ASTRO

ASTRO GAMES INC.

BLACK SHEEP SQUADRON

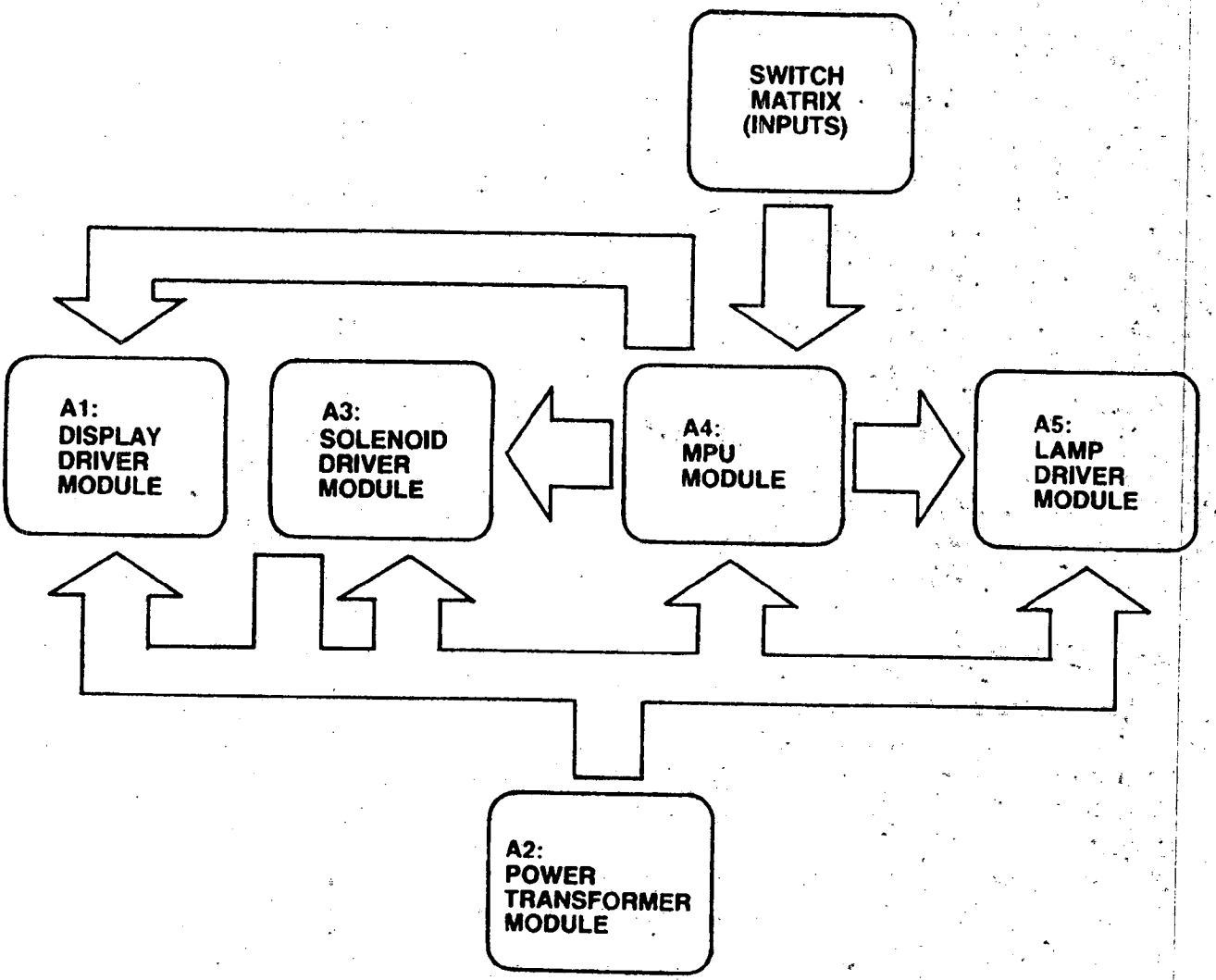
OPERATING MANUAL

ASTRO #750039

INSTALLATION AND GENERAL GAME OPERATION INSTRUCTIONS

INDEX

BLOCK DIAGRAM -- ASTRO ELECTRONIC PINBALL GAME



INSTALLATION

ASSEMBLE THE GAME AS FOLLOWS:

Bolt legs to cabinet. Bolt back box to cabinet. Use flat washers under bolt heads. Gently feed cable connectors and ground braid through cable port in back box. Carefully and fully insert connectors on printed circuit assemblies.

On all games there are certain items that should be checked after shipment. These are visual inspections which may avoid time consuming service work later. Minor troubles caused by abusive handling in shipment are unavoidable. Cable connectors may be loosened, switches (especially tilt switches) may go out of adjustment. Plumb bob tilt switch should always be adjusted after game is set on location and leg levelers are adjusted.

Visual inspections before plugging in line cord:

1. Check that all cable connectors are completely seated on printed circuit assemblies.

2. Check that cables are clear of all moving parts.

3. Check for any wires that may have become disconnected.

4. Check switches for loose solder or other foreign material that that may have come loose in shipment and could cause shorting of contacts.

5. Check wires on coils for proper soldering. Cold solder connections may not show up in factory inspection, but vibration in shipment may break contact.

6. Check that fuses are firmly seated and making good contact.

Check adjustment of the three (normally open) tilt and slam switches:

1. Plane (slam) switch on Chime board, left side of cabinet near front door.

2. Plumb bob tilt (same location).

3. Ball tilt above plumb bob tilt. Insert the smaller ball (15/16" dia.) into the ball tilt assembly, and adjust the bracket so the ball will roll free to contact the switch blade, if front of cabinet is raised.

GENERAL GAME OPERATION

PLACE BALL INTO PLAYFIELD BY OUTHOLE.

Insert coin in both coin slots (power off). Coin should be rejected. Plug in line cord. Move power ON-OFF switch at bottom right front corner of cabinet to 'ON' position. The game will play a power-up tune to announce game-readiness targets are reset, scores are set to zero, alternating with the 'High Game to Date', and the game is ready for play. Insert coin. The game should accept the coin and post credits* for coins accepted (adjustable). Pressing the credit button (game start) on the door will cause the outhole kicker to serve the ball to the shooter alley. The first player-up lite is lit. A game-up tune* is played to announce play-readiness. The bonus score is advanced to 1000 points.

One player is posted each additional time the credit button is pressed (one to four can play). The credits are reduced by one each time the credit button is pressed until the credits are reduced to zero.

Shooting the ball initiates play. Rebound switches score 10 points. Thumper-bumpers, when not lit, score 100 points.

The game awards all points earned by the player. If spinner is turning and scoring when the ball hits a target, the spinner and the target scores are awarded.

When the ball enters the outhole, the bonus score is added to the total score. The player-up and/or ball in play on the back box is advanced one position. The bonus score is advanced to 1000 points. The outhole kicker serves the ball to the shooter alley and play is resumed. This continues until each player has played the allowable number of balls per game (adjustable). At this time the 'Game Over' light is lit. A random Match* number appears and the 'Match' light is lit. If the number is the same as the last two digits in a player's score, a free game is awarded.

Extra balls won during the course of the game are played immediately after the player's regular ball enters the outhole. The player-up and/or ball in play on the back box are not advanced for extra ball play. Bonus score is added to the player's score and the bonus is set to 1000 points before the game serves the extra ball for play.

At the end of the game, a 'High Game to Date' is alternately flashed with all 4 player scores. If the "High Game to Date' is beat, this feature* awards free games.

Tilting the game results in loss of a ball. The flippers, thumper-bumpers, etc. go 'dead'. Bonus points are not scored. The purpose of the tilt penalty is to discourage the player from jostling the machine in an attempt to prolong play. Game action becomes normal after the ball kicker assembly serves the ball to the shooter alley.

Slamming the machine results in loss of the game. All feature lights go out,

the game goes 'dead', and a time delay occurs. The purpose of the time delay is to discourage unnecessary abuse of the machine. After the delay, the "Game Over" light lites and the power-up tune is played. The time delay occurs anytime one of the slam switches is made to contact. There is one factory installed slam switch on the front door. (Any number of slam switches could be installed by the operator, to meet his individual requirement.) The switch should be adjusted to have approximately 1/16" gap between the contacts. The weighted blade should be adjusted to attain the desired sensitivity. Decreasing the gap between contacts will make the switch more sensitive. Opening the gap will reduce sensitivity.

*Some tunes and features can be disabled by operator if so desired. See Back Box Adjustments.

BOOKKEEPING FUNCTIONS

The game is designed to help the operator perform certain accounting functions. The game can display the number of total play and replays (free games). It can display the number of coins dropped down each coin chute. The bookkeeping functions are displayed on all player score displays simultaneously. An identification number, 05 to 11 appears on the Match/Ball in Play window as follows:

05-- 00 to-- 40=	Current Credits
*06-10000 to--999999 =	Total Plays (Payed & Free Games)
*07-10000 to--999999 =	Total Replays (Free Games)
08-- 00 to--999999=	Total times 'High Game to Date' is beat
*09-10000 to--999999 =	Coins Dropped thru Coin Chute #1
*10--	Void (May be random number-no significance).
*11-10000 to--999999 =	Coins Dropped thru CoinChute #2

The game displays the first bookkeeping entry if the Self-Test button (see Fig. 111) on the inside of the front door is pressed nine times. Alternately push and release the Self-Test button at one second intervals. The number 05 appears in the 'Match/Ball in Play' window. Current credits appear on the player score displays. Each additional press of the button causes the next entry to be displayed.

After the data in each bookkeeping register is recorded, it can be set to zero simply by pressing switch button S33, located on A4, the MPU module in the back box. (See Fig. 111). Any or all accumulated totals can be cleared by alternating between the Self-Test button and the switch button on the MPU module. The operator is given this option as a possible convenience and can elect to use or not use it as his needs direct.

Pressing the button once more with the eleventh entry displayed causes the game to play the power-up tune and light the Game-Over light.

*The 10,000 level is pre-set at the factory; can be set to zero, initially, if desired.

FEATURE OPERATION & SCORING

A. BONUS SCORE FEATURE:

A bonus score of 1000 to 95,000 points may be scored. The game starts with a bonus score of 1000 points. The bonus score advances each time the ball rolls over the lit top rollover button, rolls over alley rollover buttons, hits target, rolls over the lit midfield rollover button or goes through either right or left outlane.

B. BONUS COLLECT AND BONUS MULTIPLIER:

When the ball goes into the outhole: The lit bonus score is added to the player's total score; if the 2X lite is lit, the bonus score is added to the player's total score twice; if the 3X lite is lit, the bonus score is added three times; if the 5X lite is lit, the bonus score is added five times. A tilt nullifies the bonus score.

C. BONUS COUNT DOWN SELECTION:

With S22 off, bonus is collected with each count multiplied by the lit bonus multiplier light (2X, 3X, 5X). If none are lit, bonus is multiplied by one. With S22 on, bonus is collected one count at a time. If a bonus multiplier is lit, bonus is collected the number of times indicated by the lit bonus multiplier light.

D. SPECIAL: REPLAY/X-BALL/NOVELTY MODES:

Switch #31 and #32 give the operator flexibility to award a Replay, Extra Ball or score (Novelty) when a Special is scored. The following chart explains the settings:

	S31	S32
Special Award	---	---
10,000 Points	OFF	OFF
Extra Ball	ON	OFF
Replay	OFF	ON
Extra Ball and Replay	ON	ON

E. TOP SAUCER FEATURE:

A ball in the top saucer scores 5000 points and lit feature then kicks out.

