit Award play with 7 games for 5 DM. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Credit	17	Backup Hi Scr 4	4,000,000
07	Special Award	Credit	18	Hi Scr 1 Credits	03
08	Match Feature	10 %	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	5,500,000	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	5,000,000	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	4,500,000	24	German 2 Coinage	7 Plays/5DM

57 Install German 5

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Ticket/Token operation with 7 games for 5 DM. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Coil	17	Backup Hi Scr 4	4,000,000
07	Special Award	Ball	18	Hi Scr 1 Credits	03
08	Match Feature	10 %	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	5,500,000	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	5,000,000	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	4,500,000	24	German 2 Coinage	7 Plays/5DM

58 Install German 6

The operator can modify the game pricing selection of Standard Setting 09 in the **Pricing Table** to permit Keyset Mode operation with 7 games for 5 DM. Individual Adjustments are affected, as follows:

58 Install German 6 (Continued)

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Audit	17	Backup Hi Scr 4	00
07	Special Award	Score	18	Hi Scr 1 Credits	00
08	Match Feature	Off	19	Hi Scr 2 Credits	00
14	Backup Hi Scr 1	00	20	Hi Scr 3 Credits	00
15	Backup Hi Scr 2	00	21	Hi Scr 4 Credits	00
16	Backup Hi Scr 3	00	24	German 2 Coinage	7 Plays/5DM

59 Install Add-A-Ball

The operator can utilize this option to delete all Free Play awards and replace them with Extra Ball awards. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Ball	18	Hi Scr 1 Credits	00
07	Special Award	Ball	19	Hi Scr 2 Credits	00
08	Match Feature	Off	20	Hi Scr 3 Credits	00
			21	Hi Scr 4 Credits	00

60 Install 5 Ball

The operator can change the game to 5-Ball play, including the changing of certain features to the recommended 5-Ball play difficulty level. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
02	Replay Start	3,000,000	09	Balls / Game	05

61 Install Novelty

The operator can remove all Free Play and Extra Ball awards. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
01	Fixed Replay	SCORES	07	Special Award	Score
02	Replay Level 1	Off	08	Match Feature	Off
03	Replay Level 2	Off	11	No Extra Ball	00
04	Replay Level 3	Off	18	Hi Scr 1 Credits	00
05	Replay Level 4	Off	19	Hi Scr 2 Credits	00
06	Replay Award	Audit	20	Hi Scr 3 Credits	00
			21	Hi Scr 4 Credits	00

62 Install Extra Easy

The operator can change the game play difficulty adjustments to a combination that is extremely easy (sometines called "liberal"). The Game Adjustment Setting Comparison Table, which follows these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Extra Easy' group.

63 Install Easy

The operator can change the game play difficulty adjustments to a combination that is slightly easier than the Factory Settings. The Game Adjustment Setting Comparison Table, which follows these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Easy' group.

64 Install Medium

The operator can change the game play difficulty adjustments to a combination that matches the Factory Settings. The Game Adjustment Setting Comparison Table, which follows these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Medium' group.

65 Install Hard

The operator can change the game play difficulty adjustments to a combination that is more difficult than the Factory Settings. The Game Adjustment Setting Comparison Table, which follows these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Hard' group.

66 Install Extra Hard

The operator can change the game play difficulty adjustments to a combination that is much more difficult than the Factory Settings. The Game Adjustment Setting Comparison Table, which follows these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Extra Hard' group.

67 Auto Burn-in

The operator can choose the YES option for this Special Preset Adjustment to perform certain automatic testing of the game, as used in the factory. It does not affect the game operation, but merely provides for a cyclic testing of most of the game's mechanisms.

68 Clear Coins

The operator can request the clearing of the coinage audits (Au 01 through 04) by selecting (via the Credit button) the YES option, as shown in the player 4 display. This adjustment zeroes the counters tallying the number of coins through each slot, the Paid Credits counter, and the Credits display.

After the YES option is displayed, the operator must press the ADVANCE button. The game then displays DONE to show that the coinage audits have been reset to zero.

69 Clear Audits

The operator can request the clearing of the non-coinage audits (Au 05 through 38) by selecting (via the Credit button) the YES option, as shown in the player 4 display. This Adjustment zeroes the counters tallying the remaining Audit factors. Please note that this does NOT affect the Automatic Replay Percentaging data nor the automatic High Score Reset counter.

After the YES option is displayed, the operator must press the ADVANCE button. The game then displays DONE to show that the non-coinage audits have been reset to zero.

70 Install Factory

The operator can request the game (via the Credit button) to provide the normal Factory Settings, essentially restoring the game to its 'factory condition'. The operator must select the 'YES' option for this adjustment. This Adjustment clears all Audits, resets all Game Adjustments to the respective Factory Settings, and provides a restart of the Auto Replay (Ad 01). After selecting the YES option, the operator must press the ADVANCE button. The game then displays FACTORY SETTING.

Closing of the coin door before appearance of the FACTORY SETTING message or a problem in the Memory Protect circuit will cause the game to display ADJUST FAILURE.

A loss of battery power or improper treatment of the Game Adjustments will cause the game to attempt to restore Factory Settings. The game announces the results of this reset process with the appropriate message, FACTORY SETTING or ADJUST FAILURE.

CYCLONE Game Adjustment Setting Comparison Table

Adj #	Adj Description	Extra Easy Ad 62	Easy Ad 63	Medium (Factory) Ad 64	Hard Ad 65	Extra Hard Ad 66
31	COMET Timer	20 sec	20 sec	20 sec	15 sec	15 sec
32	Dbl Score Timer	20 sec	20 sec	20 sec	15 sec	10 sec
33	Spookhouse Timer	20 sec	20 sec	15 sec	10 sec	10 sec
34	Adv. X Timer	Off	Off	Off	20 sec	15 sec
35	CYCLONE Timer	15 sec	20 sec	15 sec	10 sec	10 sec
36	Ferris Wheel Timer	Off	20 sec	15 sec	15 sec	15 sec
37	Million Timer	20 sec	15 sec	10 sec	10 sec	10 sec
38	CYCLONE Memory	Ball St. Lit	Mem Lit	Mem Lit	Mem Unlit	No Mem Unlit
39	COMET Memory	Mem Lit	Mem Lit	Mem Lit	Mem Unlit	No Mem Unlit
40	Million _ Shots	4 Shots	4 Shots	5 Shots	6 Shots	6 Shots
41	Ferris Bon. Adv.	5K	5K	3K	3K	2K
42	Gate Bon. Adv.	10K	10K	5K	3K	2K
43	Ex. Ball Auto Ad.	33%	33%	33%	25%	25%
44	Ducks Ex. Ball	3 Sets	3 Sets	3 Sets	4 Sets	4 Sets
45	Special Auto Ad.	5%	5%	5%	4%	3%
46	Special ___X	4X	4X	5X	5X	5X
52	Bonus Mult. Memory	Yes	Yes	Yes	No	No

RESETTING THE HIGH SCORES

The challenge of exceeding the High Score (either the factory setting or a higher score by another player) is the goal of many pinball game players. To keep a pinball game challenging requires a method of resetting the High Score value for those occasions when a skilled player registers a truly excellent score. Other players note this score and may decide not to play simply because their skill is not adequate to exceed an extremely high score.

For *CYCLONE*, in fact, three methods of resetting the High Score values are available. The simplest method involves allowing Game Adjustment Item Ad 22 to reset the High Score values automatically after the specified number of plays designated by the operator. The second method requires pressing the High Score Reset switch on the inside of the coin door in the Attract Mode. This action simply erases the previous high score values and replaces them with the Backup High Score values. The third method establishes new values replacing the factory setting values or previous operator setting values; it requires performing the following steps:

1. Using AUTO-UP or MANUAL-DOWN, reach item Ad 14 (and items Ad 15, 16, and 17, if desired). The High Score value of the factory setting (or previous operator-adjusted setting) appears in the Player 1 display. If this value is satisfactory, go to step 4 below.

2. If you wish to increase the High Score value from that displayed in the Player 1 display, use AUTO-UP, and press the Credit button, until the desired value shows in the Player 1 display.

3. If you wish to decrease the High Score value, use MANUAL-DOWN, and press the Credit button, until the desired value shows in the Player 1 display.

4. Using AUTO-UP, press and hold down ADVANCE, until the Player 3 display shows **Ad 70** Press ADVANCE once, to return to Game- Over Mode.

5. Press the High Score Reset switch (on coin door), and listen for the sound signifying that the score reset action is complete. Observe player score displays (Player 1, Player 2, etc.) to verify that the new High Score values are displayed.

GAME PRICING

PRICING MADE EASY. Game Adjustment Item Ad 24 allows the operator an easy method of setting the pricing functions. Pressing the Credit button allows the operator a choice of one of the 16 "Standard" Settings, with associated automatic pricing (Player 1 and 2 displays show the Country identifier, with a number for a country having more than one "Standard" Setting; player 3 and 4 displays show the games per coin(s) information). In the ***Pricing Table***, each "Standard" Setting is denoted by a 2-digit number (other than 00) in column 24. Automatic Pricing causes each of the other pricing items (columns 25 through 30) to change to the value shown in the table for that selected "Standard" Setting.

CUSTOM PRICING. Adjustment Item 24 must be set to the Custom Coinage Setting (player 1 and 2 displaying CUSTOM COINAGE) to enable the operator to enter desired custom pricing selections for Items 25 through 30, based on the ***Pricing Table.*** Item 25 is the left coin chute multiplier. Item 26 is the center coin chute multiplier. Item 27 is the right coin chute multiplier. Item 28 is the number of coin units equal to one Credit. (A Credit is usually equal to one game.)

The calculation of the ratio of Games : Price uses the ratio equation of X : VC , where:

X = Coin Chute Multiplier (Item 25, 26, or 27 in ***Pricing Table***);
V = Value of coin;
C = Coin units eqivalent to one Credit (Item 28).

For example, for 25¢ chutes at the factory setting, substituting values in the Games : Price ratio calculation gives 1 : 25 x 1, or one game for 25¢.

UNITS REQUIRED FOR BONUS CREDIT. Item 29 is the number of coin units that must pass through the coin chute(s) before an additional Credit (game) is posted (displayed). At the factory setting, the number in this item is 00. (This 00 means that NO bonus credit (free game) is awarded, although purchase of more than one game at a time occurs.)

GAME PRICING (Continued)

MINIMUM COIN UNITS. Item 30 determines the number of coin units that must pass through the coin chute(s) before play may begin. The factory setting for this item is 00. (This 00 means that the Minimum Coin Units feature (Item 30) is disabled, by the factory setting.)

CYCLONE Pricing Table

Country	Coin Chute Left	Coin Chute Center	Coin Chute Right	Games/Coin	*Ad 24 Display*	Pricing Functions 25	26	27	28	29	30
USA and Canada	25¢	-	25¢	1/25¢, 4/$1 [1,2]	U.S.A. 1	01	04	01	01	00	00
				1/50¢, 2/75¢, 3/$1 [2]	U.S.A. 2	03	12	03	04	00	00
				1/50¢, 2/$1 [2]	U.S.A. 3	01	04	01	02	00	00
				1/25¢, 3/50¢, 6/$1	CUSTOM	01	04	01	01	02	00
				1/25¢, 5/$1	CUSTOM	01	00	01	01	04	00
West Germany	1 DM	2 DM	5 DM	1/1 DM, 2/2 DM, 7/5 DMark [2,3]	GERMAN2	06	12	30	05	30	00
				1/1 DM, 3/2 DM, 10/5 DM [2]	GERMAN1	09	18	45	05	45	00
				1/1 DM, 3/2 DM, 9/5 DM	CUSTOM	09	18	45	05	00	00
				1/2x1 DM, 1/2 DM, 3/5 DM	CUSTOM	03	06	15	05	00	00
				2/1 DM, 5/2 DM, 14/5 DM	CUSTOM	13	26	65	05	65	00
				Ticket/Token Mode [4]	CUSTOM						
				Keyset Mode [4]	CUSTOM						
France	1 F	5 F	10 F	1/3x1 F, 2/5 F, 5/10 Franc [2]	FRANCE	02	10	20	05	20	00
Antilles (Netherlands)	25¢	-	1 G	1/25¢, 4/1 Guilder	CUSTOM	01	01	04	01	00	00
Netherlands	1 Hfl	2.5 Hfl	2.5 Hfl	1/1 Hfl, 3/2.5 Hfl [2]	NETHERL.	06	15	15	05	00	00
	25¢	-	1 G	1/25¢, 5/1 Guilder	CUSTOM	01	00	05	01	00	00
Belgium	20 F	20 F	20 F	3/20 F [2]	BELGIUM	03	12	12	12	04	00
	5 F	-	20 F	1/2x5 F, 2/20 Franc	CUSTOM	01	01	04	02	00	00
	5 F	20 F	20 F	1/2x5 F, 2/20 F, 2/20 F	CUSTOM	01	04	04	02	00	00
	5 F	5 F	20 F	1/2X5 F, 1/2X5 F, 2/20 F	CUSTOM	01	01	04	02	00	00
Spain	25 P	-	100P	1/25 P, 5/100 Peseta [2]	SPAIN	01	00	05	01	00	00
Switzerland	1 F	-	2 F	1/1 F, 3/2 F [2]	SWISS	03	00	06	02	00	00
	1 F	2 F	5 F	1/1 F, 3/2 F, 7/5 Franc	CUSTOM	02	06	14	02	00	00
Japan	-	100 ¥	-	2/100 ¥ [2]	JAPAN	01	04	01	02	00	00
	100 ¥	-	100 ¥	2/100 Yen	CUSTOM	04	00	04	02	00	00
Italy	500 L	-	500 L	1/500 Lire [2]	ITALY	01	04	01	01	00	00
Australia	20¢	-	$1	1/2x20 ¢, 3/$1 [2]	AUSTRAL.	01	00	06	02	00	00
United Kingdom	10 P	50 P	10 P	1/10 P, 5/50 P [2]	U.K.	01	05	01	01	00	00
	10 P	50 P	20 P	1/10 P, 5/50 P, 2/20 Pence	CUSTOM	01	05	02	01	00	00
Argentina	10¢	10¢	10¢	1/1 Token	CUSTOM	01	01	01	01	00	00
Austria	5 Sch	10 Sch	10 Sch	1/2x5 Sch, 3/2x10 Sch [2]	AUSTRIA	01	02	02	02	04	00
	5 Sch	-	10 Sch	2/5 Sch, 5/10 Schilling	CUSTOM	02	00	05	01	00	00
	1 Sch	5 Sch	10 Sch	2/5x1 Sch, 2/5 Sch, 5/10 Sch	CUSTOM	02	10	25	05	00	00
Chile	Token	-	Token	1/1 Token [1,2]	U.S.A. 1	01	04	01	01	00	00
Denmark	1 Kr	5 Kr	10 Kr	1/2x1 Kr, 3/5 Kr, 7/10 Krone	CUSTOM	01	06	14	02	00	00
Finland	1 Mka	-	1 Mka	1/1 Markka [1,2]	U.S.A. 1	01	04	01	01	00	00
New Zealand	20¢	-	20¢	1/2x20¢ [2]	U.S.A. 3	01	04	01	02	00	00
Norway	1 Kr	-	1 Kr	1/2x1 Kr, 3/5x1 Krone	CUSTOM	01	00	01	02	05	00
Sweden	1 Kr	5 Kr	5 Kr	1/3x1 Kr, 2/5 Krona [2]	SWEDEN	02	10	10	05	00	00
	1 Kr	-	1 Kr	1/2x1 Krona [2]	U.S.A. 1	01	04	01	02	00	00

Notes: 1. Factory Default. 2. Standard Setting - Change by pressing Credit button. 3. Default with jumper W7 cut/removed.
4. Other functions are also affected; see the explanations for Adjustment Items 53 through 58.

TEST/DIAGNOSTIC PROCEDURES

WILLIAMS ELECTRONICS GAMES provides a series of diagnostic tests to aid the operator in determining game condition (that is, whether the game's features and highlights are operating satisfactorily). These tests activate virtually all the electronic and electromechanical devices comprising the game, so that the operator can readily locate a malfunctioning device or simply verify that all devices are working properly. In order, these tests deal with the music, the displays, the game sounds, the lamps, the solenoids, and the switches.

In addition to the diagnostic testing, a feature called the Auto Burn-in Mode is available. Activating this mode enables the operator to observe the game while all of the diagnostic tests, *except the switch test,* occur. This can be very helpful in locating 'intermittent'problems.

Activating either the entire test series or one of the individual tests requires use of the Game Adjustment/ Diagnostic switches. Open the coin door for access to these switches. To proceed to the Diagnostic Tests, the operator must simply switch the game On, set the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN, and press the ADVANCE button.

CAUTION

BIG GUN's System-11B game program greatly aids the operator and service personnel: At the beginning of the Test/Diagnostic Procedures (and also at game Turn-On), the Player 1 display now signals, with a decimal point by the rightmost character, that a switch has *NOT* been actuated during ball play for a lengthy period of time (120 balls, or ≈40 games). However, for the Switch Problem Reporting activity at the beginning of the Test/ Diagnostic Procedures, the display of problem switches is *not* limited to just three switches; it now includes *ALL* switches exhibiting problems. Refer to the text on Switch Tests for additional information. To proceed with the Test/Diagnostic Procedures, use AUTO-UP, and press ADVANCE.

MUSIC TEST.

1. In the Music Test, observe that the player 1 and 2 displays show the message, MUSIC TEST. Switching to AUTO-UP, observe that the message now reads MUSIC OFF, and that the player 3 score display shows 00 00. Press the Credit button to select the desired music selection: 01 - 'Main Theme' through 06 - 'Hi. Score Theme' (the selections repeat). Adjust the volume control for proper sound level for the game location.

2. Use the AUTO-UP position.

DISPLAY TEST.

1. To initiate the Display Test, press ADVANCE. Observe that player 1 and 2 displays briefly show the message, DISPLAY TEST, and that the player 3 score display shows 01 (the Display Test identifier).

2. Use AUTO-UP. Observe that all displays begin a display cycle of all 0s through all 9s, one digit at a time. Verify that the proper comma segments light during display of the odd-numbered digits. Next, a special "all segments" character 'walks' from left to right across each player score display.

3. To halt the display cycle, use MANUAL-DOWN. Then, press ADVANCE to step through the sequential digit display, digit by digit, and the subsequent "all segments" characters display test. Use AUTO-UP to resume cycling, and to proceed to the next test.

SOUND TEST.

1. (From Display Test) To initiate the Sound Test, press ADVANCE. Observe that the player 1 and 2 displays show the message, SOUND TEST, and that the player 3 display shows 02 (the Sound Test identifier). The player 3 display shows a series of test steps from 00 through 07. Verify that a different sound is heard each time the number in the display changes.

2. To repeatedly pulse a single sound, use MANUAL-DOWN. Verify that one particular sound repeats. Press ADVANCE to step to the next sound, which repeats until ADVANCE is pressed again. Use AUTO-UP to resume cycling the sounds, and to proceed to the next test.

LAMP TESTS.

1. **All Lamps.**
   (From Sound Test) To initiate the first Lamps Test, press ADVANCE. Observe that the Player 1 and 2 displays show the message, ALL LAMPS, and that the Player 3 display shows 03 (All LampsTest identifier) and that all feature lamps (playfield and backbox) blink on and off. (Note, however, that the General Illumination lamps remain lighted steadily.) To locate the wiring associated with a particular feature lamp, refer to the **Lamp-Matrix Table.** CPU Board connections at jacks 1J6 (columns) and 1J7 (rows) are also listed in the table.

2. **Single Lamps.**
   From the All Lamps test, using AUTO-UP, press ADVANCE to initiate the Single Lamps Test. The Player 1 and 2 displays initially show the message, SINGLE LAMPS, and the Player 3 display shows 04. Then, the Player 3 display shows 04 01, and the Player 1 and 2 displays change to show HOLD, the name of the lamp currently blinking. Press the Credit button to proceed through an ascending series of designator numbers (01 through 64), with the Player 1 and 2 displays showing the individual lamp's name. Press and hold the Credit button to proceed rapidly to the desired lamp.