F. THUMPER-BUMPER ADJUSTMENT:

Each of (3) Thumper Bumpers score 1000 points when lit and 100 points when not lit. They are controlled as follows:

	Switch #16
All Bumpers ON constantly (Liberal)	OFF
1 bottom; 2 top bumpers alternate ON/OFF with each multiple score (Conservative)	ON

GAME ADJUSTMENTS

A. Playfield Panel Post Adjustments:

Posts that control left and right outlane opening on panel can be moved to make access to outlanes easier or harder for ball to enter. See Figure II.

Easier entry will decrease playing time and scoring (conservative).
Harder entry will increase playing time and scoring (liberal).

B. Back Box Game Adjustments:

Each game has thirty-two switches located on A4, the MPU module, located in the back box, that allow play to be customized to the location. See Figure III. Credits per coin, maximum credits, credit display, balls per game, match feature, high game feature, special award and melody are selectable by means of the switches. The switches are contained in four-sixteen lead packages numbered S1-8, S9-16, S17-24 and S25-32 for easy identification. The "ON" toggle position is marked on the assembly. **Turn off power before making adjustments.**

CREDITS/COIN ADJUSTMENTS

COIN CHUTE	SWITCHES					CREDITS/COIN
#1 (HINGE SIDE)	5	4	3	2	1	
#2	13	12	11	10	9	
	OFF	OFF	OFF	OFF	OFF	3/2 COINS**
	OFF	OFF	OFF	OFF	ON	3/2 COINS**
	OFF	OFF	OFF	ON	OFF	1/COIN
	OFF	OFF	OFF	ON	ON	1/2 COINS*
	OFF	OFF	ON	OFF	OFF	2/COIN
	OFF	OFF	ON	OFF	ON	2/2 COINS*
	OFF	OFF	ON	ON	OFF	3/COIN
	OFF	OFF	ON	ON	ON	3/2 COINS*
	OFF	ON	OFF	OFF	OFF	4/COIN
	OFF	ON	OFF	OFF	ON	4/2 COINS*
	OFF	ON	OFF	ON	OFF	5/COIN
	OFF	ON	OFF	ON	ON	5/2 COINS*
	OFF	ON	ON	OFF	OFF	6/COIN
	OFF	ON	ON	OFF	ON	6/2 COINS*
	OFF	ON	ON	ON	OFF	7/COIN
	OFF	ON	ON	ON	ON	7/2 COINS*
	ON	OFF	OFF	OFF	OFF	8/COIN
	ON	OFF	OFF	OFF	ON	8/2 COINS*
	ON	OFF	OFF	ON	OFF	9/COIN
	ON	OFF	OFF	ON	ON	9/2 COINS*
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	ON	OFF	ON	ON	OFF	11/COIN
	ON	OFF	ON	ON	ON	11/2 COINS*
	ON	ON	OFF	OFF	OFF	12/COIN
	ON	ON	OFF	OFF	ON	12/2 COINS*
	ON	ON	OFF	ON	OFF	13/COIN
	ON	ON	OFF	ON	ON	13/2 COINS*
	ON	ON	ON	OFF	OFF	14/COIN
	ON	ON	ON	OFF	ON	14/2 COINS*
	ON	ON	ON	ON	OFF	15/ COIN
	ON	ON	ON	ON	ON	15/2 COINS*

*No Credits until second coin is dropped
**One Credit for first coin. Two Credits for second coin provided that no scoring occured between 1st and 2nd coin drops. If scoring occured second coin gives one credit

MAXIMUM CREDITS:

The maximum credits accepted by the machine limits the number of games that can be accumulated by coining, by winning replays or both. The maximum number of credits is selectable by means of switches 17, 18 and 19. Eight credits limits are available. Switch settings are listed below.

MAXIMUM CREDITS	SWITCHES 19	18	17
5	OFF	OFF	OFF
10	OFF	OFF	ON
15	OFF	ON	OFF
20	OFF	ON	ON
25	ON	OFF	OFF
30	ON	OFF	ON
35	ON	ON	OFF
40	ON	ON	ON

BALLS PER GAME:

# BALLS/GAME	SWITCH 7
5	ON
3	OFF

MATCH FEATURE:

When the Match Feature is ON, a random number appears in the 'Match/Ball in Play' window and the word MATCH is illuminated. If the number matches the tens digit in a player's score, a free game is awarded. The Match feature creates an incentive to play.

MATCH	SWITCH 21
ON	ON
OFF	OFF

CREDIT DISPLAY:

CREDITS DISPLAYED	SWITCH 20
YES	ON
NO	OFF

HIGH SCORE FEATURE:

The game is designed to award an Extra Ball or Free Game at each of the three score levels. See Front Door Game Adjustments.

AWARD	SWITCH 6
REPLAY	ON
EXTRA BALL	OFF

MELODY OPTION:

The game is designed to play several melodies to announce power-up, game-up, etc. The tunes are intended to attract attention to the game and increase game usage. The tunes are controlled by switch 8.

TUNES	SWITCH 8
ON	ON
OFF	OFF

HIGH GAME TO DATE FEATURE:

The game is designed to award free games as an option if high game to date is beat. Each time this happens, the winning score becomes the new high game score to beat. This score is displayed on all 4 player score displays at the end of each game as an incentive to play. Recommended setting is underlined.

HIGH GAME TO DATE FEATURE	SWITCH 14	SWITCH 15
No Award	OFF	OFF
One Credit	ON	OFF
Two Credits	OFF	ON
<u>Three Credits</u>	<u>ON</u>	<u>ON</u>

C. Front Door Game Adjustments:

High Score Feature Adjustments:

The game is designed to award an extra ball (option) or a free game at each of three score levels. The recommended levels are on the score card in the game.

Any level from 10,000 to 990,000 can be set, as desired. It is also possible to reset or turn off (00) any or all of the levels, if desired.

1. Push and release Self-Test button (see Figure III) at one second intervals approximately five times or until number 01 appears on the Match/Ball in Play display.

2. The number on the Player Score Displays is the score level*. It can be increased, if desired, by holding the credit button in. To decrease the score level, reset to '00' and then hold the credit button in. Release the credit button when the desired number appears. Note that the level changes 10,000 points at a time. If the number '00' is left on the displays, the high score feature is eliminated for that level.

3. Repeat steps 1 and 2 for the second and third score levels. The number '02' and '03' on the Match/Ball in Play display are for the second and third levels, respectively.

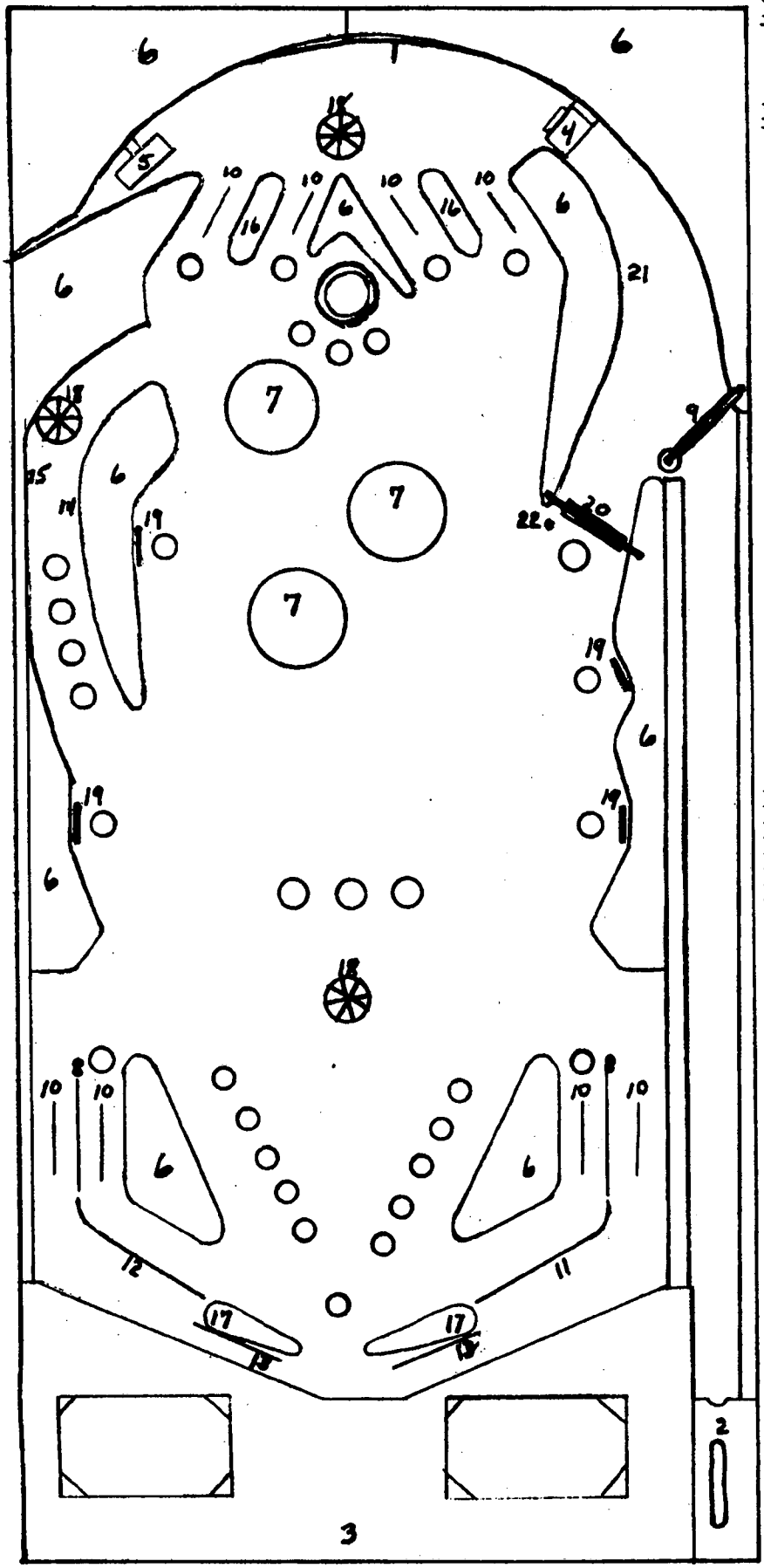
High Game to Date Feature:

The game is designed to award free games when 'High Game to Date' is beat.

It is recommended that the level, which will build with game play, be periodically reset to the factory recommended level to encourage game play. The adjustment procedure is the same as for the High Score Feature Adjustment, Steps 1 and 2. Continue pushing the Self-Test button until the number '04' appears on the Match/Ball in Play display and then do Step 2.

Any level from '00' to 990,000 can be set as described. It is to be noted that '00' does **not** turn off the feature, as it does on High Score feature. The feature is turned off by positioning switches S14 and S15 to the 'OFF' position, and on by positioning switches as discussed under "Back Box Game Adjustments.

*Can be quickly set to '00' by pressing S33 on the MPU assembly in the back box. See Figure III.