Backglass Lamps: 33 - 48 and 55 - 64

***CYCLONE* Lamp-Matrix Table**

[2] Two Lamps

Lamps = #44 Bulb, p/n 24-6549
# 555 Bulb, p/n 24-8768

COLUMN / ROW	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 1 RED-BRN 1J6-1	HOLD 1	W/L SCORE FERRIS WHEEL [2] BONUS 9	RIDE AGAIN 17	EXTRA BALL Left Outlane 25	Mystery Wheel (tdc-top dead center) 33	Mystery Wheel (180 deg from tdc) 41	2X 49	500,000 Bonus (Backglass) 57
Q81 2 RED-BLK 1J6-2	BONUS 2	ADV. "X" 10	SPINS MYSTERY WHEEL 18	EXTRA BALL Right Outlane 26	Mystery Wheel (22-1/2 deg rt of tdc) 34	Mystery Wheel (157-1/2 deg left of tdc) 42	7X 50	1,000,000 Bonus (Backglass) 58
Q82 3 RED-ORN 1J6-3	DOUBLE 3	Balloon 25K (Ducks) 11	Ducks (top) 19	COMET 20K 27	Mystery Wheel (45 deg rt of tdc) 35	Mystery Wheel (135 deg left of tdc) 43	6X 51	1,500,000 Bonus (Backglass) 59
Q83 4 RED-YEL 1J6-5	SCORES 4	Balloon 50K (Ducks) 12	Ducks (mid) 20	COMET 40K 28	Mystery Wheel (67-1/2 deg rt of tdc) 36	Mystery Wheel (112-1/2 deg left of tdc) 44	5X 52	2,000,000 Bonus (Backglass) 60
Q84 5 RED-GRN 1J6-6	CYCLONE 50K 5	Balloon LITES EX. BALL (Ducks) 13	Ducks (bottom) 21	COMET 60K 29	Mystery Wheel (90 deg rt of tdc) 37	Mystery Wheel (90 deg left of tdc) 45	4X 53	2,500,000 Bonus (Backglass) 61
Q85 6 RED-BLU 1J6-7	CYCLONE 100K 6	1 (Gate Lane) 14	Ball Toss (top) 22	COMET 80K 30	Mystery Wheel (112-1/2 deg rt of tdc) 38	Mystery Wheel (67-1/2 deg left of tdc) 46	3X 54	3,000,000 Bonus (Backglass) 62
Q86 7 RED-VIO 1J6-8	CYCLONE Gate Bonus 7	2 (Gate Lane) 15	Ball Toss (mid) 23	COMET 100K 31	Mystery Wheel (135 deg rt of tdc) 39	Mystery Wheel (45 deg left of tdc) 47	MYSTERY (Backglass) 55	3,500,000 Bonus (Backglass) 63
Q87 8 RED-GRY 1J6-9	RIDE THE COMET (on ramp) 8	3 (Gate Lane) 16	Ball Toss (bottom) 24	COMET 1 Million 32	Mystery Wheel (157-1/2 deg rt of tdc) 40	Mystery Wheel (22-1/2 deg left of tdc) 48	WHEEL (Backglass) 56	4,000,000 Bonus (Backglass) 64

SOLENOID TEST.

1. (From Lamp Test) Using AUTO-UP, press ADVANCE. Observe that the Player 1 and 2 displays show the message, COIL TEST, the Player 3 display shows 05 (Solenoid Test identifier). Next, the Player 3 display shows a series of test steps from 01 through 22, while the Player 1 and 2 displays show the solenoid/circuit name. During each of these steps, pulsing of the respective solenoid/circuit occurs. The test cycles repeatedly, unless halted via the MANUAL-DOWN switch. Refer to the **Solenoid Table** for solenoid numbers and wiring information. CPU Board connections at 1P11, 1P12, and 1P19 are also listed in the table.

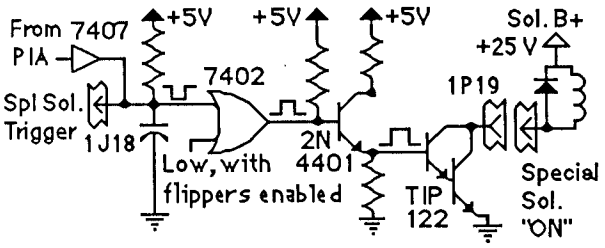
   To continuously pulse a single solenoid/circuit, use MANUAL-DOWN. Press ADVANCE to sequence through the switched, controlled, and special solenoids. Use AUTO-UP to resume test cycling, and to proceed to the next test.

CYCLONE Solenoid Table

Sol. No.	Solenoid Description (p = Playfield b = Backglass)	Solenoid Type	Wire Color [1]	Connections: CPU Bd.	Connections: Playfield/ Cabinet	Driver Trans.	Solenoid Part Number / Flashlamp Type (b = Backbox p = Playfield)
01A [3]	Outhole Kicker	Switched	{Vio-Brn	1P11-1	8P3-1 (via 5J1-9,	Q33	AE-23-800
01C [3]	L F Wheel (p) & Jackpot (b) Flashers	Switched	Blk-Brn}	(Gry-Brn)	Aux Pwr Drvr Bd.)	Q33	#89 flashlamps 2b,1p
02A [3]		Switched	{Vio-Red	1P11-3	8P3-2 (via 5J1-7,	Q25	
02C [3]	R F Wheel (p) & Teeth (b) Flashers	Switched	Blk-Red}	(Gry-Red)	Aux Pwr Drvr Bd.)	Q25	#89 flashlamps 1b,1p
03A [3]	Ball Shooter Kickbig	Switched	{Vio-Orn	1P11-4	8P3-3 (via 5J1-6,	Q32	AE-24-900
03C [3]	Top mid (p) & L Eye (b) Flashers	Switched	Blk-Orn}	(Gry-Orn)	Aux Pwr Drvr Bd.)	Q32	#89 flashlamps 1b,1p
04A [3]	Boomerang Kickbig	Switched	{Vio- Yel	1P11-5	8P3-4 (via 5J1-5,	Q24	AE-26-1500
04C [3]	Cats (p) & lwr Fireworks (b) Flashers	Switched	Blk-Yel}	(Gry-Yel)	Aux Pwr Drvr Bd.)	Q24	#89 flashlamps 1b,2p
05A [3]	Drop Target	Switched	{Vio-Grn	1P11-6	8P3-5 (via 5J1-4,	Q31	AE-23-800
05C [3]	Ducks (p) & R Fireworks (b) Flashers	Switched	Blk-Grn}	(Gry-Grn)	Aux Pwr Drvr Bd.)	Q31	#89 flashlamps 1b,2p
06A [3]		Switched	{Vio-Blu	1P11-7	8P3-6 (via 5J1-3,	Q23	
06C [3]	Ferris Wheel (p) Flashers	Switched	Blk-Blu}	(Gry-Blu)	Aux Pwr Drvr Bd.)	Q23	#89 flashlamps 2p
07A [3]	Knocker /Ticket Dispenser (b'box)	Switched	{Vio-Blk	1P11-8	8P3-7 (via 5J1-2,	Q30	AE-26-1200
07C [3]	Cyclone (p) & R Eye (b) Flashers	Switched	Blk-Vio}	(Gry-Vio)	Aux Pwr Drvr Bd.)	Q30	#89 flashlamps 1b,1p
08A [3]		Switched	{Vio-Gry	1P11-9	8P3-8 (via 5J1-1,	Q22	
08C [3]	Spook H'se (p) & L F'works (b) Flashers	Switched	Blk-Gry}	(Gry-Blk)	Aux Pwr Drvr Bd.)	Q22	#89 flashlamps 1b,1p
09	Spook House Bonus Flasher (p)	Contrld	Brn-Blk	1P12-1	8P3-9 (via 5J2-9)	Q17	#89 flashlamps 1p
10	Playfield Gen Illumin Relay (p)	Contrld	Brn-Red	1P12-2	8P3-10 (via 5J2-8)	Q9	5580-09555-01 [4]
11	Backglass Gen Illumin Relay (b)	Contrld	Brn-Orn	1P12-4	6J3-1 (via 5J2-6)	Q16	5580-09555-01 [4]
12	Solenoid A/C Select Relay (b)	Contrld	Brn-Yel	1P12-5	8P3-12 (via 5J2-5)	Q8	5580-09555-01 [5]
13	Mystery Wheel (b) Coil B	Contrld	Brn-Grn	1P12-6	6J2-3 (B'box Conn	Q15	14-7948/D-12045
14	Mystery Wheel (b) Coil A	Contrld	Brn-Blu	1P12-7	6J2-4 Bd)	Q7	14-7948/D-12045
15	Boomerang Flashers (p)	Contrld	Brn-Vio	1P12-8	8P3-15 (via 5J2-2)	Q14	#1251 lamps 3p
16	Ferris Wheel Motor/Relay (p)	Contrld	Brn-Gry	1P12-9	8P3-16 (via 5J2-1)	Q6	14-7941-3/5580-12145-01 [6]
17	Left Jet Bumper	Specl #1	Blu-Brn	1P19-7	8P3-17 (via 5J3-7)	Q75	AE-23-800
18	Left Kicker ("sling")	Specl #2	Blu-Red	1P19-4	8P3-18 (via 5J3-6)	Q71	AE-26-1500
19	Right Jet Bumper	Specl #3	Blu-Orn	1P19-3	8P3-19 (via 5J3-3)	Q73	AE-23-800
20	Right Kicker ("sling")	Specl #4	Blu-Yel	1P19-6	8P3-20 (via 5J3-4)	Q69	AE-23-800
21	Bottom Jet Bumper	Specl #5	Blu-Grn	1P19-8	8P3-21 (via 5J3-2)	Q77	AE-26-1500
22		Specl #6	Blu-Blk	1P19-9		Q79	
-	Right Flipper	-	Orn-Vio [Blu-Vio]	1P19-1	7P1-15 [7P1-16,8P3-34] [2]	-	FL11630-50VDC
-	Left Flipper	-	Orn-Gry [Blu-Gry]	1P19-2	7P1-18 [7P1-19,8P3-32] [2]	-	FL11630-50VDC

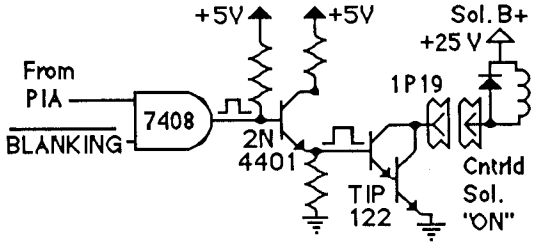
Notes: 1. Wire colors, except flipper Orn-Vio and Orn-Gry, are ground connections (to coil terminal with unbanded end of diode). Flipper Orn-Vio and Orn-Gry wires connect from CPU Board to flipper switch. 2. Flipper connections shown in braces are from flipper switch to flipper coil. 3. "A" coils are pulsed, when Sol. 12 is de-energized; "B" coils are pulsed, with Sol. 12 energized. Wire colors in brackets are those from respective A and B terminals corresponding to the J1-terminal connection listed for the Aux Power Driver Bd., which controls the device pulsing by Sol. 12. 4. Relay is mounted on Relay Bd. p/n C-11998-1. 5. Relay is mounted on Aux Pwr Driver Bd. D-11813 in the backbox. 6. Relay is mounted on Relay Bd C-11902-1.

"On" State Logic - Special Solenoid



"Off" State - Special Solenoid:
The Special Switch Trigger Input goes low. Meanwhile, the PIA line remains high. The remaining signals reverse their states.

"On" State Logic - Controlled Solenoid

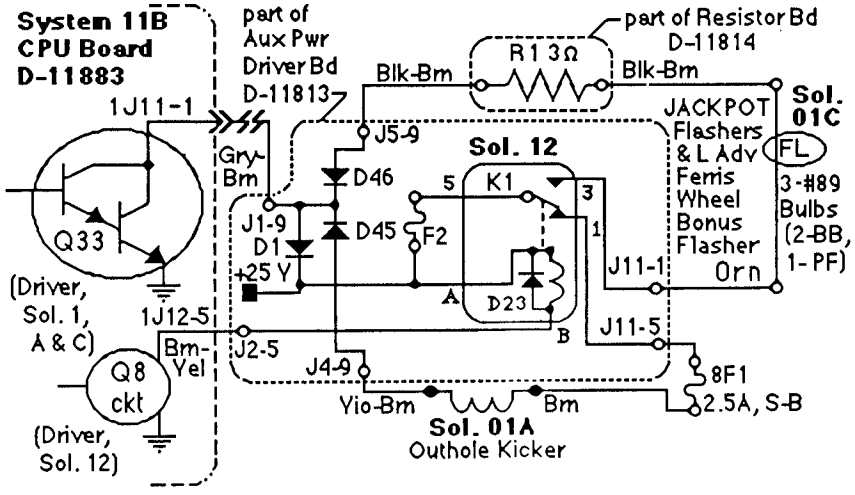


"Off" State - Controlled Solenoid:
The Enable Input (from the PIA) goes low. Meanwhile, the BLANKING signal remains high. The rest of the signals reverse their states.

NOTE

As directed by the game program, the Solenoid A/C Select Relay (solenoid 12) switches the solenoid B+ power between two power busses to permit actuating two groups of solenoids at the proper times. In its de-energized state, the Relay connects the 'circuit A power' to 16 "controlled" and "switched" solenoids (identified in the table with no suffix letter or the letter A, after the solenoid number). Individual solenoid operation then depends on the game program enabling the ground path for solenoid actuation via the driver transistor associated with each solenoid circuit. For example, the game program can actuate the Outhole Kicker solenoid (sol. 01A), via the driver transistor Q33.

When the game program determines that the Solenoid A/C Select Relay (sol. 12) must be energized, the relay connects 'circuit C power' to eight group C solenoids (01C through 08C). Now, driver transistor Q33 can actuate the Left Ferris Wheel (p/f) and Jackpot (bb) Flasher circuit (sol. 01C). Using this "multiplexing" technique, the same driver transistor can control actuation of two separate solenoid circuits.



Typical *CYCLONE* +25V Circuit showing the Function of A/C Select Relay, Sol. 12

SWITCH TESTS.

1. **Switch Levels.**

(From Solenoid Test) To initiate the Switch Levels Test, press ADVANCE. Observe that the Player 1 and 2 displays show the message, SWITCH LEVELS, and the Player 3 display shows 06 (Switch Levels Test identifier). Normally, the right portion of the Player 3 display remains blank, indicating that no switch is actuated.

If, however, a switch *is* actuated (possibly stuck closed), the Player 3 display shows that switch's number, while the Player 1 and 2 displays indicate the switch's name. A sound also accompanies the displays. (This is another facet of the *CYCLONE* System-11B's switch testing capability.) If more than one switch is closed, a series of displays show each actuated switch's name and number.

(In addition, either of these problems could result in the reporting of a switch problem (or problems) at game Turn-On or at the beginning of Diagnostic Tests.)

As soon as the operator opens a closed switch, its name and number are eliminated from the Switch Levels display series. For *CYCLONE,* switch numbers can range from 01 through 64. Refer to the **Switch-Matrix Table** for switch numbers and wiring information. CPU Board connections at jacks 1J8 (columns) and 1J10 (rows) are also listed in the table.

***CYCLONE* Switch-Matrix Table**

COLUMN / ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1 WHT-BRN 1J10-9	Plumb Bob Tilt 1	Playfield Tilt 9	Ferris Wheel Entrance 17	Ball Shooter Lane 25	Not Used 33	Mystery Wheel Opto "Home" (Insert bd) 41	Not Used 49	Left Flipper Lane Change 57
2 WHT-RED 1J10-8	Not Used 2	Outhole 10	Drop Target (center) 18	Shuttle 10K (kickbig) 26	Score CYCLONE 34	Not Used 42	Not Used 50	Right Flipper Lane Change 58
3 WHT-ORN 1J10-7	Credit Button 3	Score Spook House 11	Ducks (top) 19	Shuttle 25K (bottom) 27	10 pt (R. Bottom) 35	Not Used 43	Not Used 51	Spot Ball Toss 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Not Used 12	Ducks (middle) 20	Shuttle 100K 28	10 pt (R. Middle) 36	Not Used 44	Not Used 52	Left Jet Bumper 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Boomerang Kickbig 13	Ducks (bottom) 21	Shuttle 25K 29	10 pt (R. Top) 37	Not Used 45	Left Outlane Ex. Ball 53	Right Jet Bumper 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	1 Lane 14	Ball Toss (top) 22	Shuttle 5K (top) 30	Not Used 38	Not Used 46	Right Outlane Ex. Ball 54	Bottom Jet Bumper 62
7 WHT-VIO 1J10-2	Slam Tilt 7	2 Lane 15	Ball Toss (middle) 23	Enter COMET Ramp 31	Not Used 39	Not Used 47	Left Return Lane 55	Left Kicker 63
8 WHT-GRY 1J10-1	High-Score Reset 8	3 Lane 16	Ball Toss (bottom) 24	Score COMET Ramp 32	Not Used 40	Not Used 48	Right Return Lane 56	Right Kicker 64

Row Problems. If a display of two (or more) switch numbers of a row occurs, although only one switch is closed, check for a short circuit between the column wires.

Multiple Switch Number Indications. Check the associated column wire for a short circuit to ground.

Column Problems. If display of two (or more) switch numbers in a column occurs (while only one switch is actuated), check for a short circuit between the row wires.

Use AUTO-UP to proceed to the next test.

SWITCH TESTS (Continued).

2. **Switch Edges.**
   From the Switch Levels Test, press ADVANCE. Observe that the Player 1 and 2 displays show the message, SWITCH EDGES; the Player 3 display shows 07 (Switch Edges Test identifier). The right portion of the Player 3 display is blank, indicating that no switch is actuated.

   This test permits the operator to test whether actuating a switch provides the proper signal to the System-11B switch testing program. When actuating a switch, the operator should see the switch's name and number (in the Player 1, 2, and 3 displays, respectively). If no indication appears at the time the switch is actuated, the operator then knows that there is a malfunction associated with that switch.

   Using this technique, the operator can test each switch appearing in the *CYCLONE* switch problem reporting displays (either at game Turn-On or at the beginning of the Diagnostic Tests) to determine whether the switch can be actuated. If the switch's name and number are displayed while the operator checks its operation, the operator then knows that the reported problem with that switch is NOT currently caused by a switch malfunction. The operator can then seek other causes for the reported problem, being almost certain now that the switch did not fail. *This test is also useful when the operator is adjusting the sensitivity of a particular switch's actuation mechanism.*

   Among the possibilities is the fact that the players have not actuated that switch because of some other problem; the operator should try to analyze what could cause the switch to be missed, and remedy that problem cause. With these new tests, switch problems are, therefore, more easily isolated.

3. *Playfield or CPU Board?* To determine whether a switch problem is in the playfield or the CPU Board, remove connectors 1P8 and 1P10 from the CPU Board. Begin the Switch Test. Use a jumper wire to simulate switch actuation. For example, placing a jumper between 1J10-9 and 1J8-2 should (based on the **Switch-Matrix Table**) should produce an indication of switch 09 being actuated.

MYSTERY WHEEL TEST

From the Switch Edges Test, press ADVANCE. Observe that the Player 1 and 2 displays show the message, WHEEL TEST, and that the Player 3 displays shows 08 (Mystery Wheel Test identifier).

The Player 2 display now shows the last known position of the Mystery Wheel, while the Player 4 display is divided to show the 'state' of the Home Switch. On the left of the Player 4 display, an "H" means that the Home Switch is open or the opto is interrupted; on the right, a number shows the count of the stepper wheel (1-200; however, if the Home Switch is not working, the number can go as high as 256). If the Player 3 Display shows 08___(#), it is reporting the number of errors (#) for Mystery Wheel operation occurring since the last Game Turn-on.

Using AUTO-UP, the test is automatic: The wheel spins, waits for 2 seconds, then spins again. The wheel stops on the next counterclockwise position of the wheel, if the Home Switch works.

Using MANUAL-DOWN, press ADVANCE to spin the wheel. The wheel stops on the next counterclockwise position of the wheel, if the Home Switch works. If the wheel is not spinning, you can manually step the motor by pressing Credit button.

During the test, the Player 3 display shows 08Err (#) (Error numbers, up to 9, maximum), if errors occur (the game program did not detect the Home Switch). During a lengthy test, the Player 3 display will detect any errors and add them to the Err(#) count, so that the number displayed is the total number of errors detected during the test.

ENDING THE DIAGNOSTIC TESTS.

To end the Diagnostic Tests, reach the Switch Edges Test (06 in the Player 3 display), use AUTO-UP and press ADVANCE. The backbox displays should show the *CYCLONE* game's Identification Information. Use MANUAL-DOWN, and press ADVANCE to reach Adjustment Item 70 (INSTALL FACTORY). Use AUTO-UP and press ADVANCE to obtain the Attract Mode.

AUTO BURN-IN MODE.

The Auto Burn-in Mode permits the operator to check intermittent (or nonrecurring) problems associated with most portions of the game's circuitry. Repeatedly cycling through a group of tests can sometimes bring a problem, which occurs only randomly or occasionally, to exhibit itself more frequently, thereby aiding in the isolation of the problem. To activate the Auto Burn-in Mode:

1. While in the Game Adjustments, reach Ad 67 and change the Factory Setting of NO to YES, via the Credit button. Set the AUTO-UP/MANUAL-DOWN switch to AUTO-UP.

2. Press ADVANCE to start the Auto Burn-in Mode. This mode repeatedly sequences through the Music Test, the Display Test, the Sound Test, the All Lamps portion of the Lamp Test, and the Solenoid Test.

3. To halt the Auto Burn-in Mode, switch the game Off and then On. *CYCLONE* now starts in the Attract Mode. (If a switch problem is now reported by the displays, perform the Switch Tests again to determine the nature of the problem; then, perform necessary repairs.)

SYSTEM-11B MEMORY CHIP TEST.

A new feature is now included in the Memory Chip Test for System 11B. During power-up, the CPU performs a self-testing routine. When all tests are satisfactory, the game proceeds to the Attract Mode, allowing players to use the game. Whenever a portion of the testing does not produce satisfactory results, the game displays a message, before proceeding to the next portion of the testing. ONLY after all tests are satisfactory does the game allow play.

In addition to the displayed message, when a test fails, the lower LED mounted on the CPU Board can be observed to determine the probable cause of the problem. The LED blinks, or flashes, a certain number of times to identify the probable cause, as described in the **CPU LED Indicator Codes Table**. The operator can also start the self-testing routine by pressing the CPU Diagnostic Switch (SW 2) on the edge of the CPU Board.

CPU LED Indicator Codes Table

Diagnostic LED		
Blinks/ Flashes	**Display Message**	**Explanation**
1	U25 RAM FAILURE	U25 RAM could not be used properly (NO other tests are performed; the game is locked here, until the game is turned off).
2	MEM. PROT. FAILURE	This message means that (A) the Coin Door may be shut; (B) the Memory Protect Switch may be stuck in the ON position; (C) the memory protect logic is protecting the memory; or (D) a U25 RAM failure is occurring. (See Note 1)
3	U51 PIA FAILURE	U51 has a malfunction. (See Note 2)
4	U38 PIA FAILURE	U38 has a malfunction. (See Note 2)
5	U41 PIA FAILURE	U41 has a malfunction. (See Note 2)
6	U42 PIA FAILURE	U42 has a malfunction. (See Note 2)
7	U54 PIA FAILURE	U54 has a malfunction. (See Note 2)
8	U10 PIA FAILURE	U10 has a malfunction. (See Note 2)
9	IRQ FAILURE	IRQ has a malfunction. It may be missing or too fast or too slow.
10	U27 ROM FAILURE	U27's internal checksums do not match. It may be a ROM failure, or its associated connections and connectingdevices are causing it to appear to have a problem. (The following U26 test is skipped.)
11	U26 ROM FAILURE	U26's internal checksums do not match.

Notes: 1. This test assumes that the Coin Door is OPEN; it is initiated ONLY by pressing the CPU Diagnostic Switch (SW2).

2. Alternatively, its associated connections or connecting devices are causing the IC to appear to have problems.

SYSTEM-11B SOUND CIRCUITRY TESTS.

Tests of the System-11B Sound circuitry, including the Audio Board are possible, only after successful completion of the System-11B Memory Chip Test.

1. **Sound/Speech Board Test.** A brief check of the Audio Board (D-11581) circuitry occurs at game Turn-on; the game reports the test results by brief sounds, as follows: No sound = Sound/ Speech Board is not operating, or a failure is affecting the sound circuitry (broken cable; dead amplifier; etc.); 1 sound = system OK; 2 sounds = RAM problem; 3 sounds = U4 problem; 4 sounds = U19 problem.

2. **General System-11B Sound Test.** Press the Sound Diagnostic Switch (SW 1) on left edge of the CPU Board. Listen for the two test sounds, showing that both the CVSD (Continuously Variable Slope Delta) Modulator, which provides the voices for *CYCLONE,* and the DAC (Digital-to-Analog Converter) sound circuits are functioning properly.

   If no sound is heard, refer to the text entitled "NO SOUND ...". If one "ring" is heard, this indicates a malfunction of the U23 RAM Chip. If either two or four "rings" is heard, this indicates a problem associated with the U21 ROM Chip. If either three or five "rings" is heard, this indicates a problem with the U22 ROM Chip.

NO SOUND DURING THIS TEST (but sound can be heard during the Diagnostic Tests).

Check the sound-select inputs (pins 2 through 9 of U9) to see if they pulse during Sound Test 01. Also, check the -12 V supply voltage on the CPU Board. If this voltage is low (or AC ripple seems too high), perform the following checks:

1. The gray and gray-green transformer secondary wires for 19.4 VAC.
2. The CPU Board filter capacitor C26 for -12 VDC.
3. The filter capacitor C26 for excessive AC ripple (over 0.75VAC).

If the previous checks did not isolate the problem, turn the Volume Control for maximum output. Momentarily touch a powered-up AC soldering pencil on the center tap of the Volume Control.

CAUTION

DO NOT use a soldering iron over 40 watts. Note also that cordless soldering irons will NOT work for this test.

Hearing a low hum or a 'click' indicates that the power amplifier (U1, TDA2002), the Volume Control, and the speaker are operating satisfactorily, as is the sound circuit cabling. Not hearing a sound requires repeating the test with the Volume Control turned part way down, to determine whether the Volume Control is faulty. Also, check the cable connectors for proper mating, and that no broken wires affect this circuit .

FUSE LISTING.

The following fuses are used:

Part Number	Description	Circuit/Location
5730-09252-00	Fuse, 8A Slow-Blow (S-B), 125v	Input Power ("high voltage") Line/Cabinet Box*
5731-09651-00	Fuse, 5A S-B, 250v	Gen. Illumination/Upper Rt Backbox fuseholder (4)
5730-09071-00	Fuse, 8A S-B, 32v	+18 Vdc Lamp Ckt/ Lwr Rt Backbox fuseholder (1)
5730-12203-00	Fuse, 1/10A S-B, 250v	+ & - 100V Display Pwr/Upr Cntr B'box fuseholder (2)
5731-08665-00	Fuse, 2A S-B, 250v	F1, F3 - F6; D-11813 Aux Pwr Driver Board
5731-06314-00	Fuse, 4A S-B, 250v	F2, F7; D-11813 Aux Pwr Driver Board
5731-09651-00	Fuse, 5A S-B, 250v	F8; D-11813 Aux Pwr Driver Board
5731-08761-00	Fuse, 1/4A S-B, 250v	F1, D-8345-557 Power Supply
5731-09432-00	Fuse, 7A S-B, 250v	F5, F6; D-8345-557 Power Supply
5731-09128-00	Fuse, 2-1/2A S-B, 250v	+25Vdc Solenoid "A" ckt/Mid P'fld fuseholder (1)

* One 4A S-B, 250v fuse (5731-06314-00) is provided for an overseas (220v) game installation.

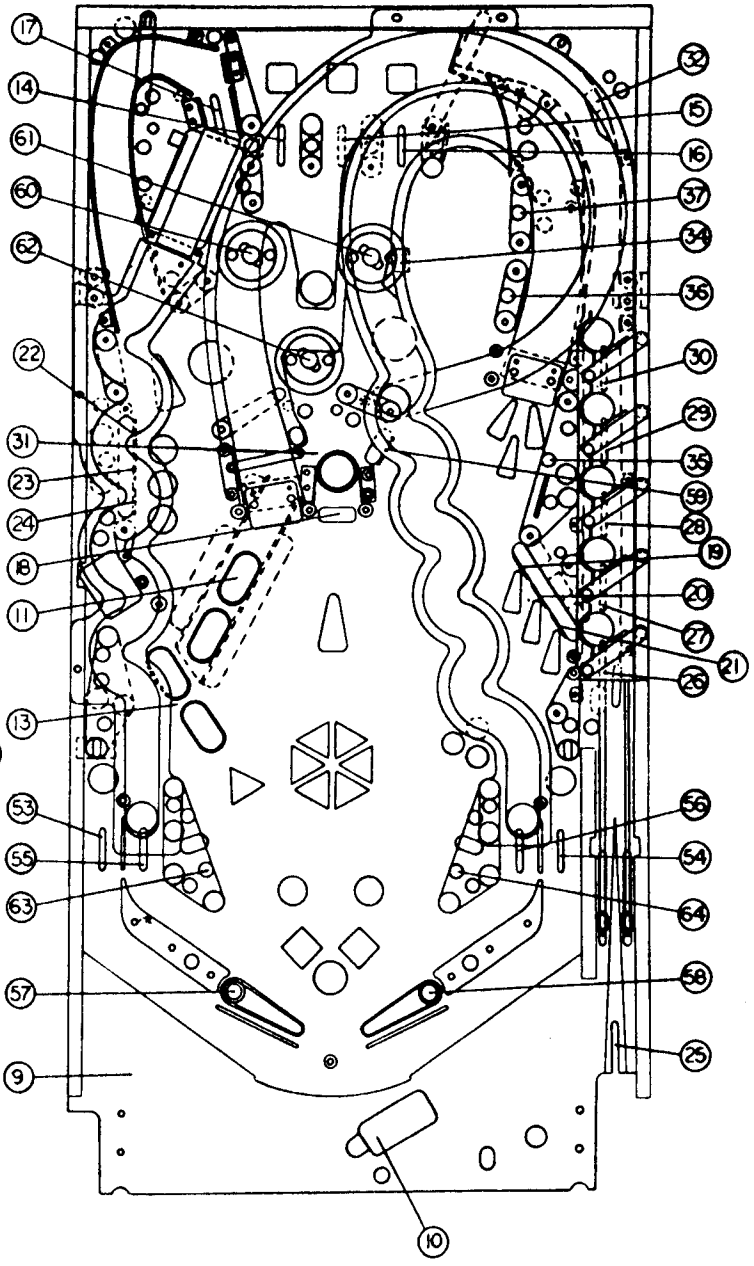
Section 2
Reference Diagrams & Schematics

- **Diagrams and Schematics:**

  Switches
  Lamps
  Solenoids/Flashers & Rubber Parts
  Cabinet Wiring
  Power Supply Board
  Aux Power Driver Board
  Audio Board
  A/N Display Unit Board
  Interboards Signals
  CPU Board
  Controlled, Special, & Switched Solenoids
  Power Wiring

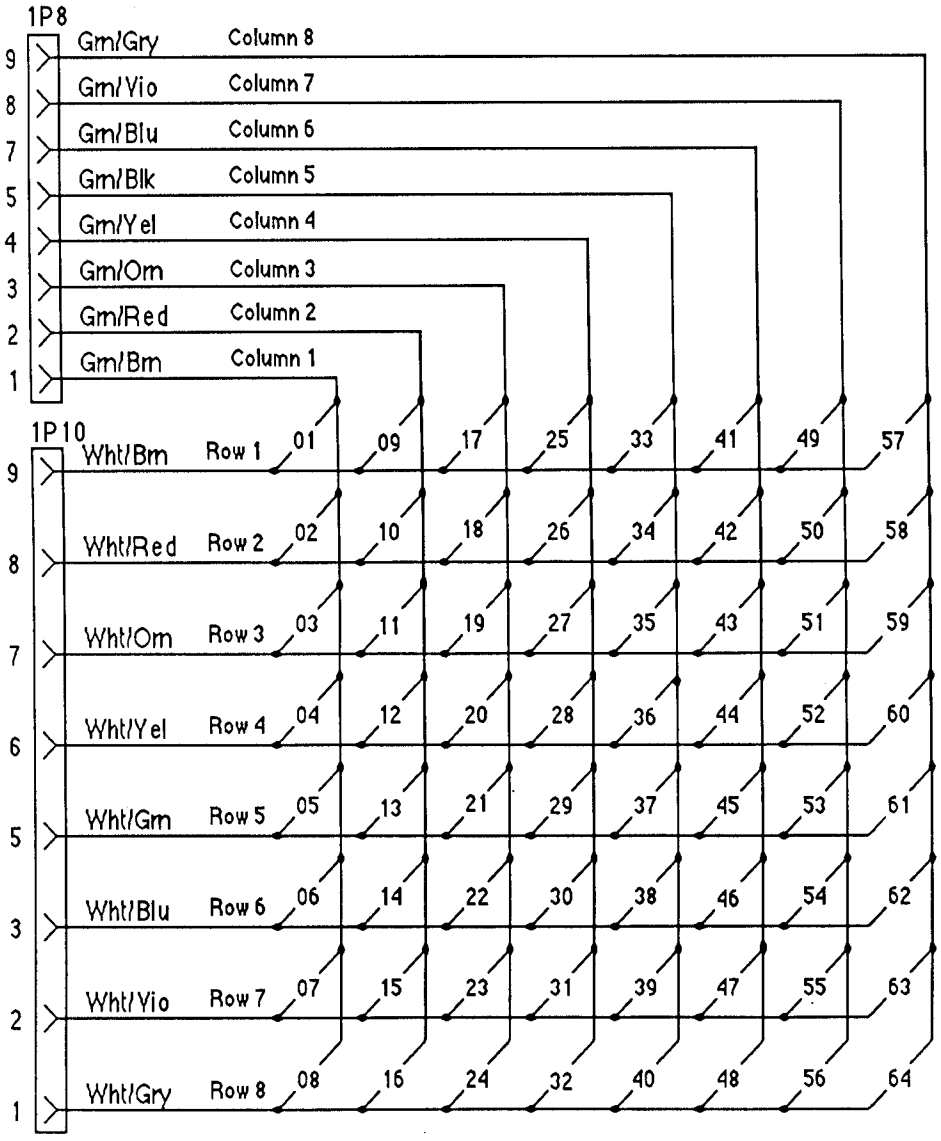
Switches

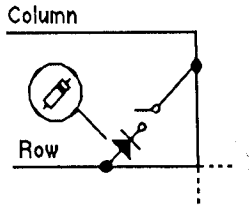
Item	Part No.	Description
1	A-8476	Plumb Bob Tilt
2	Not Used	
3	SW-1A-126	Credit Button
4	27-1092	R Coin Chute (USA)
5	Not Used (USA)	Center Coin Chute
6	27-1092	L Coin Chute (USA)
7	27-1066	Slam Tilt
8	27-1008	High Score Reset*
9	B-8306-1	Playfield Tilt
10	17-1067	Outhole
11	5647-12073-01	Score Spook House
12	Not Used	
13	5647-12073-09	Boomerang Kickbig
14	5647-12073-10	1 Gate/Lane
15	5647-12073-10	2 Gate/Lane
16	5647-12073-10	3 Gate/Lane
17	5647-12073-10	Ferris Wheel Entrance
18	C-11903-R	1-bank Dr Tgt Opto
19	B-12039-5	Duck target (top)
20	B-12039-5	Duck target (mid)
21	B-12039-5	Duck target (bottom)
22	B-11696-5	Ball Toss target (top)
23	B-11696-5	Ball Toss target (mid)
24	B-11696-5	Ball Toss target (bottom)
25	5647-12073-04	Ball Shooter Lane
26	5647-12133-01	Shuttle 10K (kickbig)
27	5647-12073-10	Shuttle 25K (lower)
28	5647-12073-10	Shuttle 100K
29	5647-12073-10	Shuttle 25K (upper)
30	5647-12073-10	Shuttle 5K (topmost)
31	SW-1A-171	Enter Comet Ramp
32	5647-12133-04	Score Comet Ramp
33	Not Used	
34	5647-12133-07	Score Cyclone (ramp)
35	B-4834-K	10 pt (bottom right)
36	B-4834-K	10 pt (mid right)
37	B-4834-K	10 pt (top right)
38	Not Used	
39	Not Used	
40	Not Used	
41	5490-10159-00	Mystery Wheel Opto**
42	Not Used	
43	Not Used	
44	Not Used	
45	Not Used	
46	Not Used	
47	Not Used	
48	Not Used	
49	Not Used	
50	Not Used	
51	Not Used	
52	Not Used	
53	5647-12073-10	Left Outlane (drain)



Item	Part No.	Description
54	5647-12073-10	Right Outlane (drain)
55	5647-12073-10	Left Return Lane
56	5647-12073-10	Right Return Lane
57	B-9951-1	L Flipper Lane Change
58	B-9951	R Flipper Lane Change
59	B-12001-4	Score Ball Toss Tgt
60	SW-11A-37	Jet Bumper (left)
61	SW-11A-37	Jet Bumper (right)
62	SW-11A-37	Jet Bumper (bottom)
63		Left Kicker***
64		Right Kicker***
-	SW-10A-48	Flipper Button (Cabinet sides)

Notes: * Part Number is for entire Diagnostic Switch Assembly, including H S Reset Switch;
** Part of Motor Control Assy, D-12046; *** [Paired Kicker Actuating Sw: A-4834-H; B-8734-1]

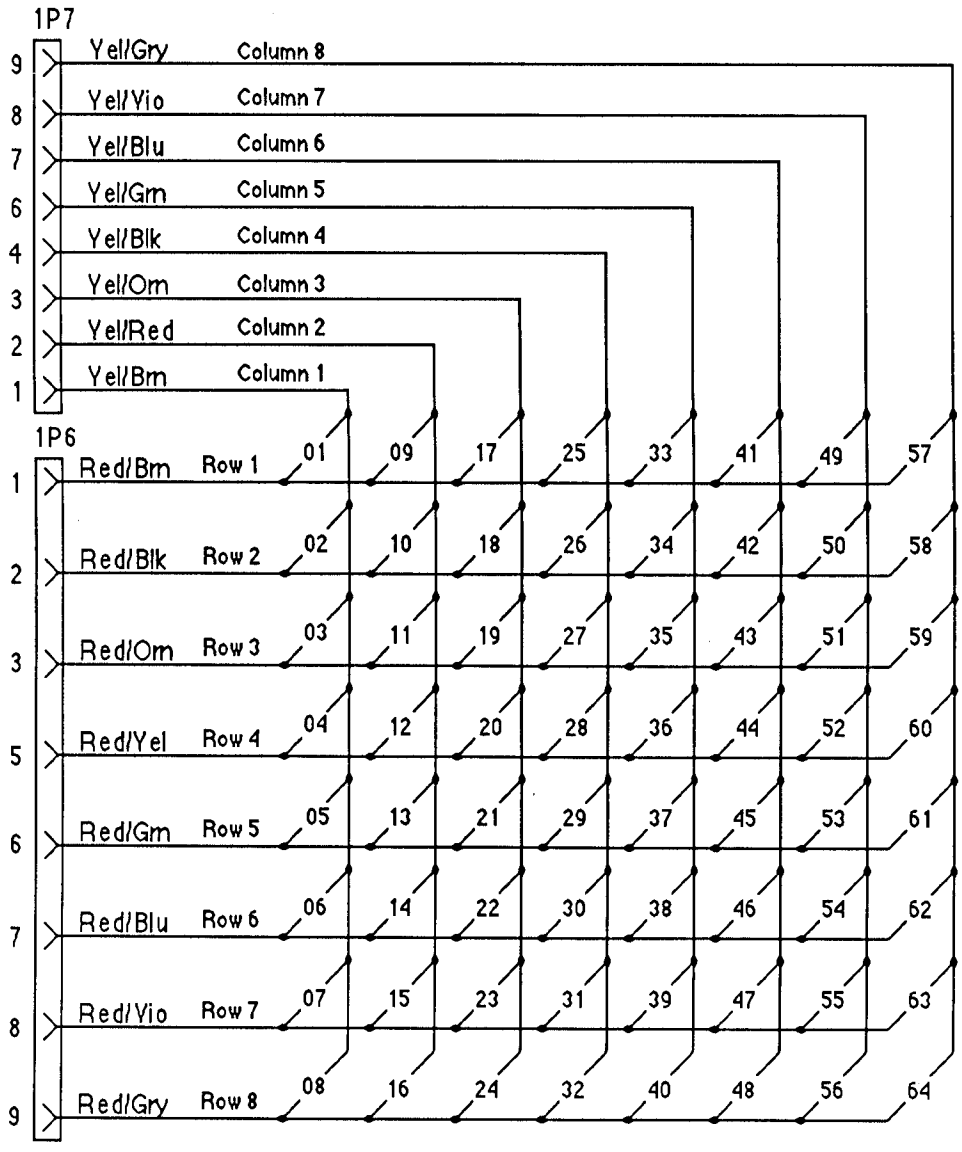


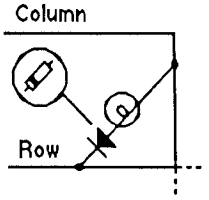


Typical Switch Circuit

***CYCLONE* Switch-Matrix Table**

COLUMN / ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1 WHT-BRN 1J10-9	Plumb Bob Tilt 1	Playfield Tilt 9	Ferris Wheel Entrance 17	Ball Shooter Lane 25	Not Used 33	Mystery Wheel Opto "Home" (Insert bd) 41	Not Used 49	Left Flipper Lane Change 57
2 WHT-RED 1J10-8	Not Used 2	Outhole 10	Drop Target (center) 18	Shuttle 10K (kickbig) 26	Score CYCLONE 34	Not Used 42	Not Used 50	Right Flipper Lane Change 58
3 WHT-ORN 1J10-7	Credit Button 3	Score Spook House 11	Ducks (top) 19	Shuttle 25K (bottom) 27	10 pt (R. Bottom) 35	Not Used 43	Not Used 51	Spot Ball Toss 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Not Used 12	Ducks (middle) 20	Shuttle 100K 28	10 pt (R. Middle) 36	Not Used 44	Not Used 52	Left Jet Bumper 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Boomerang Kickbig 13	Ducks (bottom) 21	Shuttle 25K 29	10 pt (R. Top) 37	Not Used 45	Left Outlane Ex. Ball 53	Right Jet Bumper 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	1 Lane 14	Ball Toss (top) 22	Shuttle 5K (top) 30	Not Used 38	Not Used 46	Right Outlane Ex. Ball 54	Bottom Jet Bumper 62
7 WHT-VIO 1J10-2	Slam Tilt 7	2 Lane 15	Ball Toss (middle) 23	Enter COMET Ramp 31	Not Used 39	Not Used 47	Left Return Lane 55	Left Kicker 63
8 WHT-GRY 1J10-1	High-Score Reset 8	3 Lane 16	Ball Toss (bottom) 24	Score COMET Ramp 32	Not Used 40	Not Used 48	Right Return Lane 56	Right Kicker 64