BLACK SHEEP SQUADRON

PLAYFIELD PARTS

Rubber Parts:

200014	Post Ring
200024	Mini Post Ring
200016	1½" Rubber Ring
200017	2" Rubber Ring
200018	2½" Rubber Ring
200019	3" Rubber Ring
200021	4" Rubber Ring
200035	7/16" Flipper Band

Panel Top Parts:

Item:	Astro Part #	Description:
1	700057	Arch Wireform
2	700012	Ball Shooter Cover
3	700013	Instruction Panel
4	700063	Upper Ball Gate
5	200025	Rubber Rebounder
6	499000	Buterate Parts
7	480003	Thumper Cap - Blue
8	700058	Ball Guide Wireform
9	700065	Ball Gate Wireform
10	700091	Slot Rollover Wireform
11	700059	Ball Guide Wireform -R
12	700060	Ball Guide Wireform -L
13	700067	Flipper Backstop Wireform
14	700062	Rollover Wireform
15	700056	Rollover Chute Wall
16	440008	Plastic Guide Rail(Yellow)
17	750064	Flipper Arm
18	490001	Star Rollover Insert
	750048	Star Rollover Button
19	810009	Target Assembly
20	810005	Spinner Assembly
21	700061	Ball Guide Spinner Chute Wireform
22	700055	Mini post

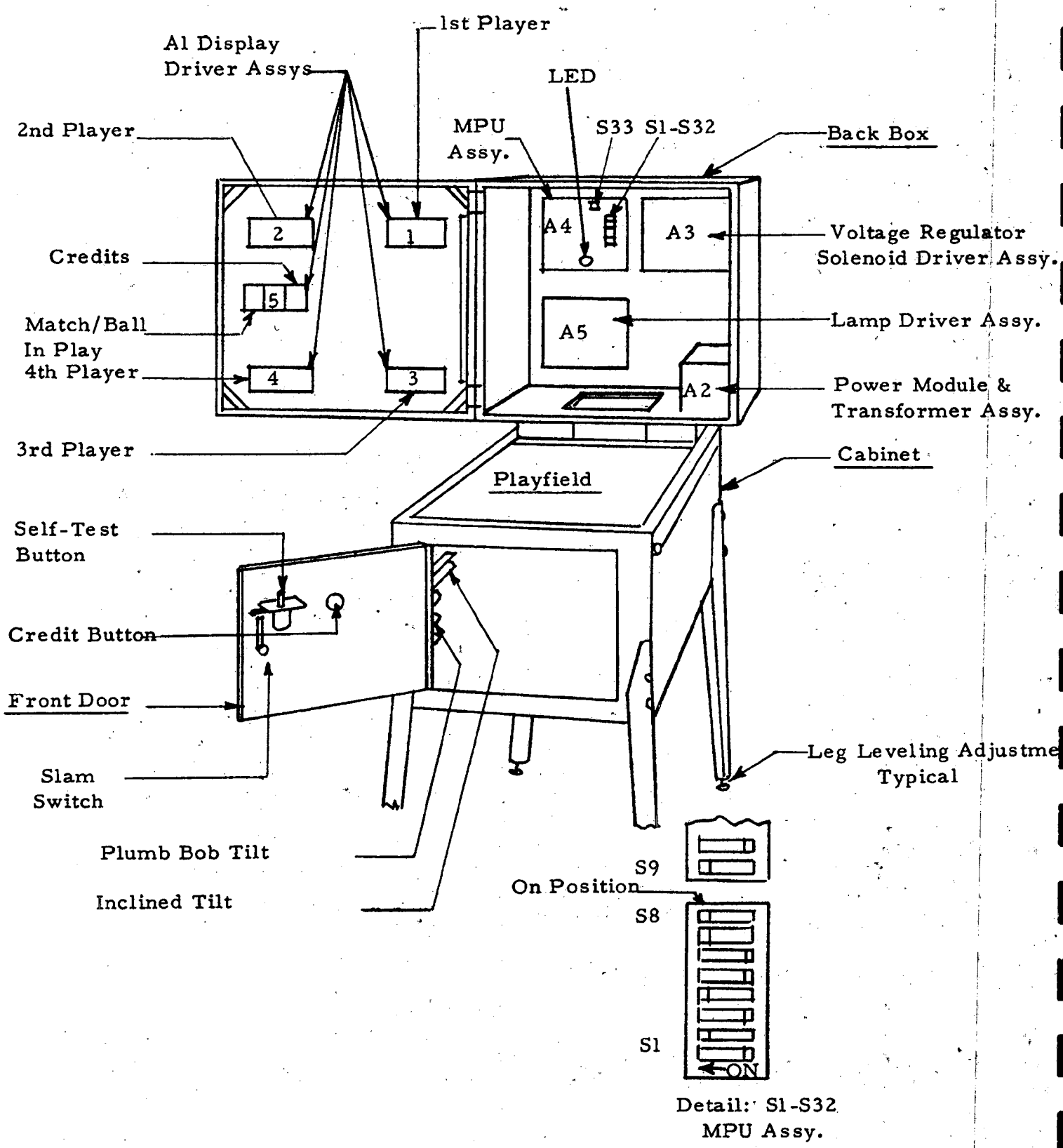


FIG. III. ASTRO ELECTRONIC PIN BALL MACHINE

Instruction, Score Cards and High Score feature settings to be used on electronic Black Sheep Squadron:

3-BALL		5-BALL	
REPLAYS	Astro #:	REPLAYS	Astro #:
Instruction Card	750080	Instruction Card	750080
Score Card #1	750081	Score Card #2	750082
1 Replay at 300,000		1 Replay at 420,000	
1 Replay at 360,000		1 Replay at 500,000	
1 Replay at 420,000		1 Replay at 580,000	
EXTRA BALL		EXTRA BALL	
Instruction Card	750096	Instruction Card	750096
Score Card #1	750097	Score Card #2	750098

(All Playfield Posts in Medium Position).

NOTE: High Game to Date Recommended levels: (Reset periodically)
3-BALL: 450,000 5-BALL: 650,000

RECOMMENDED SETTINGS:

The following chart gives recommendations for three typical types of operation.

	3-BALL	5-BALL
REPLAY:		
Instruction Card	750080	750080
Score Card	750081	750082
Special	31 OFF, 32 ON	31 OFF, 32 ON
Match	Sw. 21 ON	Sw. 21 ON
High Score to Date	Sw. 14, 15 ON	Sw. 14, 15 ON
Score Level Award	Sw. 6 ON	Sw. 6 ON
X-BALL:		
Instruction Card	750096	750096
Score Card	750097	750098
Special	Sw. 31 ON, 32 OFF	Sw. 31 ON, 32 OFF
Match	Sw. 21 OFF	Sw. 21 OFF
High Score to Date	Sw. 14, 15 OFF	Sw. 14, 15 OFF
Score Level Award	Sw. 6 OFF	Sw. 6 OFF
NOVELTY:		
Instruction Card	750095	750095
Special	Sw. 31, 32 OFF	Sw. 31, 32 OFF
Match	Sw. 21 OFF	Sw. 21 OFF
High Score to Date	Sw. 14, 15 OFF	Sw. 14, 15 OFF
X-Ball Enable	Sw. 24 OFF	Sw. 24 OFF

ROUTINE MAINTENANCE ON LOCATION:

Self-Test routines are written into the game design. They are particularly useful for routine maintenance. The tests are described below. The first test is automatic and occurs on power-up. This test causes the MPU module A4 to examine itself for failures. Seven flashes of an LED indicates proper operation. The second series of self-diagnostic tests causes the MPU to "exercise" each of the other modules in such a way as to make their faults, if any, obvious. See Figure III and block diagram.

It is recommended that these tests be used several times a week to check out the games before play. If faults are discovered, they may be corrected on location if the operator has a stock of replacement modules. See "Trouble Shooting on Location".

MPU Module Self-Test:
At power on, the LED on the MPU module flashes once. (Flicker-Flash). After a pause, it flashes six more times and goes out. A power-up tune is played to announce game readiness. This indicates proper MPU operating condition and successful completion of the power-up test.

Game Self-Diagnostic Tests:

1. Pressing the Self-Test button inside the door initiates the Self-Test routine. See Figures III and IV. All switched lamps flash off and on continuously.

2. Pressing the Self-Test button again causes each digit on each display to cycle from 0 thru 9, and repeat continuously.

3. Pressing the Self-Test button again causes each solenoid to be energized, one at a time, in a continuous sequence. Hold both flipper buttons 'in' during this test. The number appearing on the Player Score displays is the same as the number assigned to the solenoid. The sound of a solenoid pulling-in as a number appears indicates proper operation. The absence of sound is improper. If sound is absent, see Page 17 for help in Solenoid identification.

4. Pressing the Self-Test button again causes the MPU to search each switch assembly for stuck contacts. If any are found, the number of the first set encountered is flashed on the Player Score displays. The number remains until the fault is cleared. See Page 17 for help in Stuck Switch identification. Other numbers may follow if more stuck contacts are present. If there are no stuck switches, the Match/Ball in Play display flashes '0'.

5. Pressing the Self-Test button eleven more times causes the MPU to step thru the threshold and bookkeeping functions described previously and finally to repeat the power-up test. For more rapid exit to power-up, turn the game off, then on. The game is now ready to play.

After successful completion of the Self Diagnostic Test procedure, set the game up for play. Exercise each rollover, thumper-bumper, slingshot,

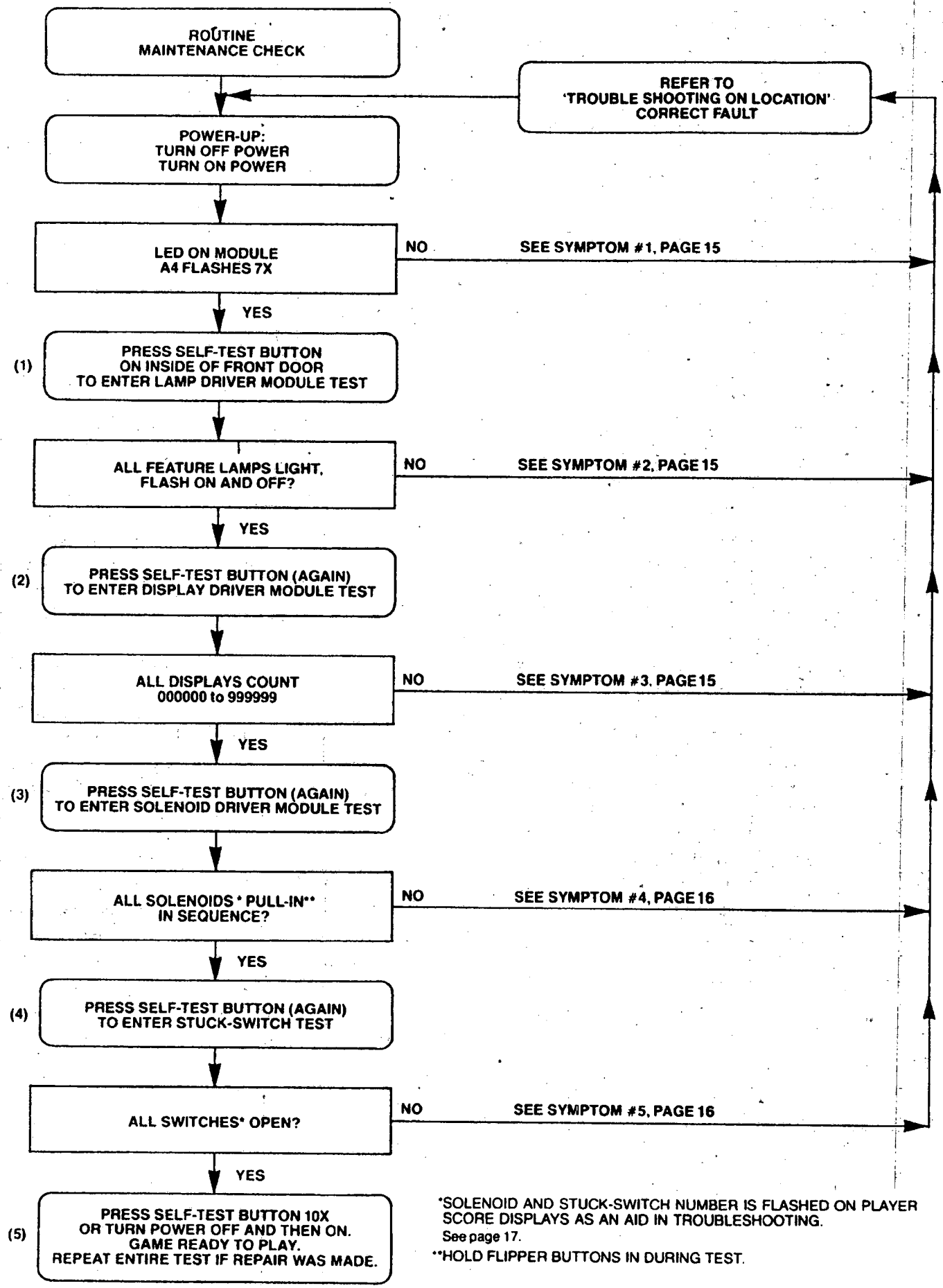
etc., by hand until each switch assembly on the playfield has been checked for proper operation. If actuating a switch assembly results in intermittent or no response, clean contacts by gently closing them on a clean business card or piece of paper and wiping until they appear clean. Regap, if necessary, to 1/16". Do not burnish or file Gold Plated Switch Contacts.