Typical Lamp Circuit

Backglass Lamps: 33 - 48 and 55 - 64

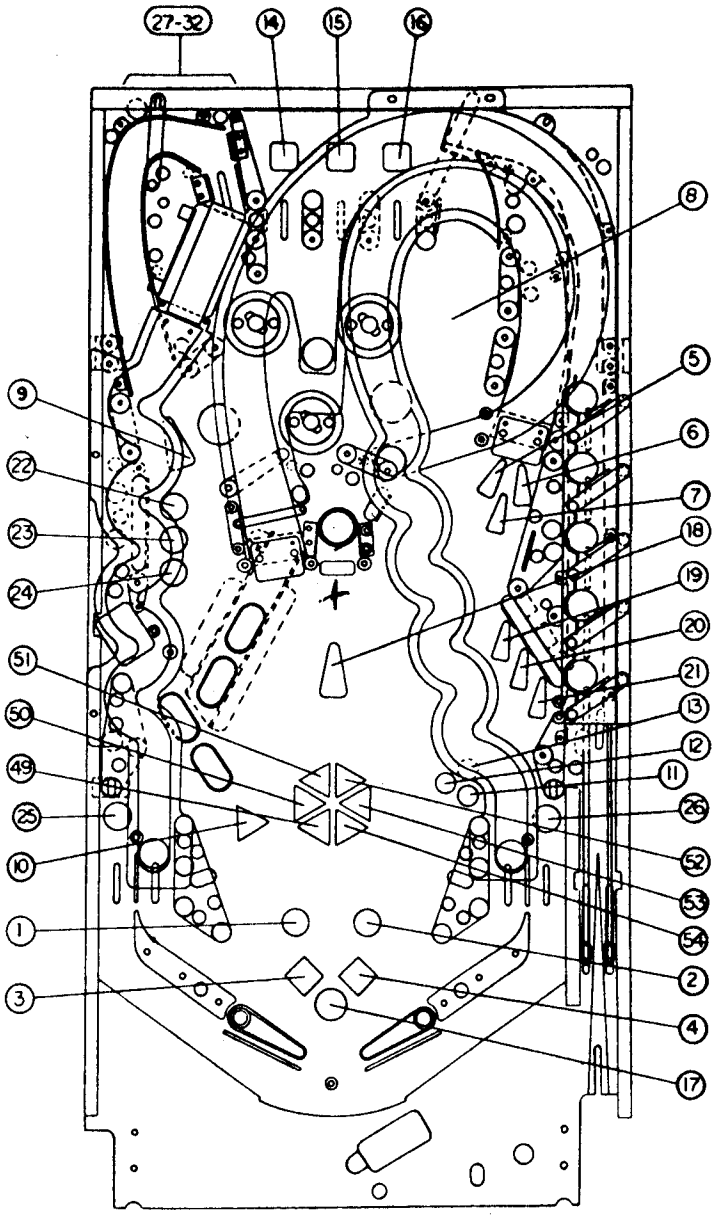
CYCLONE Lamp-Matrix Table

[2] Two Lamps

Lamps = #44 Bulb, p/n 24-6549
# 555 Bulb, p/n 24-8768

ROW \ COLUMN	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 1 RED-BRN 1J6-1	HOLD 1	W/L SCORE FERRIS WHEEL [2] BONUS 9	RIDE AGAIN 17	EXTRA BALL Left Outlane 25	Mystery Wheel (tdc-top dead center) 33	Mystery Wheel (180 deg from tdc) 41	2X 49	500,000 Bonus (Backglass) 57
Q81 2 RED-BLK 1J6-2	BONUS 2	ADV. "X" 10	SPINS MYSTERY WHEEL 18	EXTRA BALL Right Outlane 26	Mystery Wheel (22-1/2 deg rt of tdc) 34	Mystery Wheel (157-1/2 deg left of tdc) 42	7X 50	1,000,000 Bonus (Backglass) 58
Q82 3 RED-ORN 1J6-3	DOUBLE 3	Balloon 25K (Ducks) 11	Ducks (top) 19	COMET 20K 27	Mystery Wheel (45 deg rt of tdc) 35	Mystery Wheel (135 deg left of tdc) 43	6X 51	1,500,000 Bonus (Backglass) 59
Q83 4 RED-YEL 1J6-5	SCORES 4	Balloon 50K (Ducks) 12	Ducks (mid) 20	COMET 40K 28	Mystery Wheel (67-1/2 deg rt of tdc) 36	Mystery Wheel (112-1/2 deg left of tdc) 44	5X 52	2,000,000 Bonus (Backglass) 60
Q84 5 RED-GRN 1J6-6	CYCLONE 50K 5	Balloon LITES EX. BALL (Ducks) 13	Ducks (bottom) 21	COMET 60K 29	Mystery Wheel (90 deg rt of tdc) 37	Mystery Wheel (90 deg left of tdc) 45	4X 53	2,500,000 Bonus (Backglass) 61
Q85 6 RED-BLU 1J6-7	CYCLONE 100K 6	1 (Gate Lane) 14	Ball Toss (top) 22	COMET 80K 30	Mystery Wheel (112-1/2 deg rt of tdc) 38	Mystery Wheel (67-1/2 deg left of tdc) 46	3X 54	3,000,000 Bonus (Backglass) 62
Q86 7 RED-VIO 1J6-8	CYCLONE Gate Bonus 7	2 (Gate Lane) 15	Ball Toss (mid) 23	COMET 100K 31	Mystery Wheel (135 deg rt of tdc) 39	Mystery Wheel (45 deg left of tdc) 47	MYSTERY (Backglass) 55	3,500,000 Bonus (Backglass) 63
Q87 8 RED-GRY 1J6-9	RIDE THE COMET (on ramp) 8	3 (Gate Lane) 16	Ball Toss (bottom) 24	COMET 1 Million 32	Mystery Wheel (157-1/2 deg rt of tdc) 40	Mystery Wheel (22-1/2 deg left of tdc) 48	WHEEL (Backglass) 56	4,000,000 Bonus (Backglass) 64

Lamps



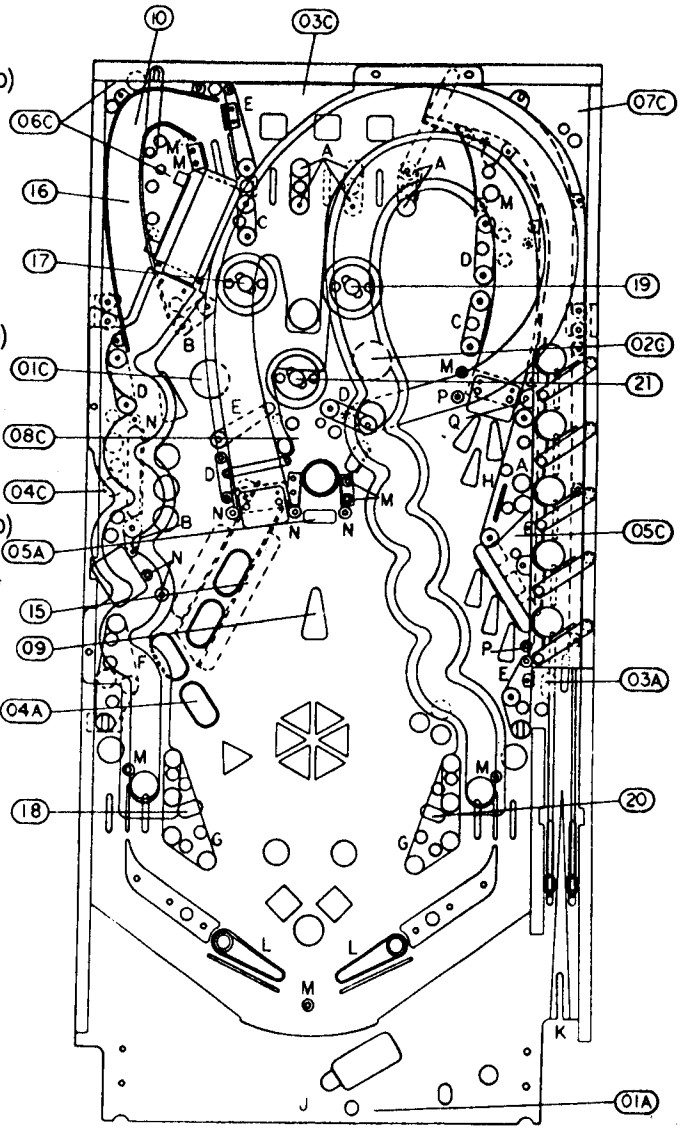
Lamp	Location/Description
1	HOLD
2	BONUS
3	DOUBLE
4	SCORES
5	CYCLONE 50K
6	CYCLONE 100K
7	CYCLONE Gate Bonus
8	RIDE THE COMET (on ramp)
9	W/L SCORE FERRIS WHEEL BONUS
10	ADV. "X"
11	25K Balloon (Ducks)
12	50K Balloon (Ducks)
13	LITES EX. BALL Balloon (Ducks)
14	1 (Gate Lane)
15	2 (Gate Lane)
16	3 (Gate Lane)
17	RIDE AGAIN
18	SPINS MYSTERY WHEEL
19	Ducks (top)
20	Ducks (mid)
21	Ducks (bottom)
22	Ball Toss (top)
23	Ball Toss (mid)
24	Ball Toss (bottom)
25	EXTRA BALL (L Outlane)
26	EXTRA BALL (R Outlane)
27	COMET 20K
28	COMET 40K
29	COMET 60K
30	COMET 80K
31	COMET 100K
32	COMET 1 MILLION
33	Mystery Wheel (top)
34	Mystery Wheel (r of top 1)
35	Mystery Wheel (r of top 2)
36	Mystery Wheel (r of top 3)
37	Mystery Wheel (right)
38	Mystery Wheel (below right 1)
39	Mystery Wheel (below right 2)
40	Mystery Wheel (below right 3)
41	Mystery Wheel (bottom)
42	Mystery Wheel (l of bottom 1)
43	Mystery Wheel (l of bottom 2)
44	Mystery Wheel (l of bottom 3)
45	Mystery Wheel (left)
46	Mystery Wheel (above left 1)
47	Mystery Wheel (above left 2)
48	Mystery Wheel (above left 3)
49	2X
50	7X
51	6X
52	5X
53	4X
54	3X

Lamp	Location/Description
55	MYSTERY (backglass)
56	WHEEL (backglass)
57	500,000 Bonus (backglass)
58	1,000,000 Bonus (backglass)
59	1,500,000 Bonus (backglass)
60	2,000,000 Bonus (backglass)
61	2,500,000 Bonus (backglass)
62	3,000,000 Bonus (backglass)
63	3,500,000 Bonus (backglass)
64	4,000,000 Bonus (backglass)

Solenoids/Flashers

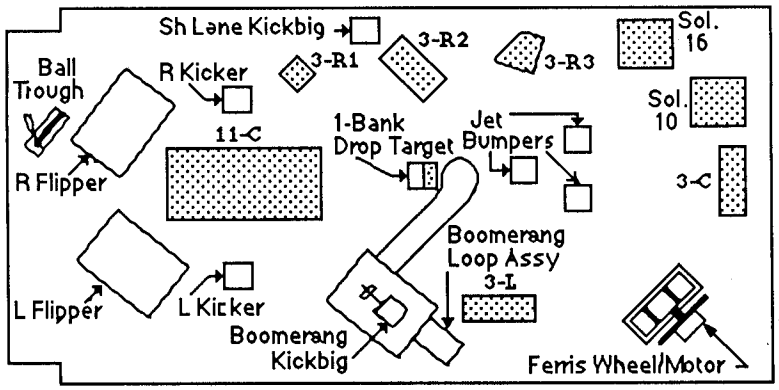
Item	Part No.	Description
01A	AE-23-800	Outhole Kicker
01C	#89 Flashlamp	L F. Wheel (pf) & Jackpot (bb)
02A		
02C	#89 Flashlamp	R F. Wheel (pf) & Teeth (bb)
03A	AE-24-900	Ball Shooter Kickbig
03C	#89 Flashlamp	Top mid (pf) & L Eye (bb)
04A	AE-26-1500	Boomerang Kickbig
04C	#89 Flashlamp	Cats (pf) & lwr Fireworks (bb)
05A	AE-23-800	Drop Target
05C	#89 Flashlamp	Ducks (pf) & R Fireworks (bb)
06A		
06C	#89 Flashlamp	Ferris Wheel (pf)
07A	AE-26-1200	Knocker (Ticket Dispenser)
07C	#89 Flashlamp	Cyclone (pf) & R Eye (bb)
08A		
08C	#89 Flashlamp	Sp'k Hse (pf) & L F'works (bb)
09	#89 Flashlamp	Spins Mystery Wheel (pf)
10	5580-09555-01	P'field General Illumin Relay*
11	5580-09555-01	B'glass Gen. Illumin. Relay *
12	5580-09555-01	Solenoid A/C Select Relay**
13		Mystery Wheel (bb) Coil A
14		Mystery Wheel (bb) Coil B
15	#1251 Flashlamp	Boomerang Flasher
16	5580-12145-01	Ferris Wheel Motor/Relay***
17	AE-23-800	Left Jet Bumper
18	AE-26-1500	Left Kicker ("Sling")
19	AE-23-800	Right Jet Bumper
20	AE-26-1500	Right Kicker ("Sling")
21	AE-23-800	Bottom Jet Bumper
22		
-	FL 11630-50VDC	Left and Right Flipper

* - On Relay Board, C-11998-1
** - In backbox on Aux Power Driver Bd, D-11813
*** - On Relay Board, C-11902-1; Motor p/n 14-7941-3



Rubber Parts

Item	Part No.	Description	Qty	Item	Part No.	Description	Qty
A	23-6300	5/16" Ring	7	J	23-6313-1	Grommet	1
B	23-6301	3/4" Ring	2	K	23-6327	Ball Shooter Tip	1
C	23-6302	1" Ring	2	L	23-6519-4	Red Flipper Ring	2
D	23-6303	1-1/4" Ring	6	M	23-6535	Bumper	9
E	23-6304	1-1/2" Ring	3	N	23-6552	Sleeving	6
F	23-6305	2" Ring	1	P	23-6556	Sleeving, Black	2
G	23-6306	2-1/2" Ring	2	Q	23-6579	Bumper, 3/4" Taper	1
H	23-6307	3" Ring	1				

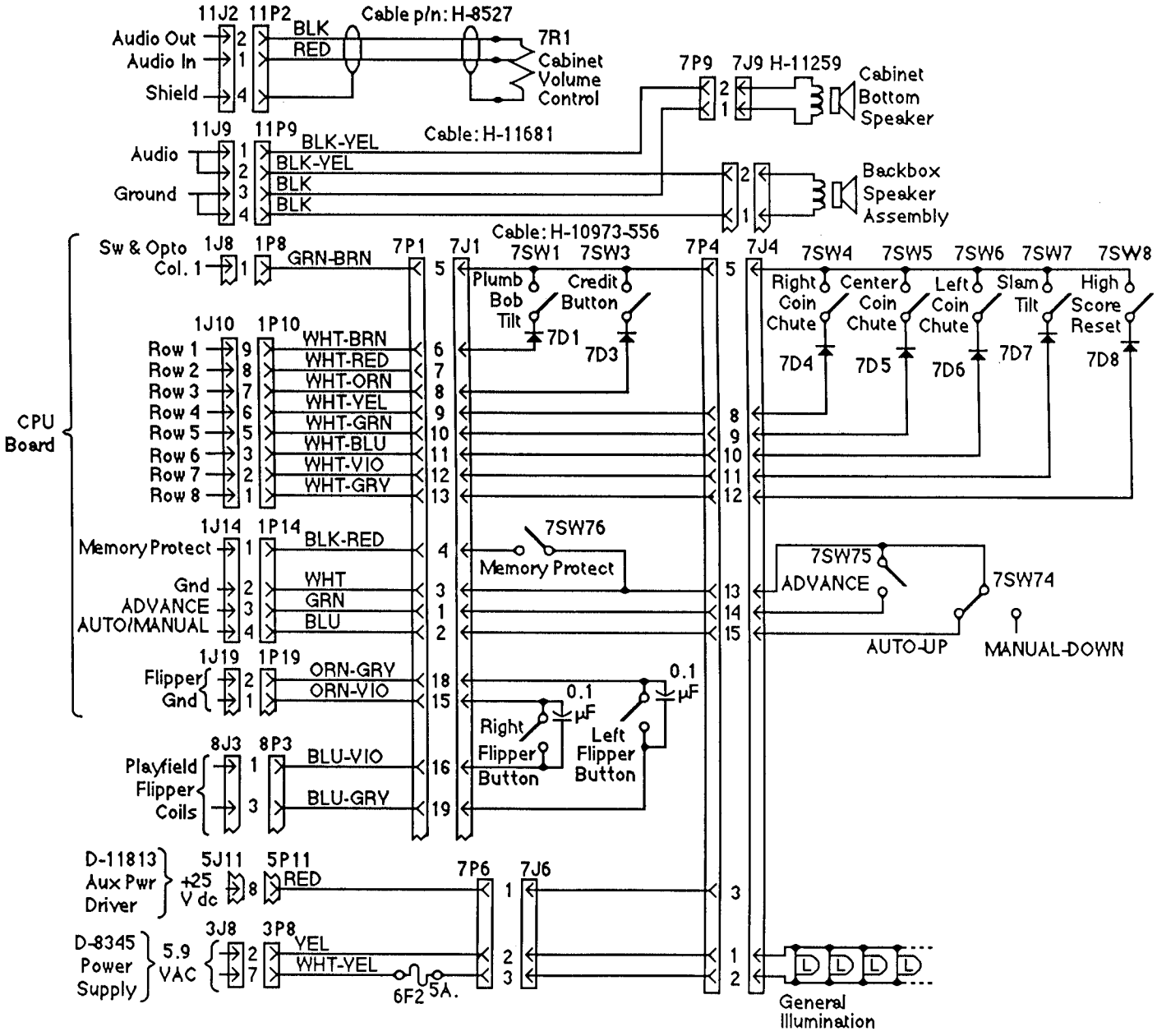


(underside of playfield)