TROUBLESHOOTING ON LOCATION

The game is designed to make troubleshooting easy. Several simple procedures are given herein that cover the greatest percentage of game failures. They are written for an operator on location and require module replacement. (See Figure III) Symptoms and the action to be taken are given for each type of problem.

If the problem is more complicated and is not solved by following this procedure, more detailed procedures are available. See the Parts List for ordering information.

SELF DIAGNOSTIC TEST



*SOLENOID AND STUCK-SWITCH NUMBER IS FLASHED ON PLAYER SCORE DISPLAYS AS AN AID IN TROUBLESHOOTING.
See page 17.

**HOLD FLIPPER BUTTONS IN DURING TEST.

1A) SYMPTOM: Game does not play power-up tune when power is turned on. General Illumination is present.

ACTION: **A)** Turn power OFF. Open back box. Locate light emitting diode (LED) on MPU module A4.

B) Turn Power ON. LED must flash 7X to indicate that module A4 is good. Correct flash sequence is flicker/flash-pause-and then six more flashes and LED goes out.

C. If LED does not come on, or does not flash, or flashes, but less than 7X, turn off power. Replace MPU module A4.

CAUTION: **Replacement MPU Module must have same Part Number or incorrect operation will result! See Parts List for MPU Module Part Number.**

Turn power ON.

D) If game is correct, it is now ready for play. If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2A) SYMPTOM: Not all feature lamps light during game play.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) once. If the game is correct, **all** feature lamps flash ON and OFF.

B) Carefully raise playfield or open back box to gain access to lamps.

C) Replace bulbs that do not flash.

D) If game is correct, it is now ready for play.

E) If game is not correct, turn power OFF. Replace Lamp Driver Module A5. Turn power ON and repeat A.

F) If game is correct, if is now ready for play.*

G) If game is not correct, turn power OFF. Replace MPU module A4. See CAUTION, 1C. Turn power ON and repeat A.

H) If game is correct, it is now ready for play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2B) SYMPTOM: One or some switched lamps always ON.

ACTION: Repeat 2AA, AB, AE, and AF and, if necessary AG & AH.

3A) SYMPTOM: Display digits improper on **one** or **several,** but less than all Display Driver module(s), A1. Improper: One or several segments always OFF, digits mottled or several segments or digit(s) always ON.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) twice. If the game is correct, each digit on each Display Driver Module A1 (5 used/game) displays the count 1-9 and 0 continuously in all 6 digit positions. Note defective Display Driver modules.

B) Turn power OFF.

CAUTION: High Voltage is supplied to the Display Driver Modules, A1, from the Solenoid Driver/Voltage Regulator Module A3. Wait 30 seconds for High Voltage to Bleed Off.

C) Replace Display Driver module(s) A1. Turn power ON. Repeat A.

D) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

3B) SYMPTOM: **All** displays improper (all five display Driver modules). Improper: Digit(s) always on or off/segment(s) always on or off, all displays.

ACTION: **A)** Repeat 3AA, and AB.

B) Replace MPU module A4. See CAUTION NOTE, 1C. Turn power ON. Repeat A.

C) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

3C) **SYMPTOM:** One or several displays always off.

ACTION: **A)** Do 3AA, AB, AC, and AD.

B) Repeat 3BB and BC, if necessary.

4A) **SYMPTOM:** Solenoid(s) do(es) not pull-in during course of game.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) three times.

B) If game was correct, each solenoid would be energized. A number is flashed on the Player Score displays as each solenoid is pulsed. Note any numbers that do not have the sound of a solenoid associated. See Solenoid Identification Table, Page 17 and Figure V.

C) Carefully lift the playfield (or open the back box) to gain access to the solenoid. Turn power OFF. Inspect the solenoid.

D) If a lead is broken off, repair. Repeat A & B. If game is correct, it is now ready for play.* If solenoid wiring was correct, turn power OFF.

E) Replace Solenoid Driver/Voltage Regulator module A3. See CAUTION NOTE 3AB.

F) Repeat AA & AB. If game is correct, it is now ready to play.* If game is not correct, turn power OFF.

G) Replace MPU module A4. See CAUTION NOTE, 1C.

H) Repeat A & B. If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement Procedure. (See Parts List.)

4B) **SYMPTOM:** Solenoid(s) always energized—Note: If impulse solenoids (chimes, ball ejects, slingshots, thumper-bumpers, etc.) are energized continuously, they are subject to damage. Limit troubleshooting to one minute with power ON, followed by **five minutes with power OFF.** Repeat as necessary. Replace damaged solenoids.

ACTION: Do 4AA, AB, AE, AF and if necessary, AG and AH.

5) **SYMPTOM:** Feature (Drop Targets, etc.) does not score.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) four times.

B) If the game is correct, Match/Ball in Play display would flash '0.' If a number appears on the Player Score displays, see Switch Assembly Identifcation Table, Page 17 and Figure V.

C) Carefully lift the playfield. Locate the switch assembly identified from the number. Visually inspect the switch assembly. If the contacts are 'stuck', regap them to 1/16". See section under ADJUSTMENTS. Repeat A & B. If the game is correct, it is now ready to play.* If game is not correct, turn the power OFF.

D) Replace MPU module A4. See CAUTION NOTE 1, C.

E) Repeat A & B. If the game is correct, it is now ready to play.* If the game is not correct, refer to Module Replacement Procedure. (See Parts List.)

6) **SYMPTOM:** Game blows fuse(s) repeatedly.

ACTION: See Module Replacement Procedure.

*Turn power On-Off switch OFF and then ON

BLACK SHEEP SQUADRON

SELF-TEST DISPLAY NUMBERS

SOLENOID IDENTIFICATION TABLE

SELF-TEST #	SOLENOID IDENTIFICATION:	SELF-TEST #	SOLENOID IDENTIFICATION:
01	10 Chime Q1	08	Middle Bumper Q9
02	100 Chime Q5	09	Top Bumper Q10
03	1,000 Chime Q6	10	Bottom Bumper Q12
04	10,000 Chime Q7	11	Right Slingshot Q11
05	Knocker Q3	12	Left Slingshot Q16
06	Outhole Q4	13	K1 Relay Q15
07	Saucer Q14	14	Coin Lockout Q19

SWITCH ASSEMBLY IDENTIFICATION

SELF-TEST #	SWITCH DESCRIPTION:	SELF-TEST #	SWITCH DESCRIPTION:
01	Chute Rollover	24	Slot #1
02	Spinner	25	Right Return Lane
06	Credit Button	26	Left Return Lane
07	Tilt (3)	29	Target #4
08	Outhole	30	Target #3
09	Coin 2 Right	31	Target #2
10	Coin 1 Left	32	Target #1
12	Rollovers (Top & Middle)	33	Right Outlane
13	Saucer	34	Left Outlane
16	Slam (2)	36	Right Slingshot
17	10 PT	37	Left Slingshot
21	Slot #4	38	Top Bumper
22	Slot #3	39	Middle Bumper
23	Slot #2	40	Bottom Bumper

ASSEMBLY ADJUSTMENTS

GENERAL:

All switch assemblies consist of leaf springs, contacts, separators, plastic tubing and screws to hold them to the mounting surface. Before attempting to adjust a switch assembly, make sure that these screws are tight. If not, tighten screw closest to the contact end of the leaf spring first. This will prevent the assembly from being secured in such a manner that the leaf springs tend to fan out. In general, all leaf springs are adjusted to a 1/16" gap in the open position and .010" overtravel or wipe in the closed position. All contacts should be in good condition. Unless otherwise instructed, they should be dry or non-lubricated. All contacts should be free of dust and dirt. Contacts, with the exception of the flipper button switch assemblies, are plated to resist corrosion. Filing or burnishing breaks the finish and encourages corrosion. Clean by closing the contacts over a clean piece of paper (or business card) and wipe gently until the contacts are clean. For the flipper button switch assemblies ONLY: Tarnish can be removed with a contact file followed by a burnishing tool. Severely pitted contacts must be replaced as an assembly. In general, contacts need be cleaned or replaced and adjusted only when they are found to be inoperative.

SERVICE PARTS:

A parts catalogue is available upon request. The catalogue lists all replacement parts for each game manufactured by ASTRO. Requests should be addressed to:

ASTRO GAMES, INCORPORATED
360 Scott Street
Elk Grove Village, Illinois 60007
Attn: PARTS DEPARTMENT

SERVICE HINTS:

The ASTRO playfield has an improved surface finish with excellent wearing properties. Its life, as well as play appeal, can be extended by periodic cleaning of the playfield.

DO: We recommend you clean your playfield with Wildcat #125 (Wildcat Chemical Company, 1333 W. Seminary Drive, Ft. Worth, Texas 76115). Wildcat #125 is a combination cleaner and polish. Inspect and hand polish the ball in a clean cloth. A chipped ball must be replaced. It can ruin the finish on the playfield in a short time.

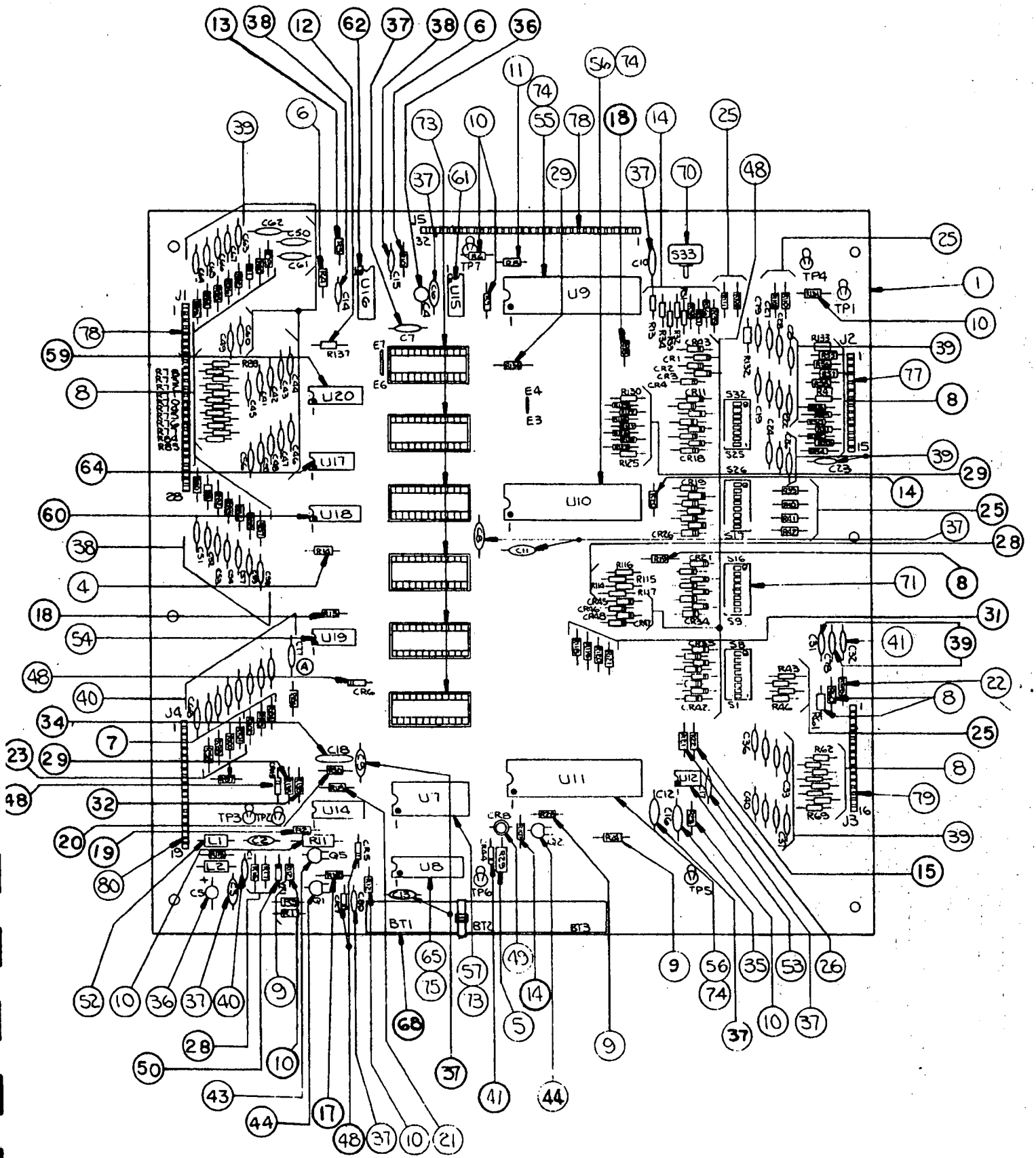
DON'T: Use water in large quantities, highly caustic cleaners, abrasive cleaners or cleaning pads on the playfield. Do not allow a wax or polish build up. Waxes yellow with age and spoil play appeal.

PARTS LIST

BLACK SHEEP SQUADRON #BSS-2678

		Part Number:
MISCELLANEOUS:		
Transformer (Domestic)		200029
Bulbs, #44		200012
ASSEMBLY COILS:	Wire Ga. #/Turns:	
Chimes (4)	31/2000	200036
Coin Lockout	40/5600	200037
Flipper Left & Right (4)	25/500 & 34/5050	200002
Knocker	26/1000	200038
Outhole Kicker	26/1000	200038
Saucer	27/1300	200001
Thumper-Bumper (3)	26/1200	200000
Sling-Shot (2)	26/1200	200000
PLAYFIELD PARTS:	See Fig. II	
MODULES:		
Lamp Driver A5		805003
Display Module A1 (5 used)		805004
Solenoid Driver/A3		805002
MPU Control Board A4		805000
Power Module A2		805001
Power Transformer (Part of A2)		200029

MPU CONTROL BOARD:

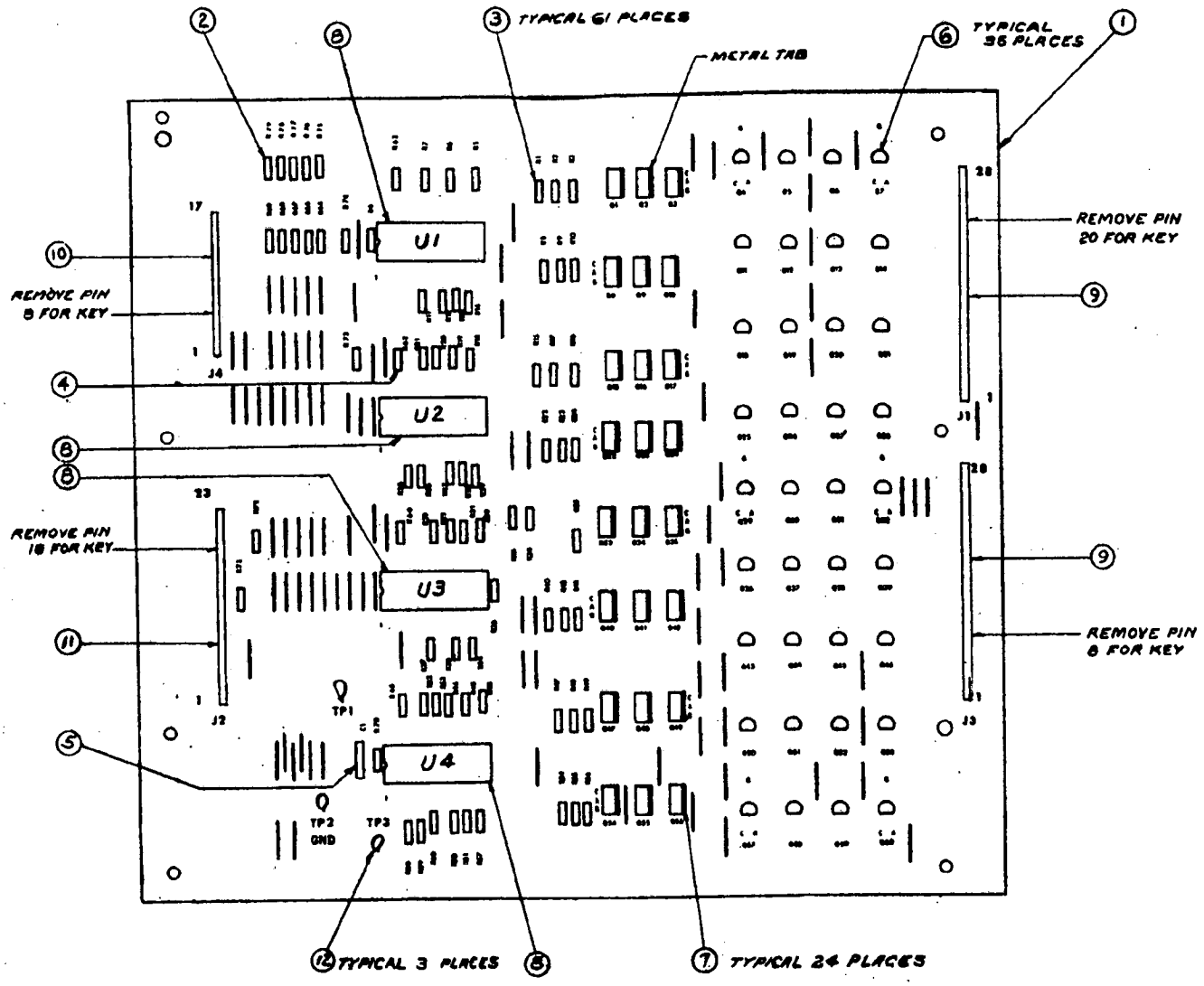


A4: MPU MODULE - Component Parts List

Item:	Reference Designation:	ASTRO Part #:	Description:
1	A4	805000	MPU Module Complete.
2	A4(see note 1)	805000-A	MPU Module less Program Memory, U1-6 incl.
3-32	See Schematic		Resistors-See schematic for value.
34	C18	025007	Capacitor, .05 MFD, 100 V.
35	C16	040000	Capacitor, .1 MFD, 100 V.
36	C4, C5	035000	Capacitor, 4.7 MFD, 35 V.
37	C3, C6-C13, C17	025006	Capacitor, .01 MFD, 100 V.
38	C14, C15, C79, C41-67	025003	Capacitor, 470 PFD, 1kv.
39	C19-C31, C78, C33-40	025003	Capacitor, 390PFD, 1kv.
40	C1, C2, C68-C77	025004	Capacitor, 820 PFD, 1kv.
41	C32	025005	Capacitor, .003 MFD, 100 V.
43	Q5	050011	Transistor, PNP (2N4403).
44	Q1, Q2	050010	Transistor, (2N3904).
47	CR44	050001	Diode (IN4004).
48	CR1-CR7, CR11-CR43, CR45-CR48.	050008	Diode (IN4148).
49	CR8	125002	LED (Red).
50	VR1	050009	Diode Zener (8.2V, IN959B).
52	L1, L2	200039	Inductor, .22 Micro Henry.
53	U12	075013	Timer (555).
54	U19	075008	Quad 2 Input (4011).
55	U9	075000	MPU I. C. (6800).
56	U10, U11	075002	PIA I. C. (6820).
57	U7	075001	RAM I. C. (6810).
59	U20	075010	HEX Buffer I. C. (14502B).
60	U14, U18	075007	HEX Inverter (4049B).
61	U15	075012	Quad Memory Driver (MC3459L).
62	U16	075011	Dual Monostable (9602).
64	U17	075009	Quad 2 Inputs (74L00N).
65	U8	075003	RAM (C MOS, P5101L-3).
68	BT1, BT2, BT3	200040	Battery.
70	S33	200042	Push Button Switch.
71	S1-S8, S9-S16, S17-S24, S25-S32.	200041	DIP Switch.
73		100007	24 Pin Socket.
74		100008	40 Pin Socket.
75		100006	22 Pin Socket.
77	J2	100010	15 Pin Wafer Connector.
78	J4, J5.	100013	28 Pin Wafer Connector.
79	J3	100011	16 Pin Wafer Connector.
80	J1	100012	19 Pin Wafer Connector.
81	J5	100009	4 Pin Wafer Connector.

Note 1: Order replacement memory chips U1-U6, by specifying game, socket and part number stamped on chip.

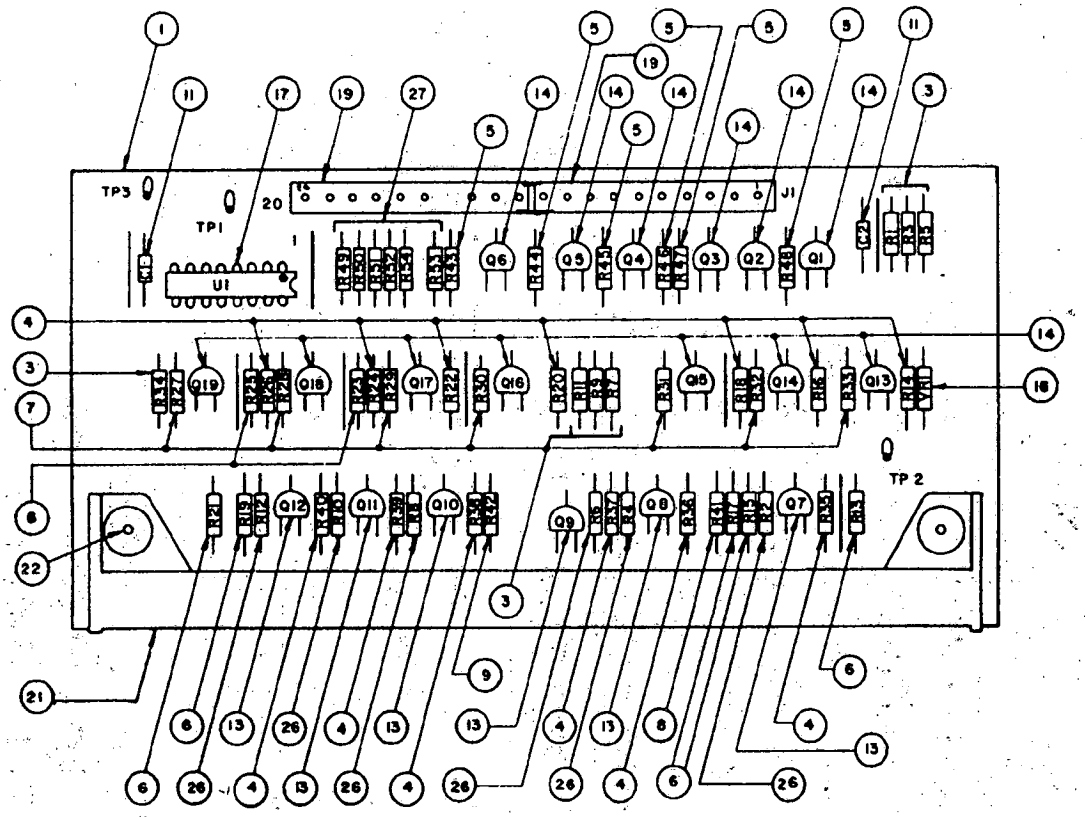
LAMP DRIVER MODULE



A5: LAMP DRIVER MODULE - Components Part List

Item:	Reference Designation:	ASTRO Part #:	Description:
1	A5	805003	Lamp Driver Module, complete.
2	R71-R79	000098	Resistor, 20k Ohm, 5%, $\frac{1}{4}$W.
3	R1-R60, R70	000074	Resistor, 2k Ohm, 5%, $\frac{1}{4}$W.
4	R61-R69	000147	Resistor, 2.2M Ohm, $\frac{1}{4}$W.
5	C1	025008	Capacitor, .01 MFD, 100 V.
6	Q4-Q7, Q11-Q14, Q18-Q21, Q25-Q32, Q36-Q39, Q43-Q46, Q50-Q53, Q57, Q58-Q60.	050012	SCR, 2N5060.
7	Q1-Q3, Q8-Q10, Q15-Q17, Q22-Q24, Q33-Q35, Q40-Q42, Q47-Q49, Q54-Q56.	050013	SCR, MCR106-1.
10	U1-U4	075014	I.C., Decoder, 14514B.
12	J1, J3	100013	28 Pin Wafer Connector.
13	J1	100014	17 Pin Wafer Connector.
14	J4	100015	23 Pin Wafer Connector.