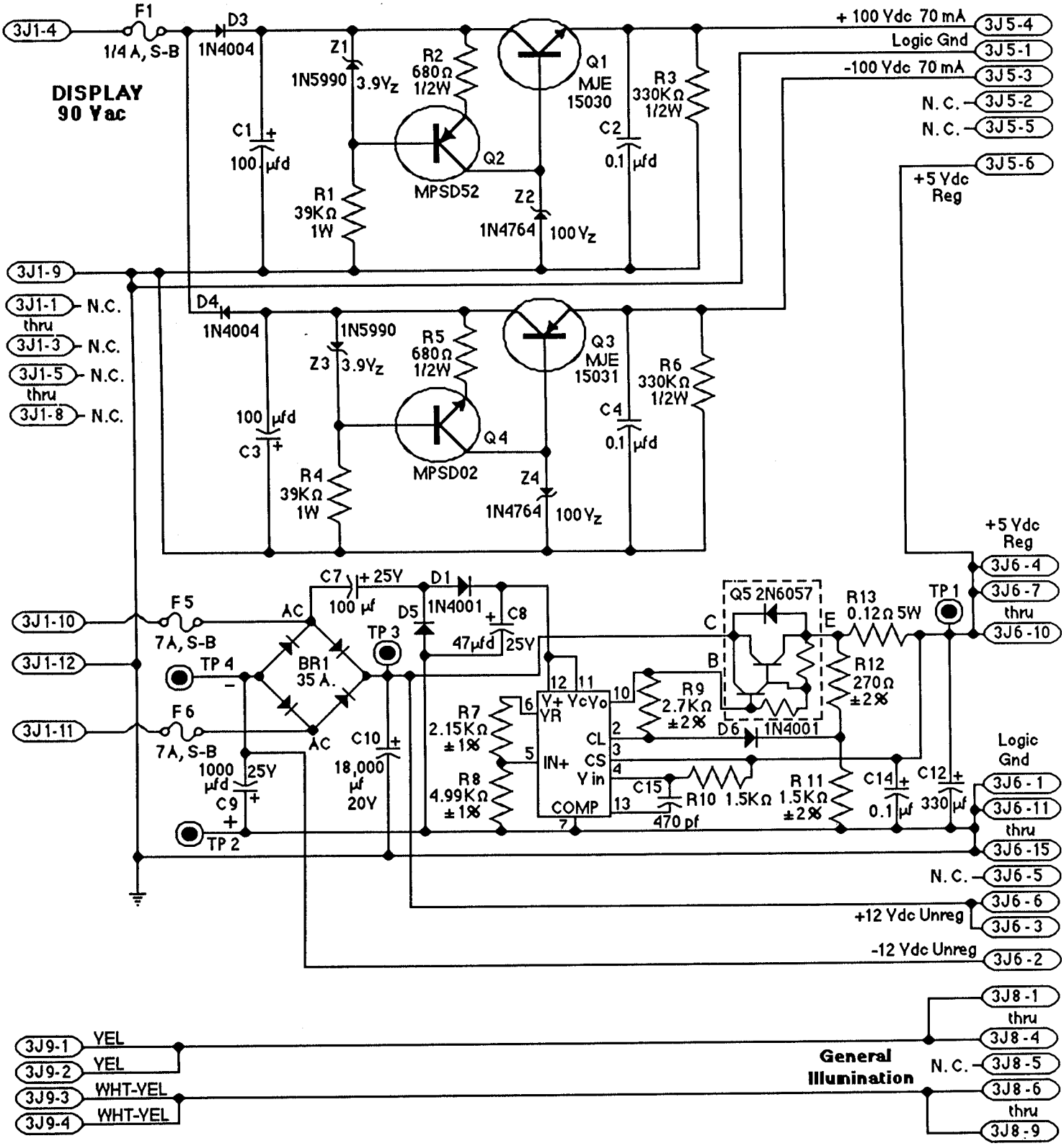
Locations: { **Playfield Circuit Boards** ⊡ / **Major Mechanisms** □

(Left to right from ball trough area)

C-11626-R-4	Lower Right Flipper Assembly	B-11984	Boomerang Loop Assembly
C-11626-L-4	Lower Left Flipper Assembly	C-11866	3-Lamp PC Bd ("3-R2")
B-9463	Right Kicker	C-11903-R	1-b Drop Target Opto Assembly
D-11999	11-Lamp PC Bd ("11-C")	C-11866	3-Lamp PC Bd ("3-L")
B-9463	Left Kicker	C-12004	3-Lamp PC Bd ("3-R3")
C-12005	3-Lamp PC Bd ("3-R1")	B-9414-1/B9415-1	Jet Bumper(s)/Coil(s)
B-11051-R	Shooter Lane Kickbig	C-11902-1	F. Wheel Relay PC Bd (Sol. 16)
B-11052	Kickbig Mounting Assembly	C-11900	Ferris Wheel /Motor Assembly
B-11051-R	Boomerang Kickbig	C-11998-1	Relay PC Bd (Sol. 10)
B-11052	Kickbig Mounting Assembly	C-12000	3-Lamp PC Bd ("3-C")



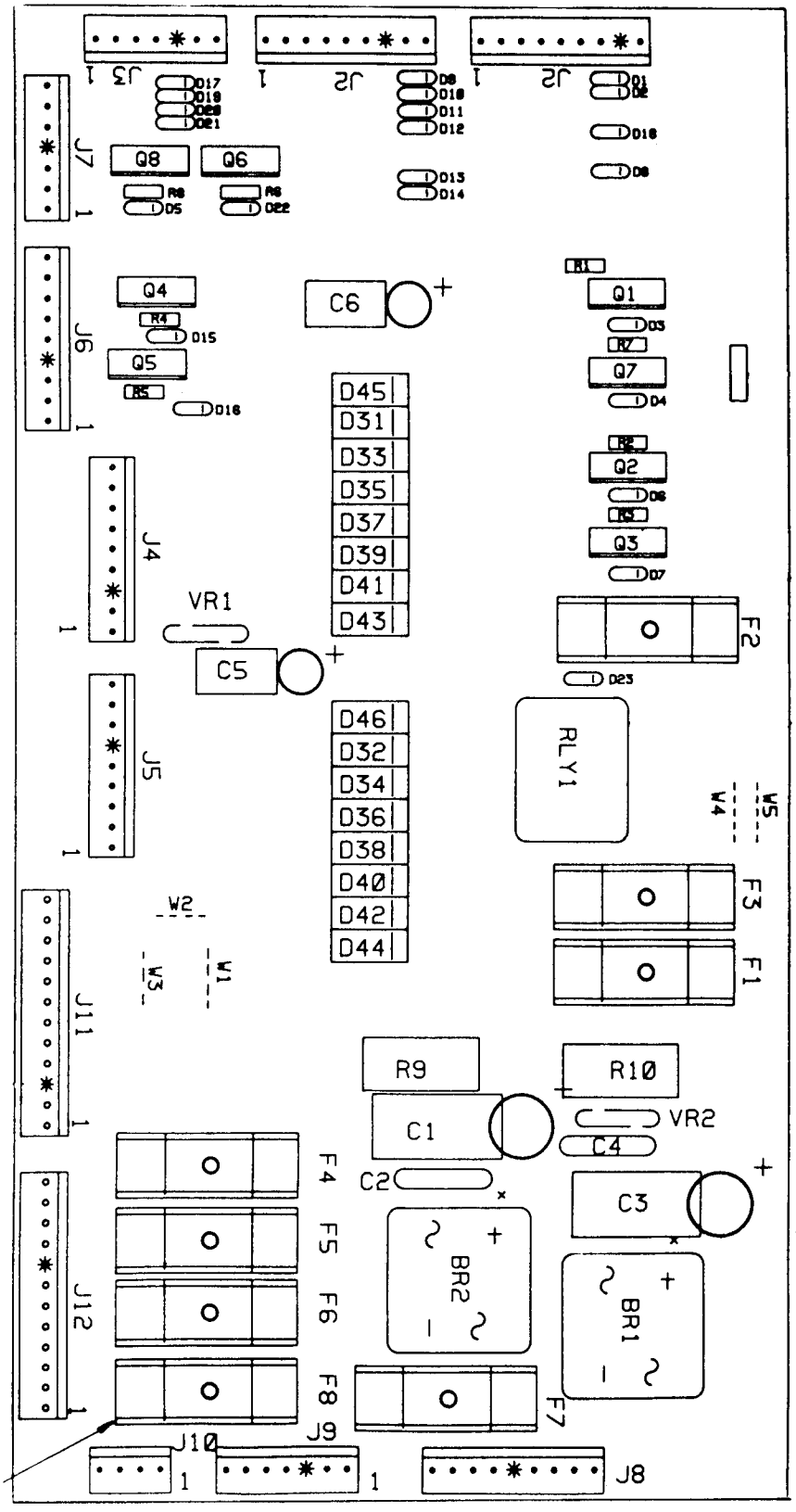
Cabinet Wiring Diagram



NOTES:

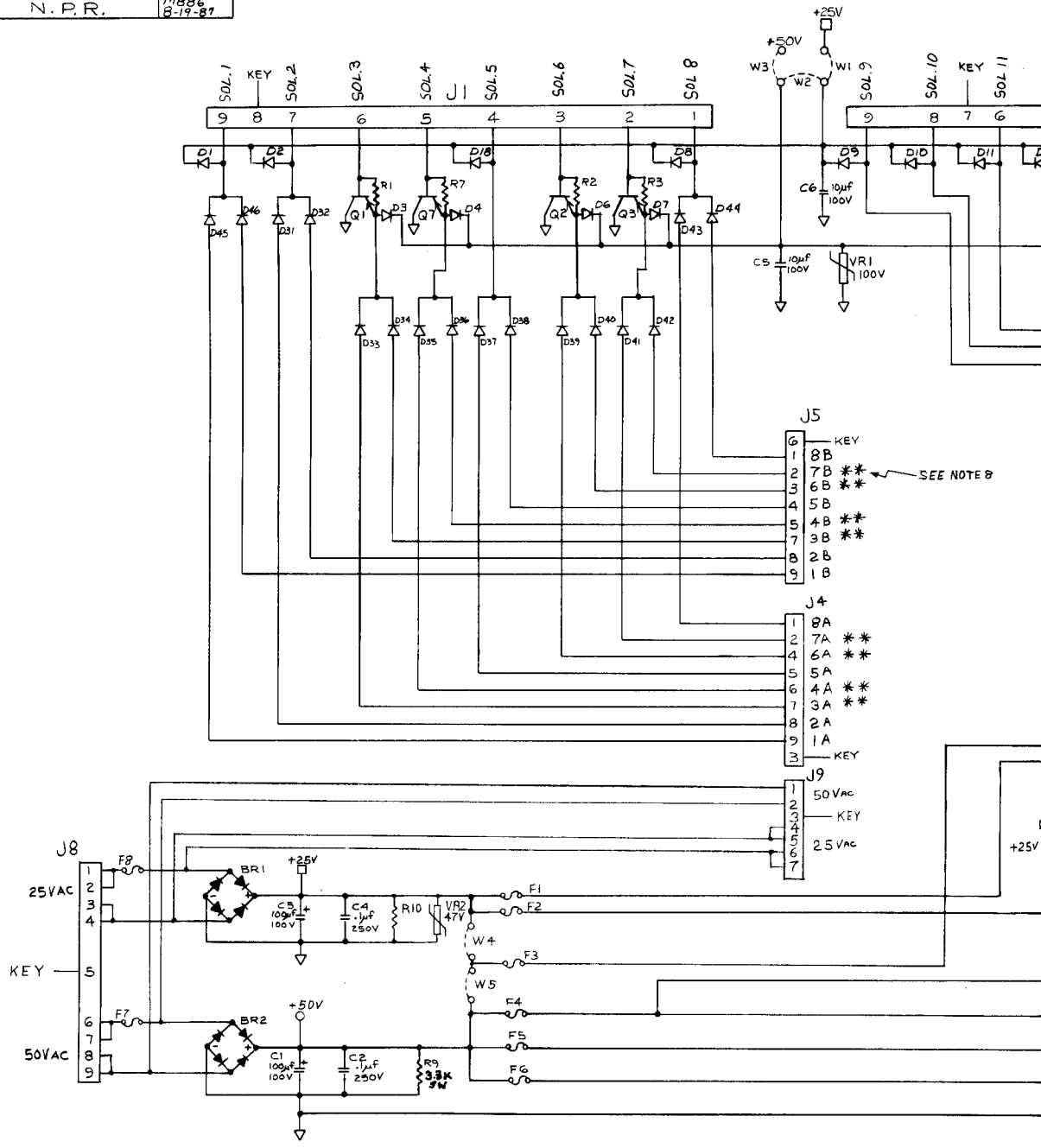
1. Display voltage measured with digits display test ON, and displays at all zeroes.
2. Unless otherwise indicated, all resistors are in ohms (Ω), 1/4 watt.
3. TP3 (unregulated +12 VDC) readout should not go lower than +10.5 V, or intermittent reset will occur.

D-8345-557 Power Supply Schematic



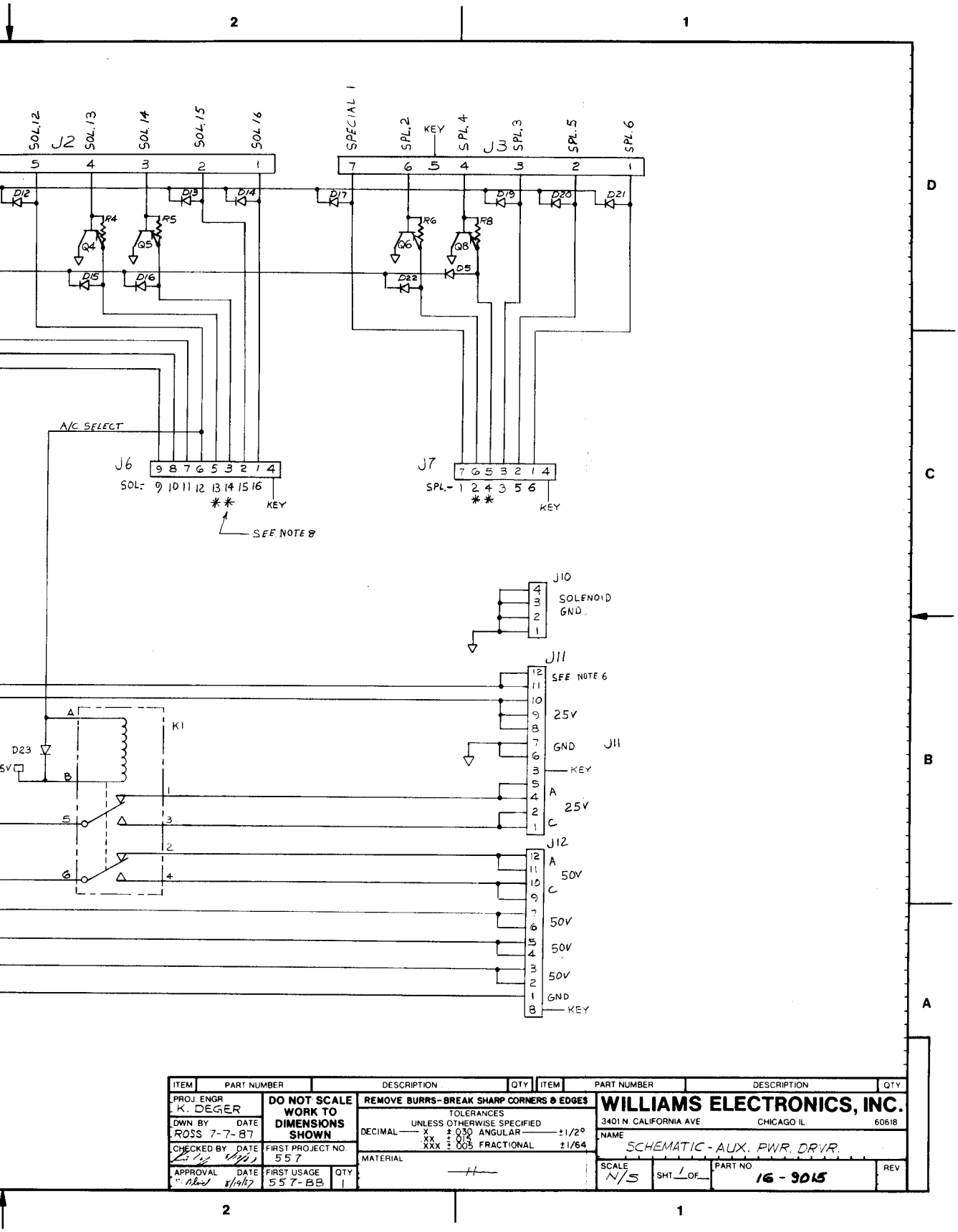
Aux Power Driver Board, D-11813

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N.P.R.	17886 8-19-87



NOTES:

1. R1-R8, 220Ω 1/4 W
2. Q1-Q8, TIP-36C
3. D1-D29, IN4003
4. D31-D46, MR501
5. BR1, BR2, 35A 250V
6. W1, W3, W4 JUMPERS SELECT COMBINATION OF 25V AND 50V COILS; W2, W3, W5 JUMPERS SELECT 50V COILS.
7. F1-F8, SEE APPROPRIATE ASSEMBLY FOR FUSE VALUES (D-11813-).
8. *, 50V COILS ONLY; **, 50V COIL OR FLASH LAMP ONLY.
9. VOLTAGES SPECIFIED UNDER FULL LOAD CONDITIONS.



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

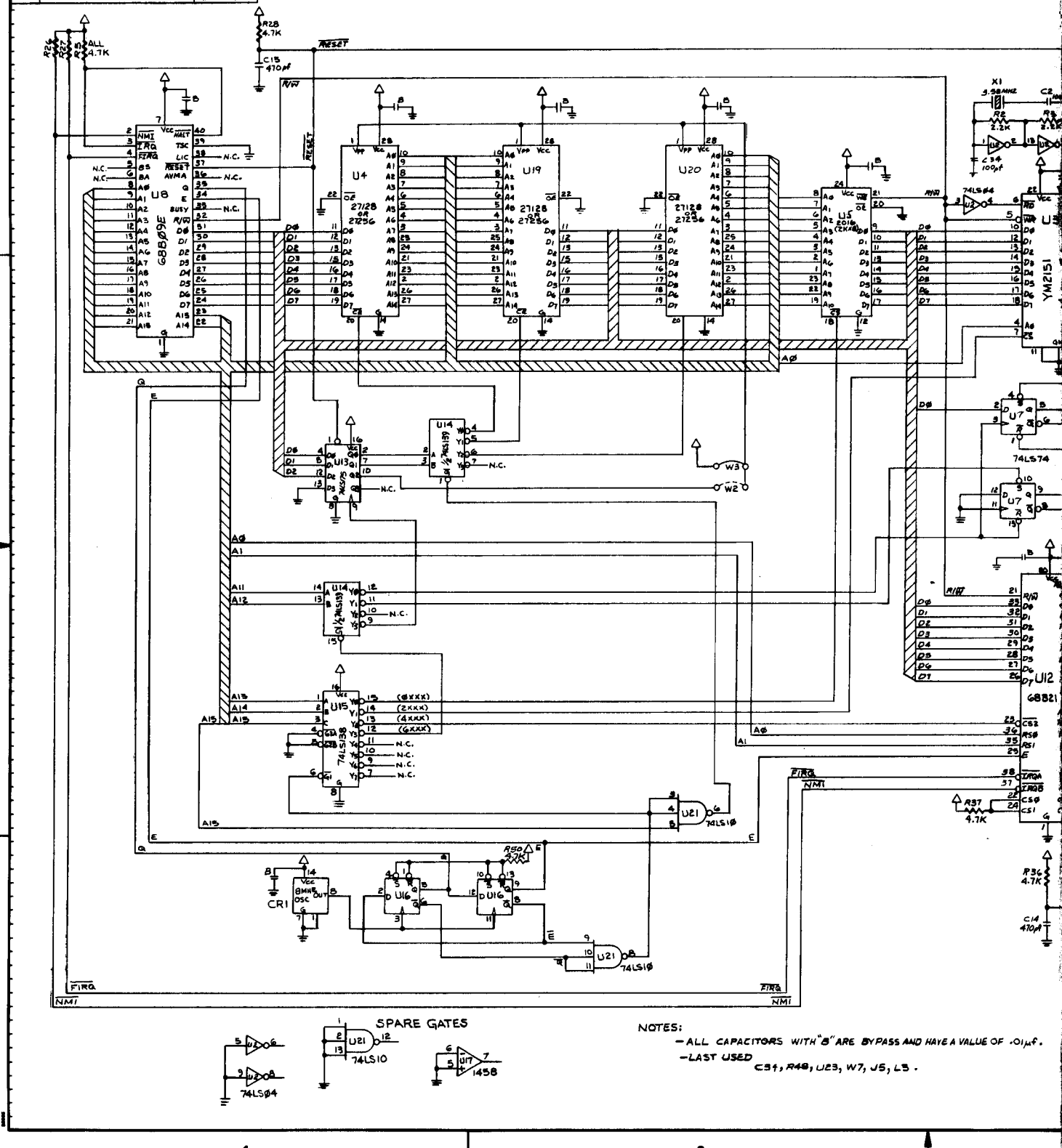
PROJ. ENGR: K. DEGER
DWN BY / DATE: ROSS 7-7-87
CHECKED BY / DATE:
APPROVAL / DATE: 8/19/87
DO NOT SCALE WORK TO DIMENSIONS SHOWN
FIRST PROJECT NO.: 557
FIRST USAGE: 557-BB
QTY: 1

REMOVE BURRS-BREAK SHARP CORNERS & EDGES
TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMAL — X ± .030 ANGULAR — ± 1/2°
XX ± .015
XXX ± .005 FRACTIONAL ± 1/64
MATERIAL

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618
NAME: SCHEMATIC - AUX. PWR. DRVR.
SCALE: N/S
SHT 1 OF
PART NO.: 16 - 9015
REV

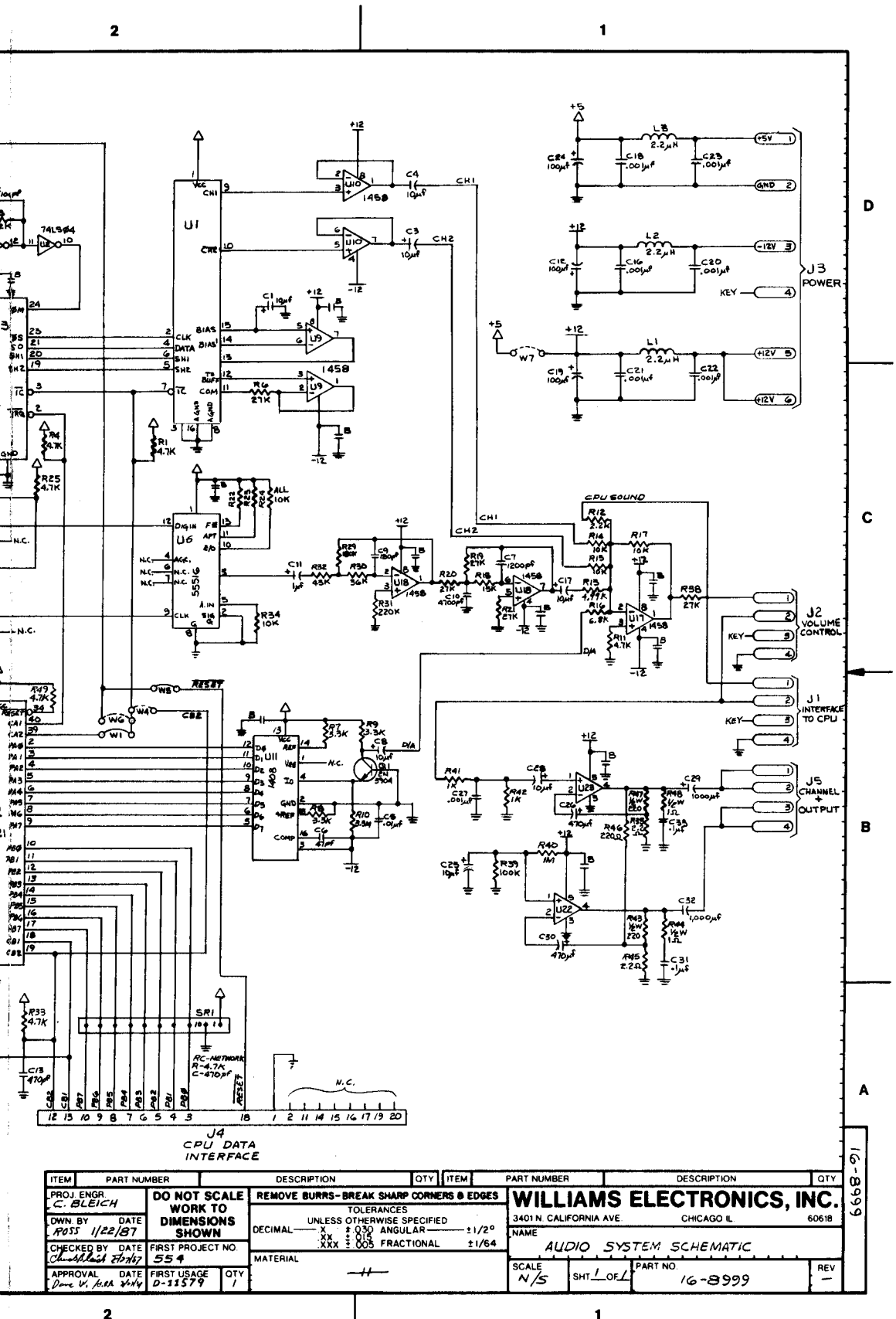
Aux Power Driver Board Schematic

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N. P. R.	16926 2-27-87



NOTES:

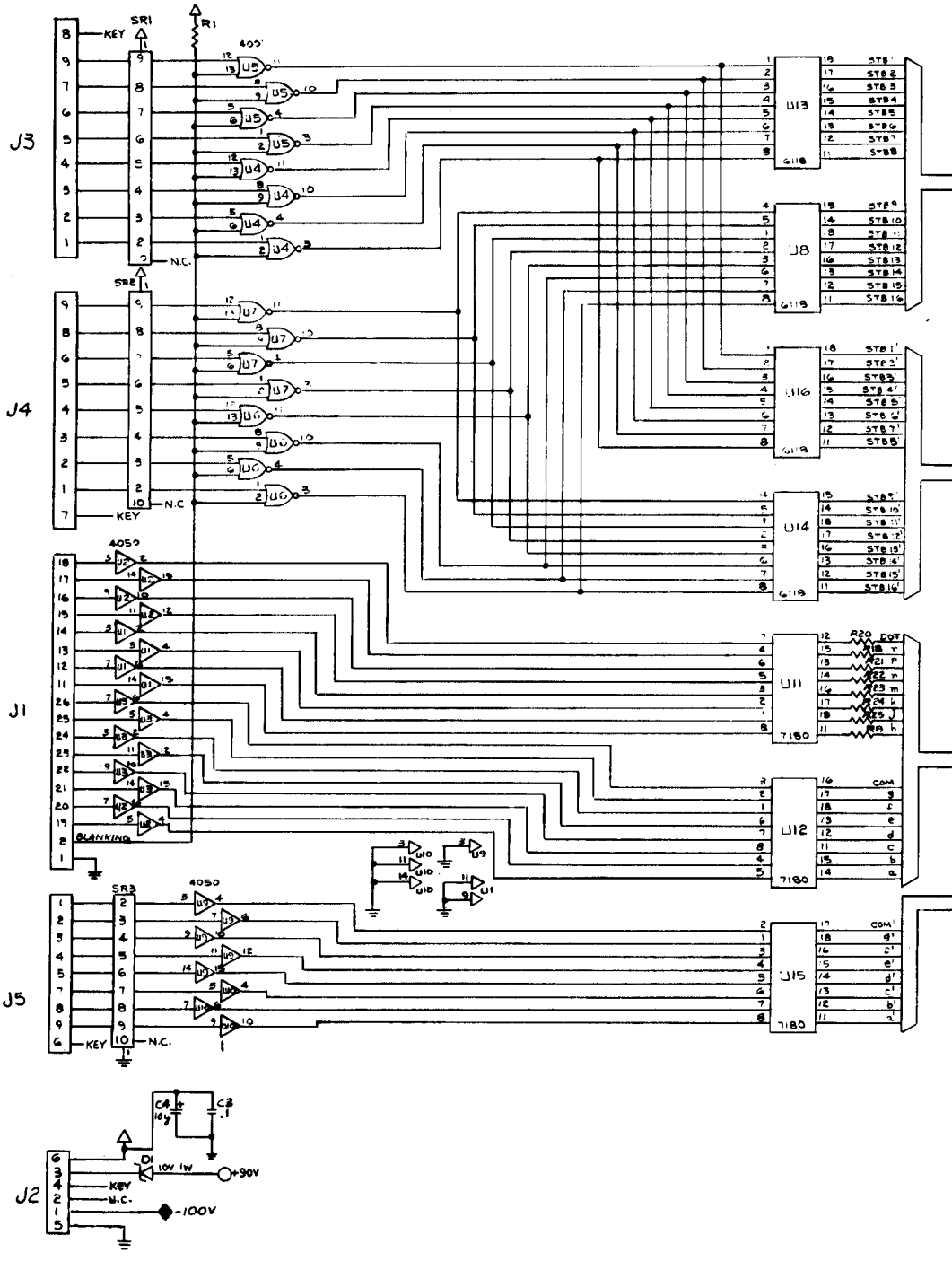
- ALL CAPACITORS WITH "B" ARE BYPASS AND HAVE A VALUE OF .01μf.
- LAST USED C34, R48, U23, W7, J5, L5.

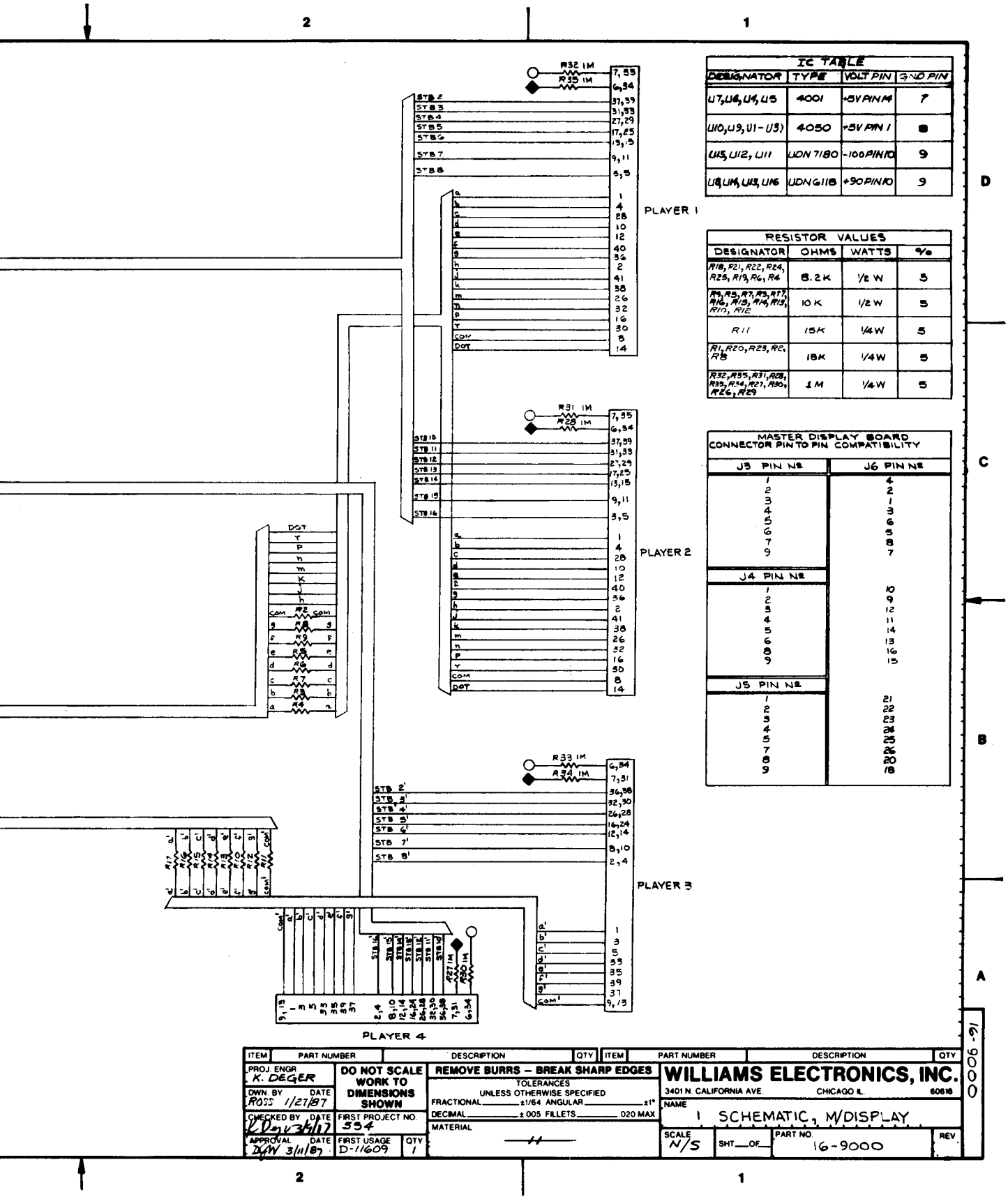


Audio Board (D-11581) Schematic

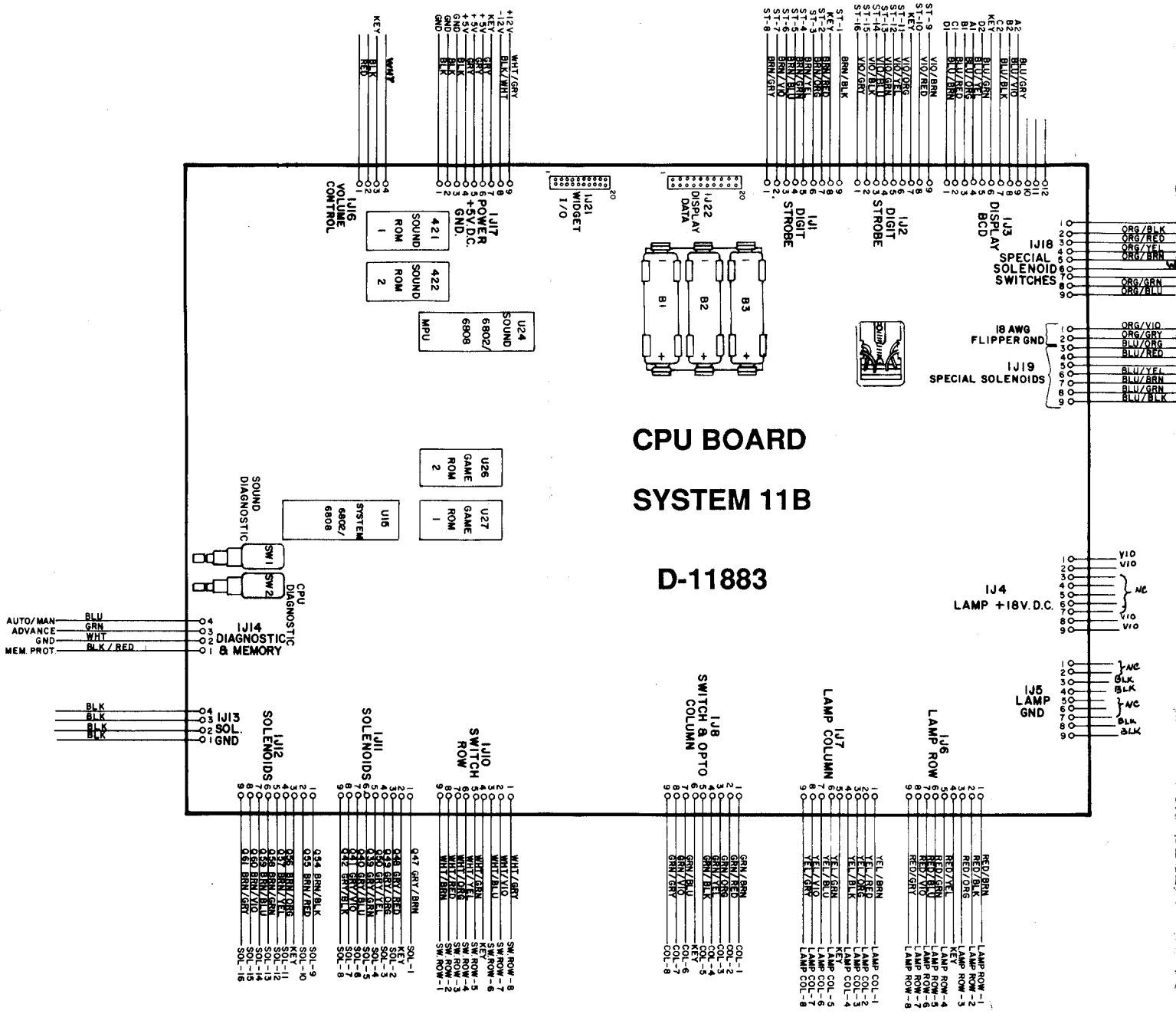
CYCLONE 46

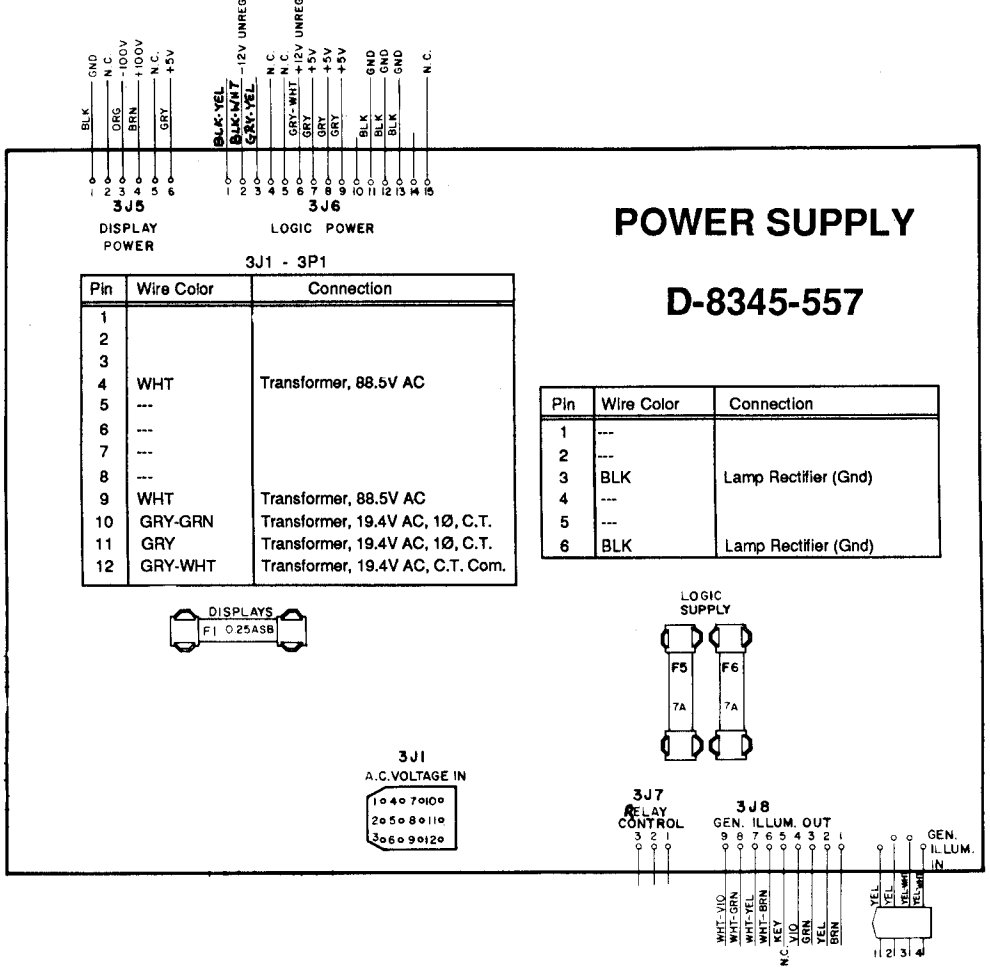
REV	DESCRIPTION OF CHANGE	ECN NO. DATE
	N. P. R.	16987 8-11-82





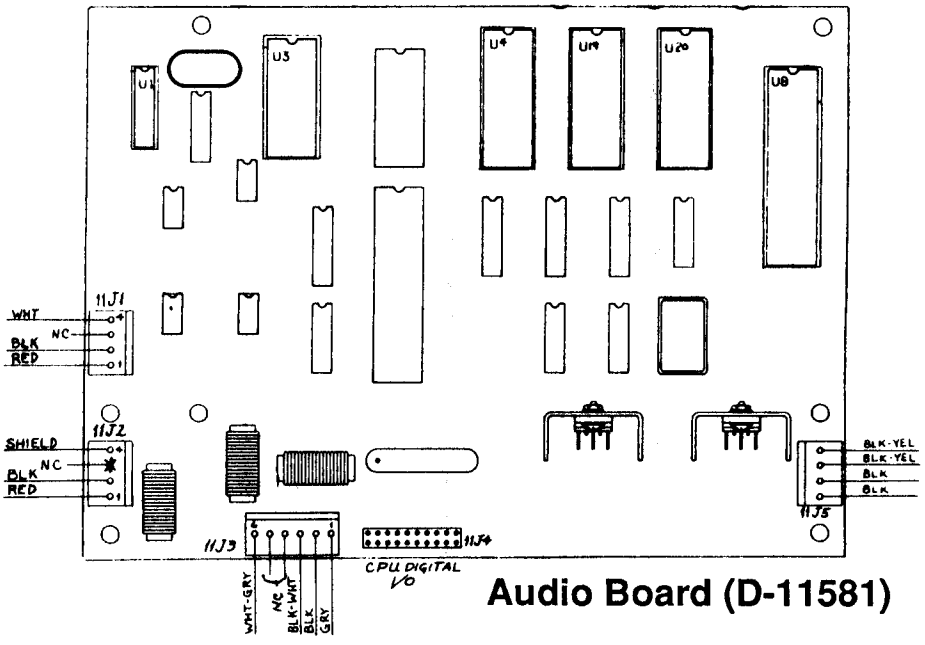
Alphanumeric Display Unit Board (D-11610) Schematic


CPU BOARD
SYSTEM 11B
D-11883
J16 VOLUME CONTROL
J17 POWER +5V.D.C. GND.
J21 WIDGET I/O
J22 DISPLAY DATA
J1 DIGIT STROBE
J2 DIGIT STROBE
J3 DISPLAY BCD
J18 SPECIAL SOLENOID SWITCHES
18 AWG FLIPPER GND
J19 SPECIAL SOLENOIDS
J4 LAMP +18V. D.C.
J5 LAMP GND
J6 LAMP ROW
J7 LAMP COLUMN
J8 SWITCH & OPTO COLUMN
J9 SWITCH ROW
J11 SOLENOIDS
J12 SOLENOIDS
J13 SOL. GND
J14 DIAGNOSTIC & MEMORY
CPU DIAGNOSTIC
SOUND DIAGNOSTIC
SW1
SW2
U15 SYSTEM 6802/6808
U24 SOUND 6802/6808 MPU
U26 GAME ROM 2
U27 GAME ROM 1
421 SOUND ROM 1
422 SOUND ROM 2
B1
B2
B3
AUTO/MAN
ADVANCE
GND
MEM. PROT