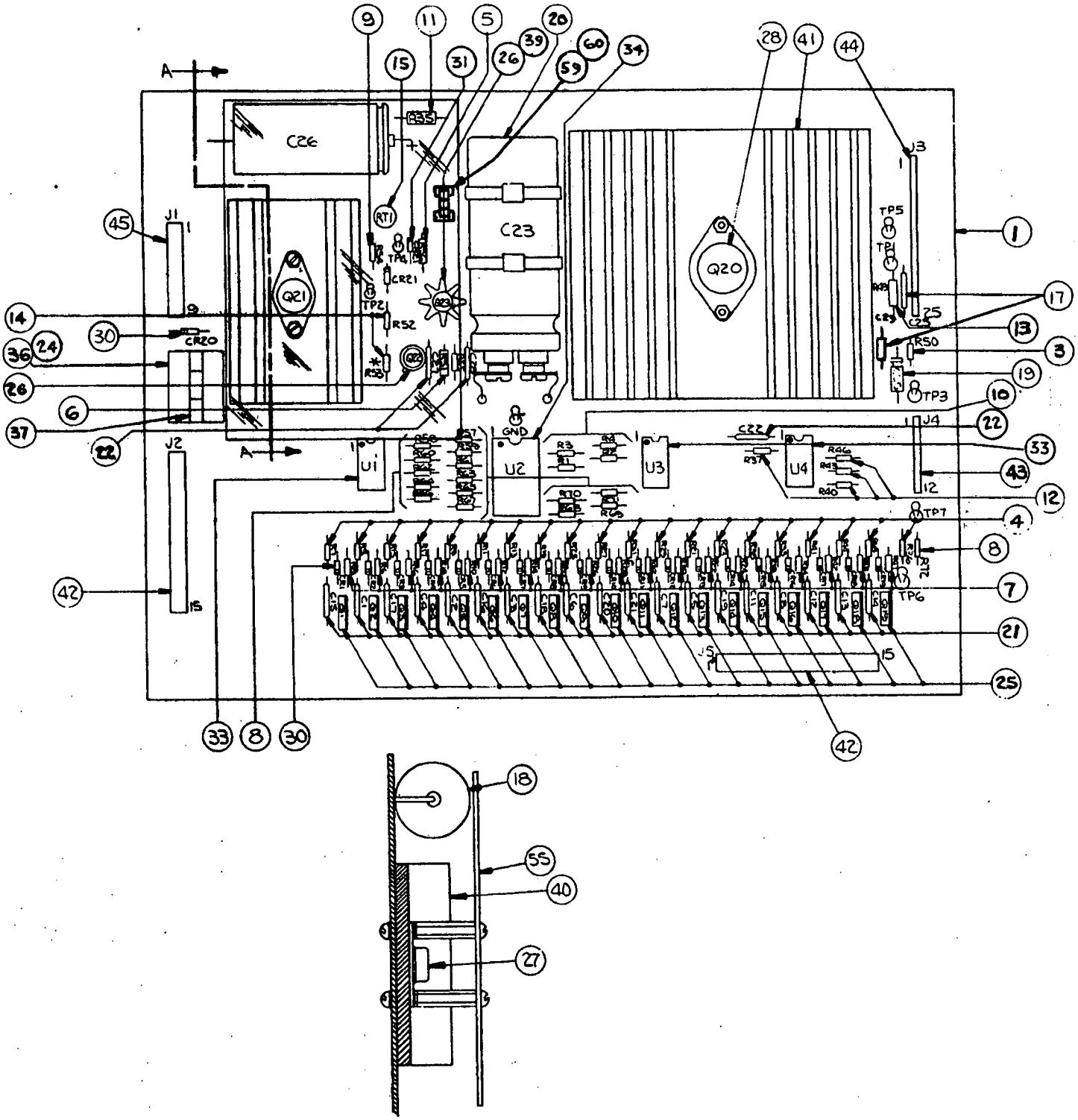
DISPLAY DRIVER MODULE



A1: DISPLAY DRIVER MODULE - Component Parts List

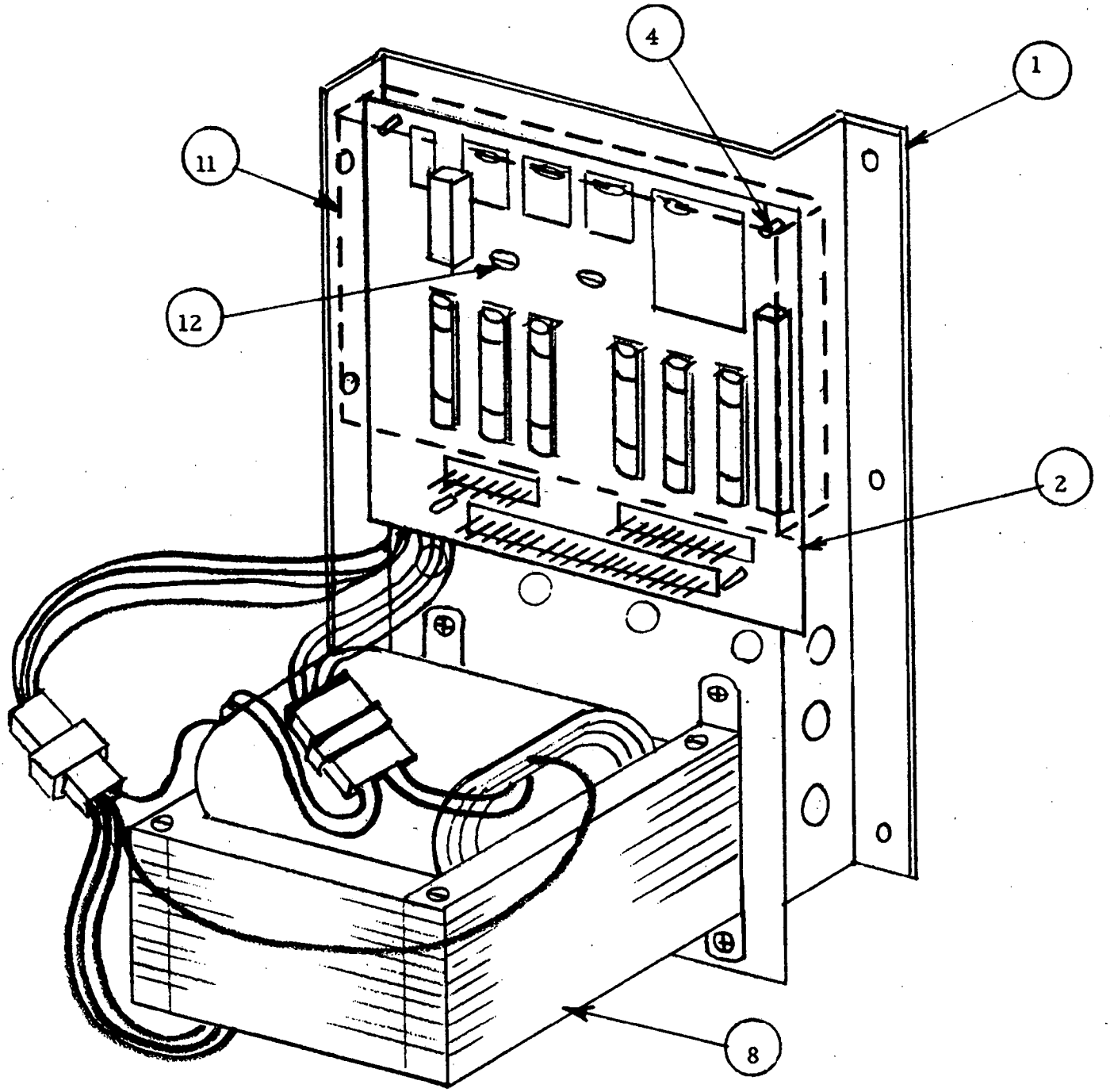
Item:	Reference Designation:	ASTRO. Part #:	Description:
1		805004	P.C. Board Assembly, complete.
3	R1, R3, R5, R7, R9, R11, R34.	000115	Resistor, 100K Ohm.
4	R14, R16, R18, R20, R22, R24, R26, R35, R36, R37, R38, R39 R40.	000126	Resistor, 300K Ohm.
5	R43, R44, R45, R46, R47, R48.	000090	Resistor, 9.1K Ohm.
6	R13, R15, R17, R19, R21, R23, R25.	000071	Resistor, 1.5K Ohm.
7	R27, R28, R29, R30, R31, R32, R33.	000075	Resistor, 2.2K Ohm.
8	R41	000015	Resistor, 39K Ohm.
9	R42	000124	Resistor, 240K Ohm.
11	C1, C2	025001	Capacitor, .01 MFD.
13	Q7, Q8, Q9, Q10, Q11, Q12.	050004	PNP Transistor, (2N5401).
14	Q1, Q2, Q3, Q4, Q5, Q6, Q13, Q14, Q15, Q16, Q17, Q18, Q19.	050003	NPN Transistor (MPS-A42).
16	VR1	050002	Zener Diode, 110V.
17	U1	075006	I.C. Decoder, MC14543B.
19	J1	100000	20 Pin Wafer Pin Connector.
21	DS1	125001	Digital Display Panel.
26	R2, R4, R6, R8, R10, R12	000075	Resistor, 2.2K Ohm.
27	R49, R50, R51, R52, R53, R54.	000098	Resistor, 20K Ohm.
28		915504	Wire Jumper - $1\frac{1}{2}$" long.