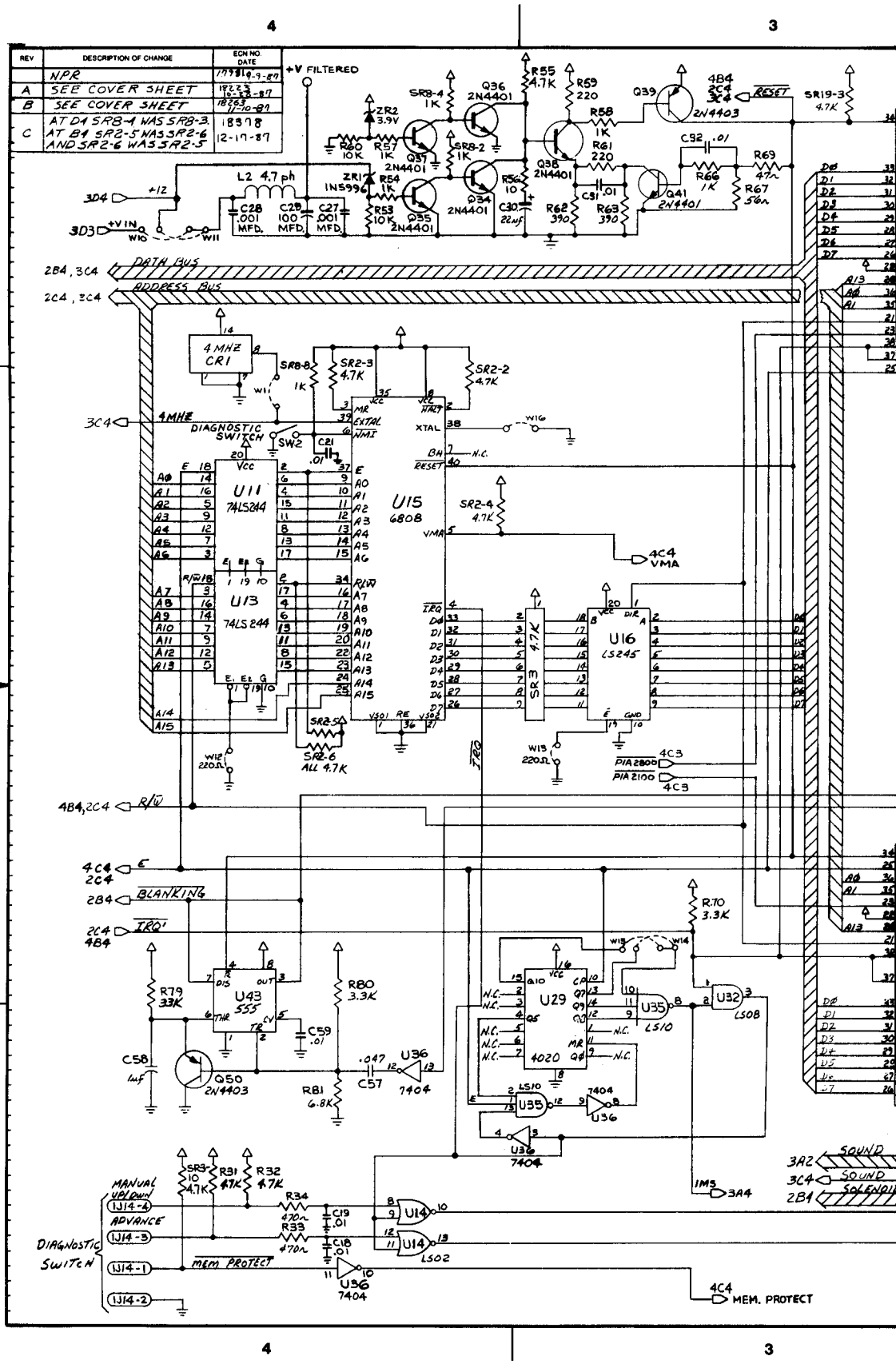
Pin	Wire Color	Connection
1		
2		
3		
4	WHT	Transformer, 88.5V AC
5	---	
6	---	
7	---	
8	---	
9	WHT	Transformer, 88.5V AC
10	GRY-GRN	Transformer, 19.4V AC, 1Ø, C.T.
11	GRY	Transformer, 19.4V AC, 1Ø, C.T.
12	GRY-WHT	Transformer, 19.4V AC, C.T. Com.

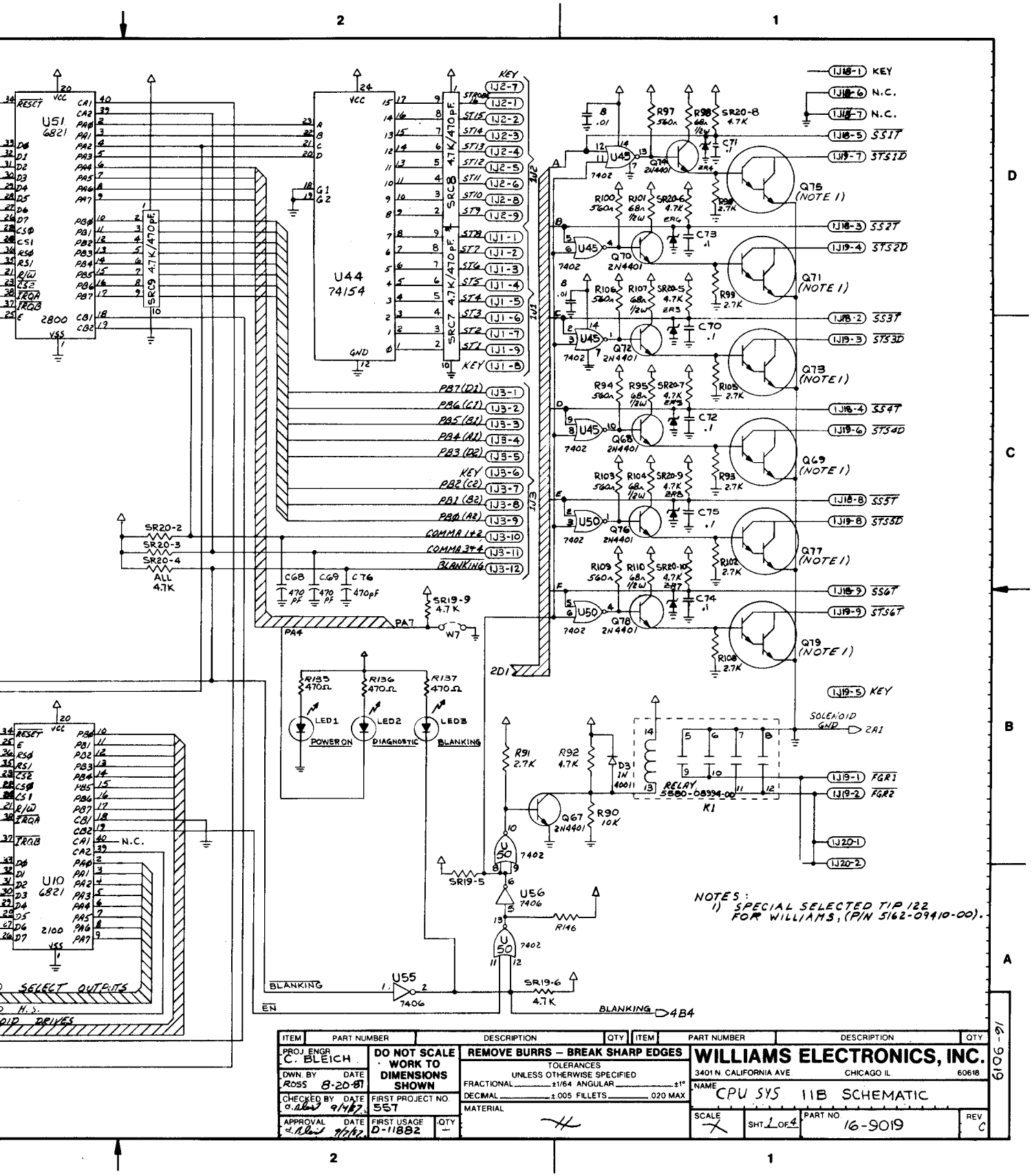
Pin	Wire Color	Connection
1	---	
2	---	
3	BLK	Lamp Rectifier (Gnd)
4	---	
5	---	
6	BLK	Lamp Rectifier (Gnd)



Audio Board (D-11581)

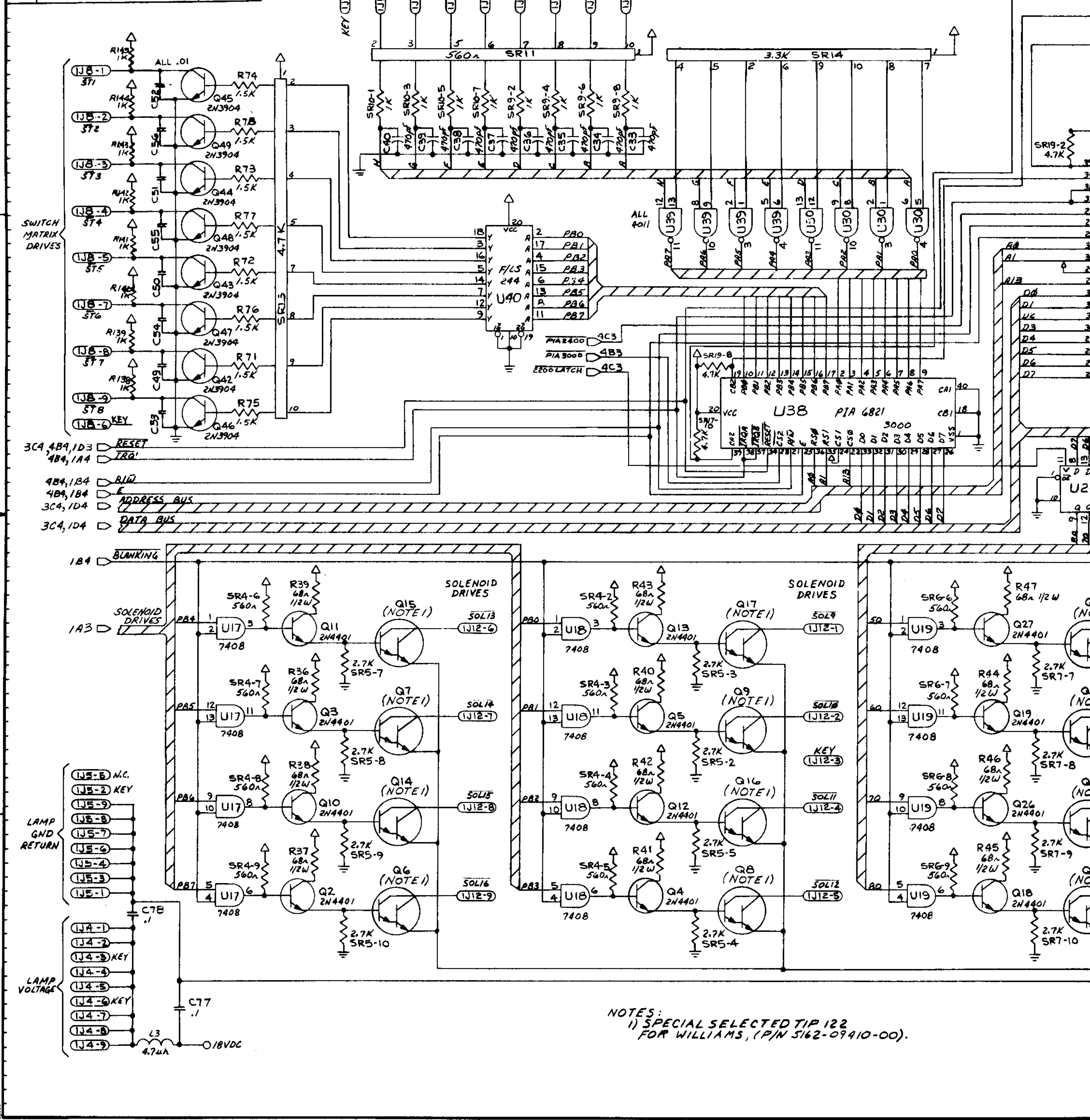
Interboards Signals Diagrams


REV
DESCRIPTION OF CHANGE
ECN NO. DATE
NPR
SEE COVER SHEET
SEE COVER SHEET
AT D1 SR8-1 WAS SR8-3. AT B1 SR2-5 WAS 3R2-6 AND 3R2-6 WAS 3R2-5
+V FILTERED
4 MHZ CR1
DIAGNOSTIC SWITCH
DATA BUS
ADDRESS BUS
U11 74LS244
U13 74LS244
U15 6808
U16 LS245
U29 4020
U43 555
U35 LS10
U32 LS08
U36 7404
U14 LS02
SOUND
SOLENOID
MEM. PROTECT
PIA 2800
PIA 2100
VMA
RESET
MANUAL UP/DOWN
ADVANCE
DIAGNOSTIC SWITCH
BLANKING
IRQ'
R/W
E

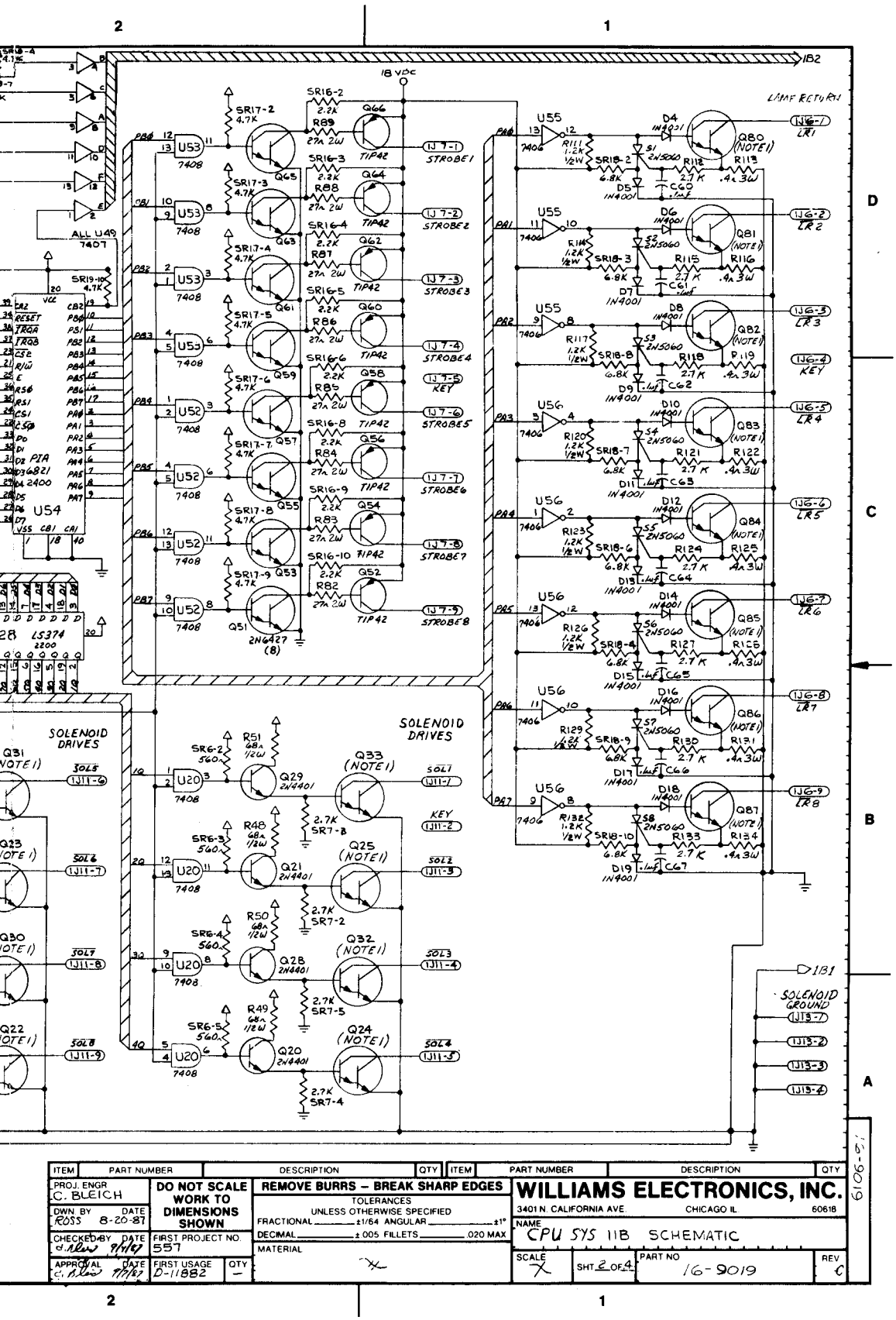


System 11B CPU Schematic (16-9019, Sheet 1 of 4)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	17981 9-9-87
A	SEE COVER SHEET	18223 10-20-87
B	SEE COVER SHEET	18268 11-18-87
	AT A4 C77 WAS C78 AND C78 WAS C77	18378 12-17-87



NOTES:
1) SPECIAL SELECTED TIP 122 FOR WILLIAMS, (P/N 5162-09410-00).



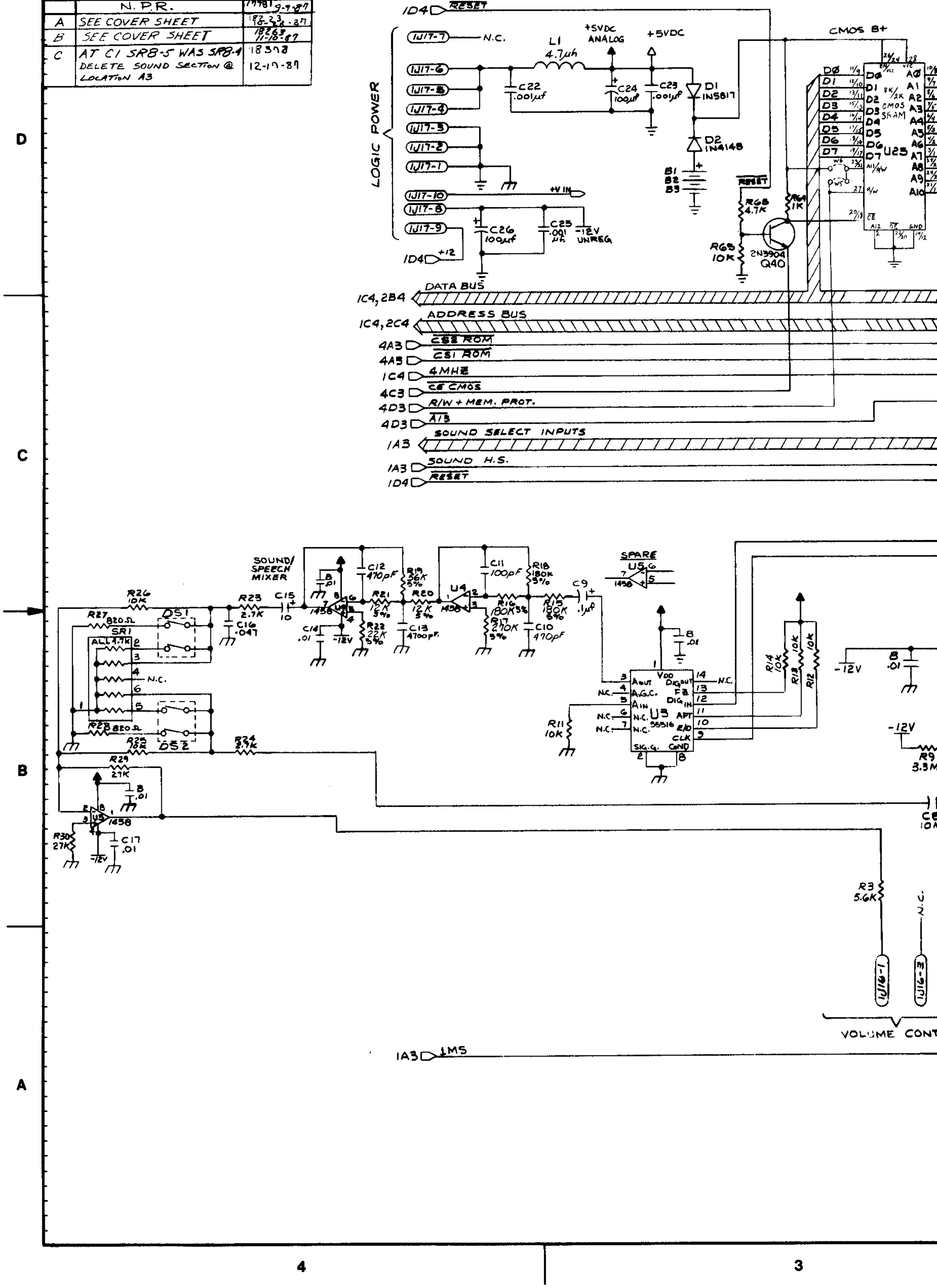
ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

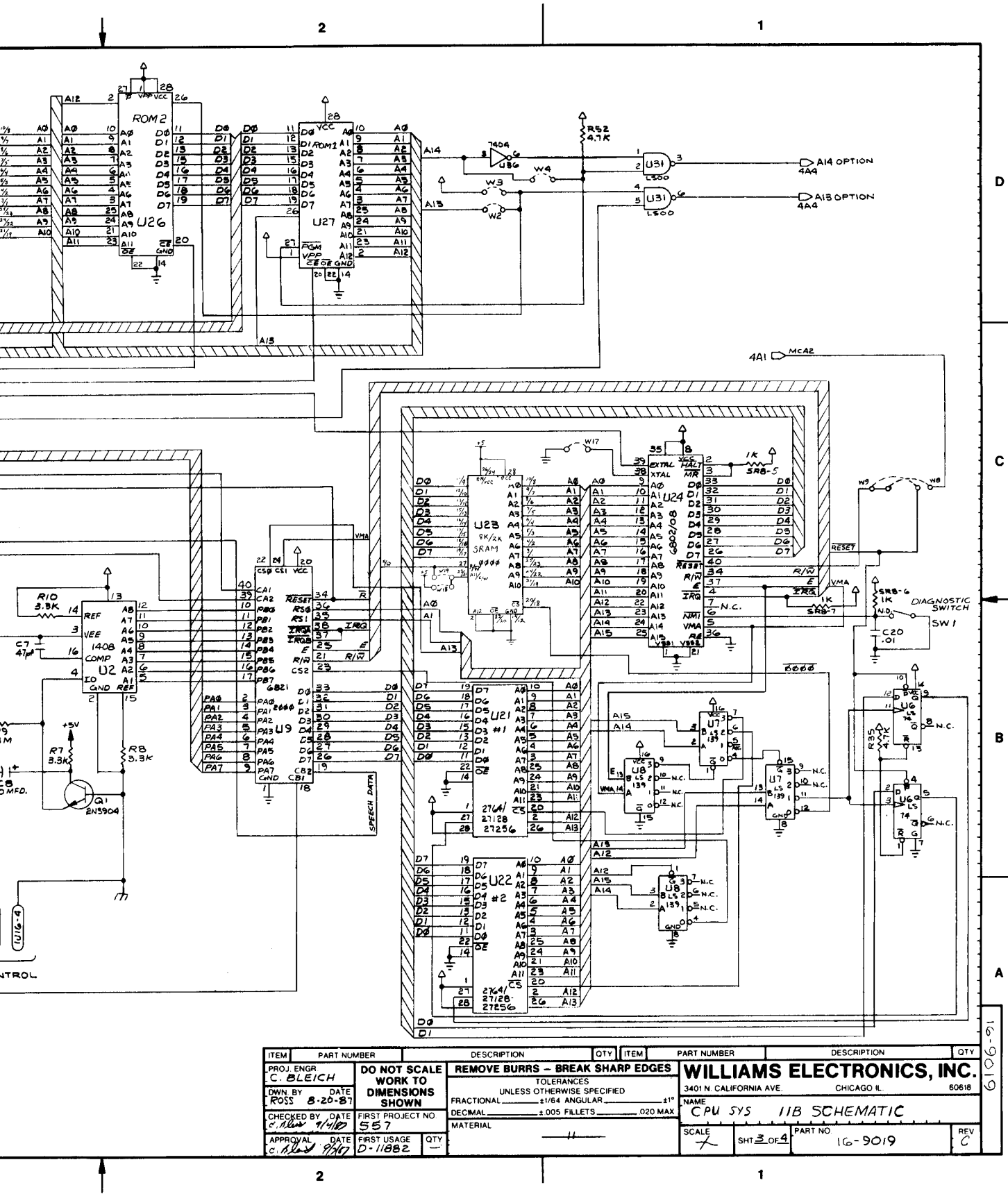
PROJ. ENGR. C. BLEICH	DO NOT SCALE WORK TO DIMENSIONS SHOWN	REMOVE BURRS – BREAK SHARP EDGES	WILLIAMS ELECTRONICS, INC.
DWN BY ROSS DATE 8-20-87		TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONAL ±1/64 ANGULAR ±1° DECIMAL ± .005 FILLETS .020 MAX	3401 N. CALIFORNIA AVE. CHICAGO IL. 60618
CHECKED BY DATE 9/4/87	FIRST PROJECT NO. 557	MATERIAL X	NAME CPU SYS 11B SCHEMATIC
APPROVAL DATE 9/7/87	FIRST USAGE D-11882 QTY —		SCALE X SHT 2 OF 4 PART NO 16-9019 REV C

6106-5

System 11B CPU Schematic (16-9019, Sheet 2 of 4)

REV	DESCRIPTION OF CHANGE	ECN NO. DATE
	N.P.R.	17981 9-9-87
A	SEE COVER SHEET	18723 10-23-87
B	SEE COVER SHEET	18263 11-10-87
C	AT C1 SR8-5 WAS SR8-4 DELETE SOUND SECTION @ LOCATION A3	18398 12-17-87





ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR. C. BLEICH
DWN. BY ROSS DATE 8-20-87
CHECKED BY C. Bleich DATE 9/4/87
APPROVAL C. Bleich DATE 9/8/87
DO NOT SCALE WORK TO DIMENSIONS SHOWN
FIRST PROJECT NO. 557
FIRST USAGE D-11882
QTY —

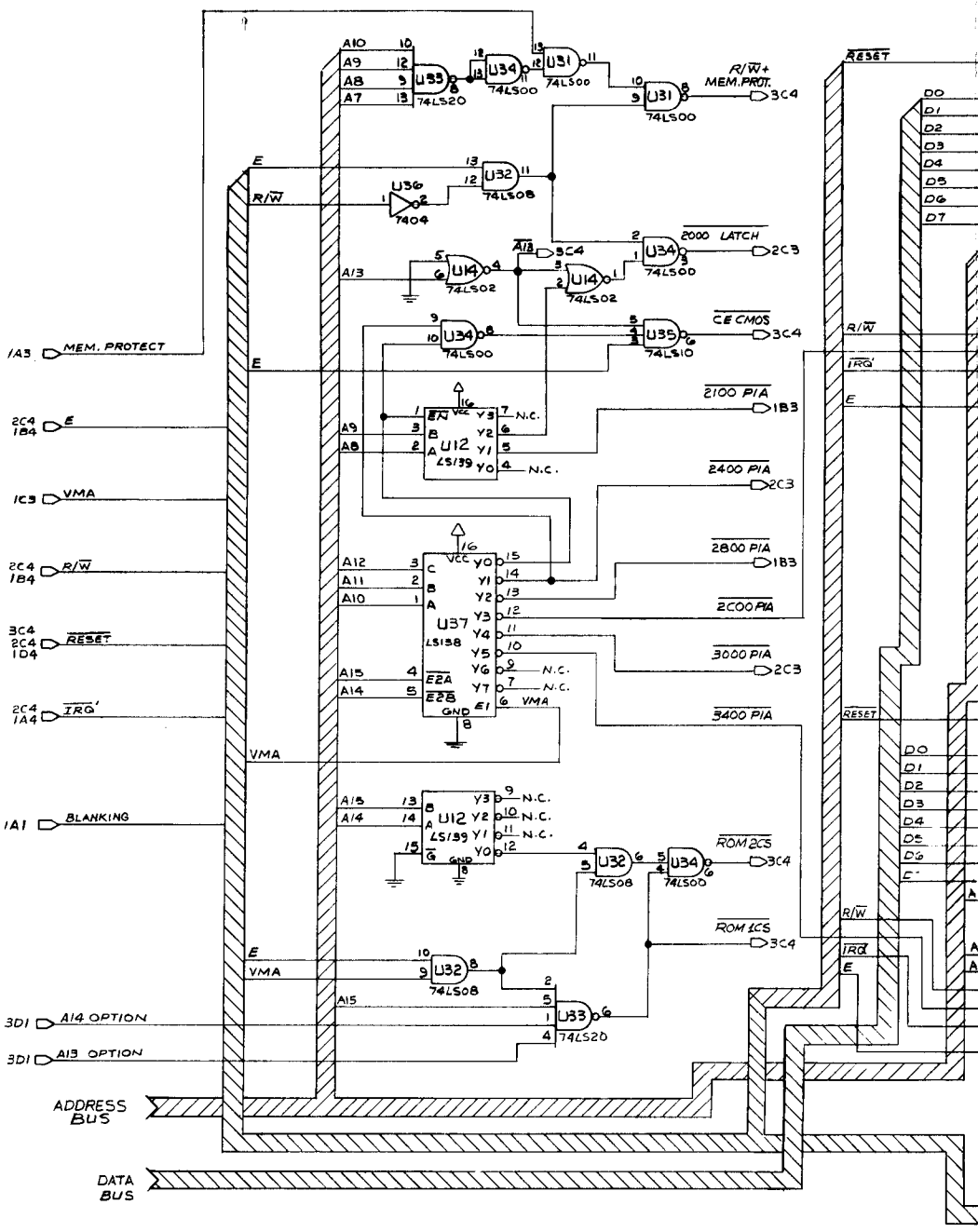
REMOVE BURRS – BREAK SHARP EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ± .005 FILLETS .020 MAX
MATERIAL —

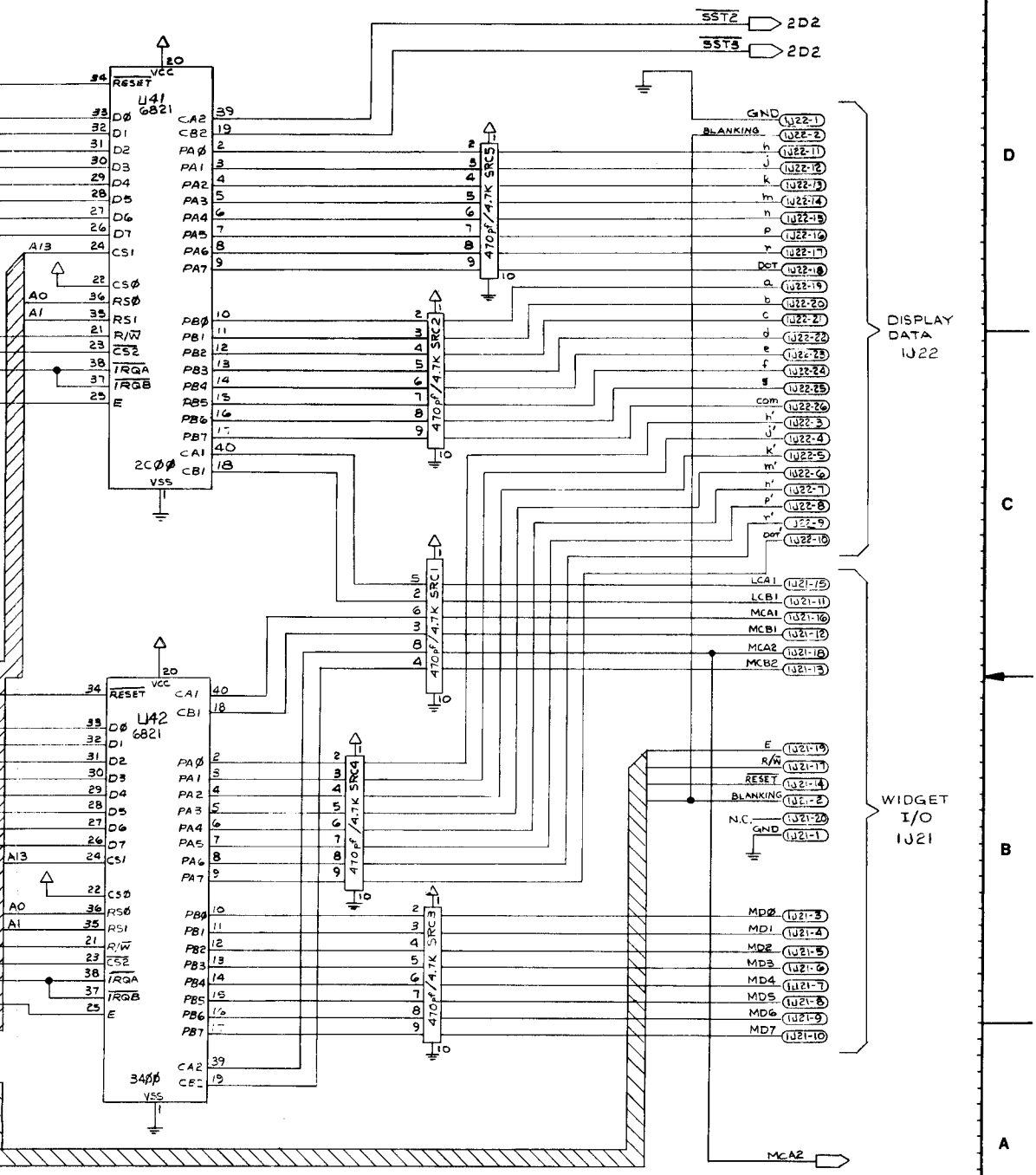
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618
NAME CPU SYS 11B SCHEMATIC
SCALE — SHT 3 OF 4 PART NO. 16-9019 REV C

16-9019

System 11B CPU Schematic (16-9019, Sheet 3 of 4)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
-	N. P. R.	17781 5-7-87
A	SEE COVER SHEET	18222 10-28-87
B	SEE COVER SHEET	18263 11-10-87
C	SEE SHEET 1-3	18478 12-11-87





ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR. C. BLEICH
DWN. BY ROSS 8-20-87 DATE
CHECKED BY DATE
APPROVAL DATE

DO NOT SCALE WORK TO DIMENSIONS SHOWN

REMOVE BURRS – BREAK SHARP EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ± .005 FILLETS .020 MAX
MATERIAL

FIRST PROJECT NO. 557
FIRST USAGE D-11882
QTY —

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618
NAME CPU SYS 11B SCHEMATIC
SCALE N/S
SHT 4 OF 4
PART NO. 16-9019
REV C

16-9019

System 11B CPU Schematic (16-9019, Sheet 4 of 4)

Backglass Lamps: 33 - 48 and 55 - 64

CYCLONE Lamp-Matrix Table

[2] Two Lamps

Lamps = #44 Bulb, p/n 24-6549
# 555 Bulb, p/n 24-8768

COLUMN / ROW	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 1 RED-BRN 1J6-1	HOLD 1	W/L SCORE FERRIS WHEEL [2] BONUS 9	RIDE AGAIN 17	EXTRA BALL Left Outlane 25	Mystery Wheel (tdc-top dead center) 33	Mystery Wheel (180 deg from tdc) 41	2X 49	500,000 Bonus (Backglass) 57
Q81 2 RED-BLK 1J6-2	BONUS 2	ADV. " X" 10	SPINS MYSTERY WHEEL 18	EXTRA BALL Right Outlane 26	Mystery Wheel (22-1/2 deg rt of tdc) 34	Mystery Wheel (157-1/2 deg left of tdc) 42	7X 50	1,000,000 Bonus (Backglass) 58
Q82 3 RED-ORN 1J6-3	DOUBLE 3	Balloon 25K (Ducks) 11	Ducks (top) 19	COMET 20K 27	Mystery Wheel (45 deg rt of tdc) 35	Mystery Wheel (135 deg left of tdc) 43	6X 51	1,500,000 Bonus (Backglass) 59
Q83 4 RED-YEL 1J6-5	SCORES 4	Balloon 50K (Ducks) 12	Ducks (mid) 20	COMET 40K 28	Mystery Wheel (67-1/2 deg rt of tdc) 36	Mystery Wheel (112-1/2 deg left of tdc) 44	5X 52	2,000,000 Bonus (Backglass) 60
Q84 5 RED-GRN 1J6-6	CYCLONE 50K 5	Balloon LITES EX. BALL (Ducks) 13	Ducks (bottom) 21	COMET 60K 29	Mystery Wheel (90 deg rt of tdc) 37	Mystery Wheel (90 deg left of tdc) 45	4X 53	2,500,000 Bonus (Backglass) 61
Q85 6 RED-BLU 1J6-7	CYCLONE 100K 6	1 (Gate Lane) 14	Ball Toss (top) 22	COMET 80K 30	Mystery Wheel (112-1/2 deg rt of tdc) 38	Mystery Wheel (67-1/2 deg left of tdc) 46	3X 54	3,000,000 Bonus (Backglass) 62
Q86 7 RED-VIO 1J6-8	CYCLONE Gate Bonus 7	2 (Gate Lane) 15	Ball Toss (mid) 23	COMET 100K 31	Mystery Wheel (135 deg rt of tdc) 39	Mystery Wheel (45 deg left of tdc) 47	MYSTERY (Backglass) 55	3,500,000 Bonus (Backglass) 63
Q87 8 RED-GRY 1J6-9	RIDE THE COMET (on ramp) 8	3 (Gate Lane) 16	Ball Toss (bottom) 24	COMET 1 Million 32	Mystery Wheel (157-1/2 deg rt of tdc) 40	Mystery Wheel (22-1/2 deg left of tdc) 48	WHEEL (Backglass) 56	4,000,000 Bonus (Backglass) 64

CYCLONE Switch-Matrix Table

COLUMN / ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1 WHT-BRN 1J10-9	Plumb Bob Tilt 1	Playfield Tilt 9	Ferris Wheel Entrance 17	Ball Shooter Lane 25	Not Used 33	Mystery Wheel Opto "Home" (Insert bd) 41	Not Used 49	Left Flipper Lane Change 57
2 WHT-RED 1J10-8	Not Used 2	Outhole 10	Drop Target (center) 18	Shuttle 10K (kickbig) 26	Score CYCLONE 34	Not Used 42	Not Used 50	Right Flipper Lane Change 58
3 WHT-ORN 1J10-7	Credit Button 3	Score Spook House 11	Ducks (top) 19	Shuttle 25K (bottom) 27	10 pt (R. Bottom) 35	Not Used 43	Not Used 51	Spot Ball Toss 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Not Used 12	Ducks (middle) 20	Shuttle 100K 28	10 pt (R. Middle) 36	Not Used 44	Not Used 52	Left Jet Bumper 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Boomerang Kickbig 13	Ducks (bottom) 21	Shuttle 25K 29	10 pt (R. Top) 37	Not Used 45	Left Outlane Ex. Ball 53	Right Jet Bumper 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	1 Lane 14	Ball Toss (top) 22	Shuttle 5K (top) 30	Not Used 38	Not Used 46	Right Outlane Ex. Ball 54	Bottom Jet Bumper 62
7 WHT-VIO 1J10-2	Slam Tilt 7	2 Lane 15	Ball Toss (middle) 23	Enter COMET Ramp 31	Not Used 39	Not Used 47	Left Return Lane 55	Left Kicker 63
8 WHT-GRY 1J10-1	High-Score Reset 8	3 Lane 16	Ball Toss (bottom) 24	Score COMET Ramp 32	Not Used 40	Not Used 48	Right Return Lane 56	Right Kicker 64

WARNINGS & NOTICES

WARNING

FOR SAFETY AND RELIABILITY, *WILLIAMS ELECTRONICS GAMES* does not recommmend or authorize any substitute parts or modifications of *WILLIAMS'* equipment. Use of Non-*WILLIAMS'* parts, or modifications of game circuitry, may adversely affect game play, or may cause injuries.

SUBSTITUTE PART OR EQUIPMENT 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 interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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FCC STICKER. Check the back of your *CYCLONE* game to verify that an FCC-certification sticker was attached to your game at the factory.

All games that leave *WILLIAMS'* plants have been tested and found to comply with FCC Rules. Because the sticker is proof of this fact, legal repercussions to the owner and distributor of the game may result, if the sticker is missing. If you receive any *WILLIAMS'* game, manufactured after December 1982, that has no FCC sticker, call *WILLIAMS'* for advice or write us a note on your Game Registration Card. Be sure that the card bears your game's serial number.

RF Interference Notice

CABLE HARNESS PLACEMENTS and ground strap routing on this game have been designed to keep RF radiation and conduction within levels accepted by the FCC Rules.

TO MAINTAIN THESE LEVELS, reposition harnesses and reconnect ground straps to their original placements, if they become disconnected during maintenance.

Notice

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WARNING: **Transport this game ONLY with hinged backbox down!**