SOLENOID DRIVER/VOLTAGE REGULATOR MODULE



A3: SOLENOID DRIVER/VOLTAGE REGULATOR MODULE
Component Parts List

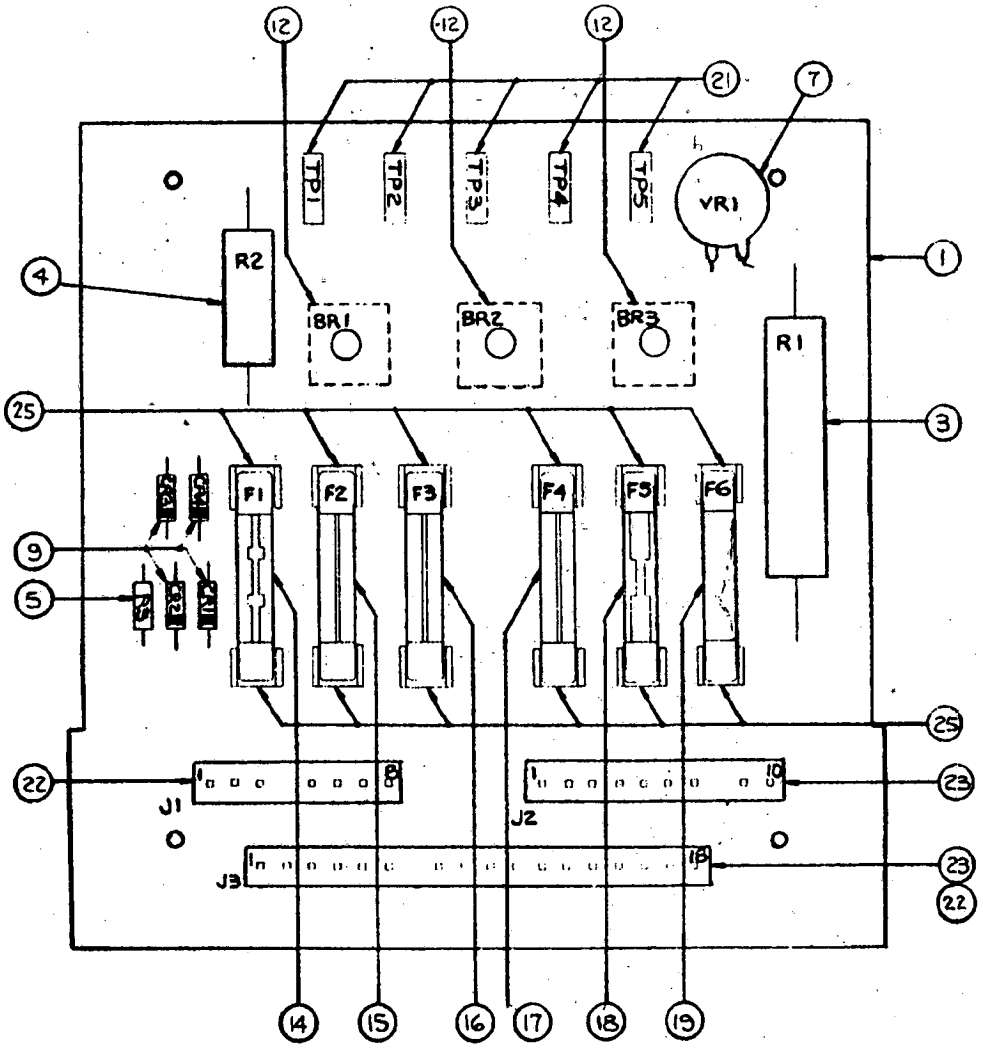
Item:	Reference Designation:	ASTRO Part #:	Description:
1	A3	805002	Solenoid Driver/Voltage Regulator Module, complete.
3-14	Resistors		Resistor, see Schematic for value.
15	RT1	150000	Pot. (Linear) 25K.
17	C25, C29	025011	Capacitor, .1 MFD, 50V.
18	C25,	030001	Capacitor, 160 MFD, 350 V.
19	C24	030000	Capacitor, 2 MFD, 50 V.
20	C23	030002	Capacitor, 11700 MFD, 20 V.
21	C1-C8, C11-C21	025010	Capacitor, .002 MFD, 1kv.
22	C22, C27, C28	025009	Capacitor, .01 MFD, 1kv.
24	K1	255000	Relay.
25	Q1-Q19	050015	Transistor, 2N6045.
26	Q22, Q23.	050016	Transistor, 2N3440.
27	Q21	050017	Transistor, 2N3584.
28	Q20	075015	5Volt Regulator, LAS1405 (or 78H05KC or LM323K).
30	CR1-CR21	050001	Diode (IN4004).
31	VR1	050014	Diode, Zener, 140 V., IN5275A.
33	U1, U3, U4	075016	I. C. Transistor Array, CA3081.
34	U2	075017	I. C. Binary to 1/16 Decoder, 74L154.
36		255001	Relay Socket.
37		255002	Relay Holder.
39		250001	Heat Sink, TO5.
40		250002	Heat Sink, TO66.
41		250000	Heat Sink, TO3 Case.
42		100019	15 Pin Wafer Connector.
43		100016	12 Pin Wafer Connector.
44		100017	25 Pin Wafer Connector.
45		100018	9 Pin Wafer Connector.
55		175001	Safety Cover.
59		175000	Fuse Clips.
60	F1	175008	Fuse, 3/16 Amp, 8AG, 250 volt.



A2: POWER TRANSFORMER MODULE
Components Parts List

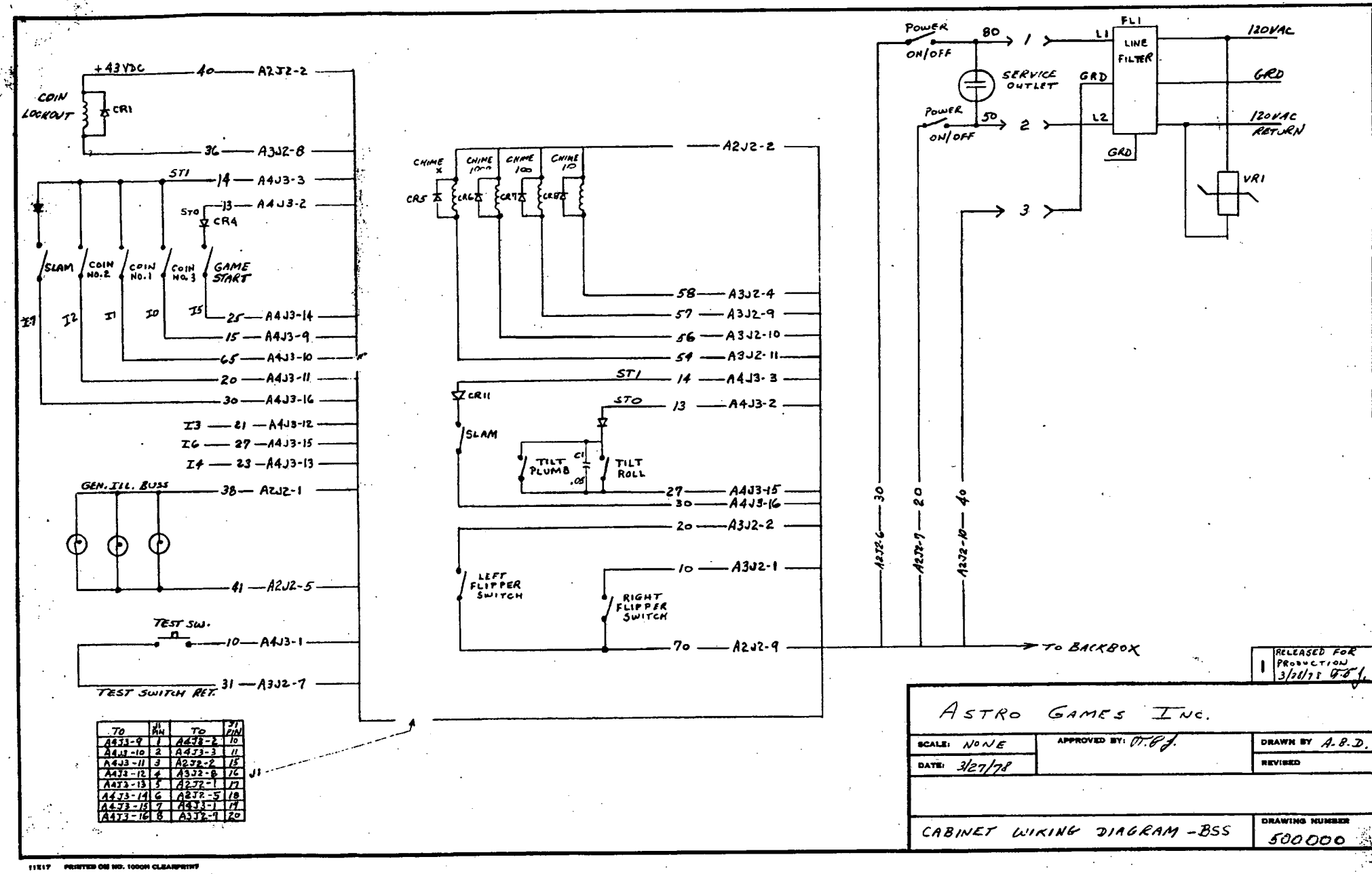
:m:	Reference Designation:	ASTRO Part #:	Description:
1	A2	815003	Power Transformer Module, complete.
2		805001	TA100 Power Module Assembly.
4		750038	P.C. Board Retainer (4 required).
8		200029	Power Transformer.
11		750084	Power Board Insulator.
12		750087	Heat Sink Compound.
		100022	Molded Kwik Disconnect Block.
		100020	Female Kwik Disconnect.
		100021	Kwikon Insulating Sleeve.
		100023	Molex Male Pin.

POWER MODULE A2



A2: POWER MODULE - Component Parts List

Item:	Reference Designation:	ASTRO Part #:	Description:
1	P/O A2	805001	Power Module Board Assembly, complete.
3	R1	000345	Resistor, 10%, 600 Ohm, 10 W.
4	R2	000213	Resistor, 25 Ohm, 5W.
5	R3	000115	Resistor, 5%, 100K Ohm, 1/4W.
7	VR1	050006	Varistor
9	CR1, CR2, CR3, CR4		
		050001	Diode (IN4004)
12	BR1, BR2, BR3	050005	Bridge Rectifier, (PK20).
14	F1	175005	Fuse, 10Amp, 250 V.
15	F2	175006	Fuse, 3/4Amp, 250 V., S.B.
16	F3	175003	Fuse, 4 Amp, 250 V.
17	F4	175004	Fuse, 5 Amp, 250 V.
18	F5	175007	Fuse, 20 Amp, 32 V.
19	F6	175002	Fuse, 3 Amp, 250 V., S.B.
22	J1, J3	100001	8 Pin Wafer Connector
23	J2, J3	100002	10 Pin Wafer Connector
25		175000	Fuse Clips
26		175001	Fuse Clips (Heavy Duty).



TO	J1 PIN	TO	J1 PIN
A4J3-9	1	A4J3-2	10
A4J3-10	2	A4J3-3	11
A4J3-11	3	A2J2-2	15
A4J3-12	4	A3J2-8	16
A4J3-13	5	A2J2-1	17
A4J3-14	6	A2J2-5	18
A4J3-15	7	A4J3-1	19
A4J3-16	8	A3J2-9	20

J1

1	RELEASED FOR PRODUCTION 3/28/78	

ASTRO GAMES INC.

SCALE: NONE	APPROVED BY:	DRAWN BY A.B.D.
DATE: 3/27/78		REVISED

CABINET WIRING DIAGRAM -BSS

DRAWING NUMBER 500000

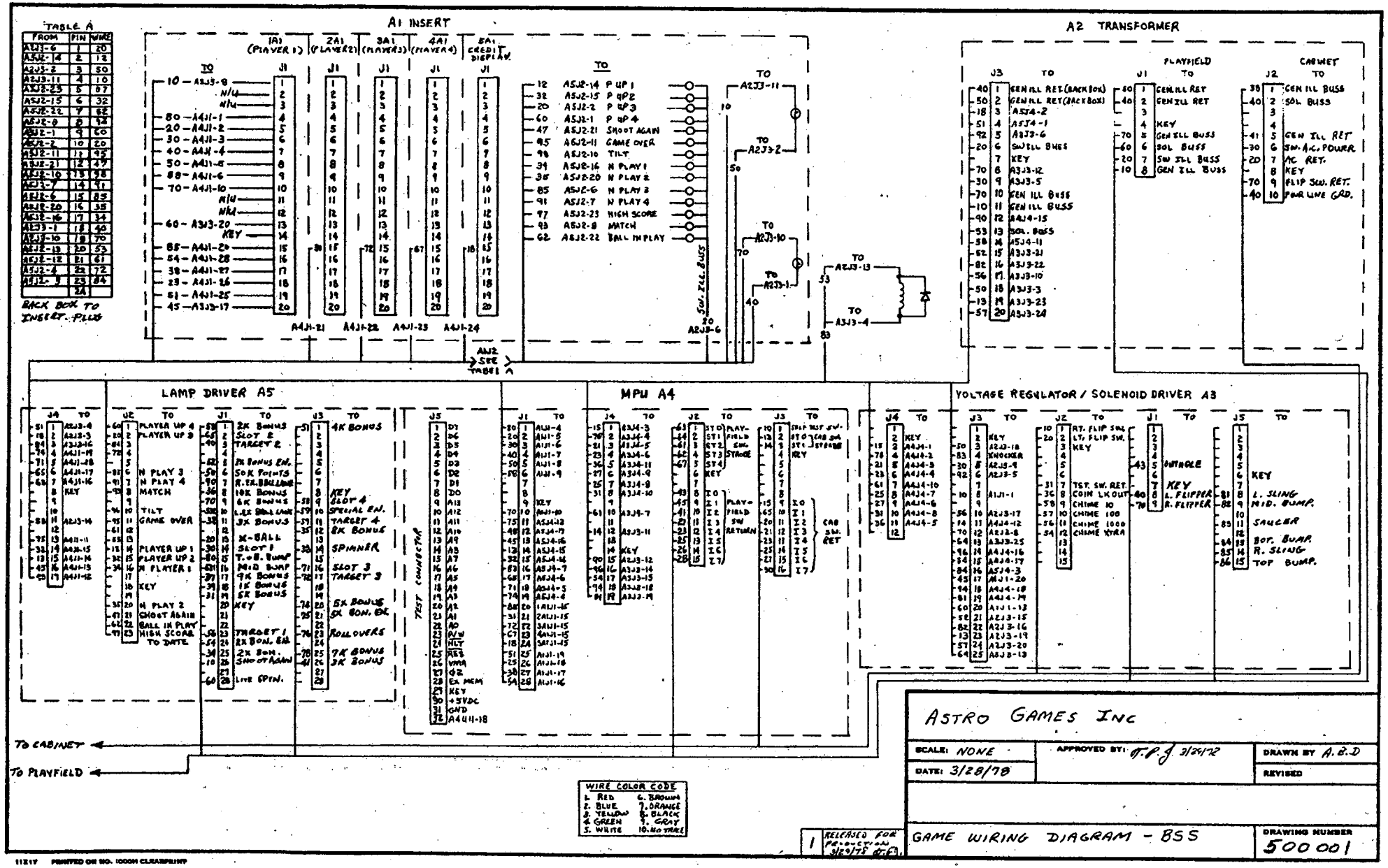
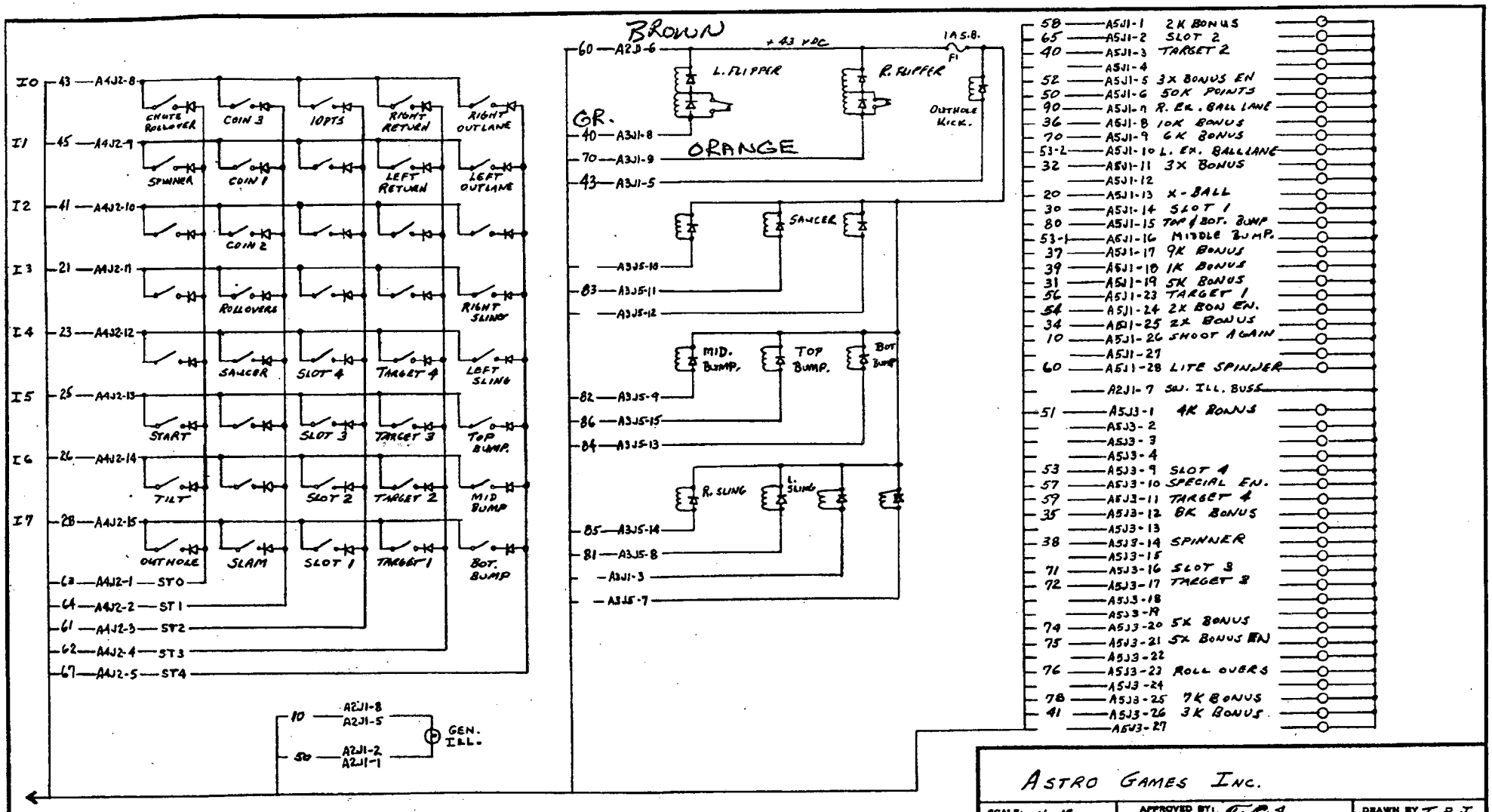


TABLE A
FROM | PIN | WIRE
BACK BOX TO INSERT PLUG
A1 INSERT
A2 TRANSFORMER
PLAYFIELD
CABINET
LAMP DRIVER A5
MPU A4
VOLTAGE REGULATOR / SOLENOID DRIVER A3
TEST CONNECTOR
TO CABINET
TO PLAYFIELD
WIRE COLOR CODE
1. RED 6. BROWN
2. BLUE 7. ORANGE
3. YELLOW 8. BLACK
4. GREEN 9. GRAY
5. WHITE 10. NO WIRE
ASTRO GAMES INC
SCALE: NONE
APPROVED BY: 3/29/78
DRAWN BY A.B.D
DATE: 3/28/78
REVISED
GAME WIRING DIAGRAM - BSS
DRAWING NUMBER 500 001
1 RELEASED FOR PRODUCTION 3/29/78



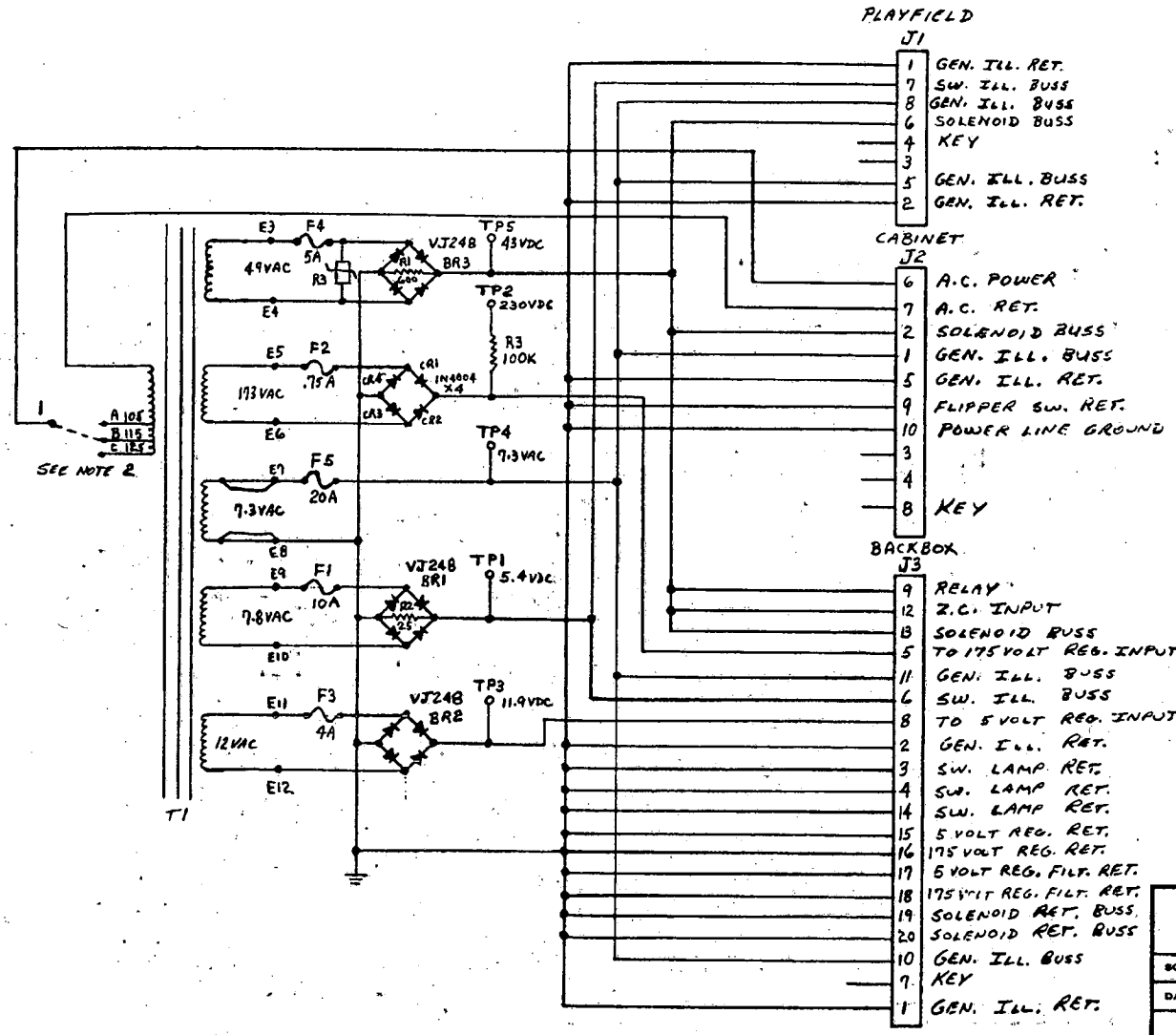
ASTRO GAMES INC.

SCALE: NONE	APPROVED BY: T.P.J.	DRAWN BY T.P.J.
DATE: 3/25/78		REVISED

PLAYFIELD WIRING DIAGRAM - BSS

DRAWING NUMBER 500002

1	RELEASED FOR PRODUCTION 3/27/78 BF	



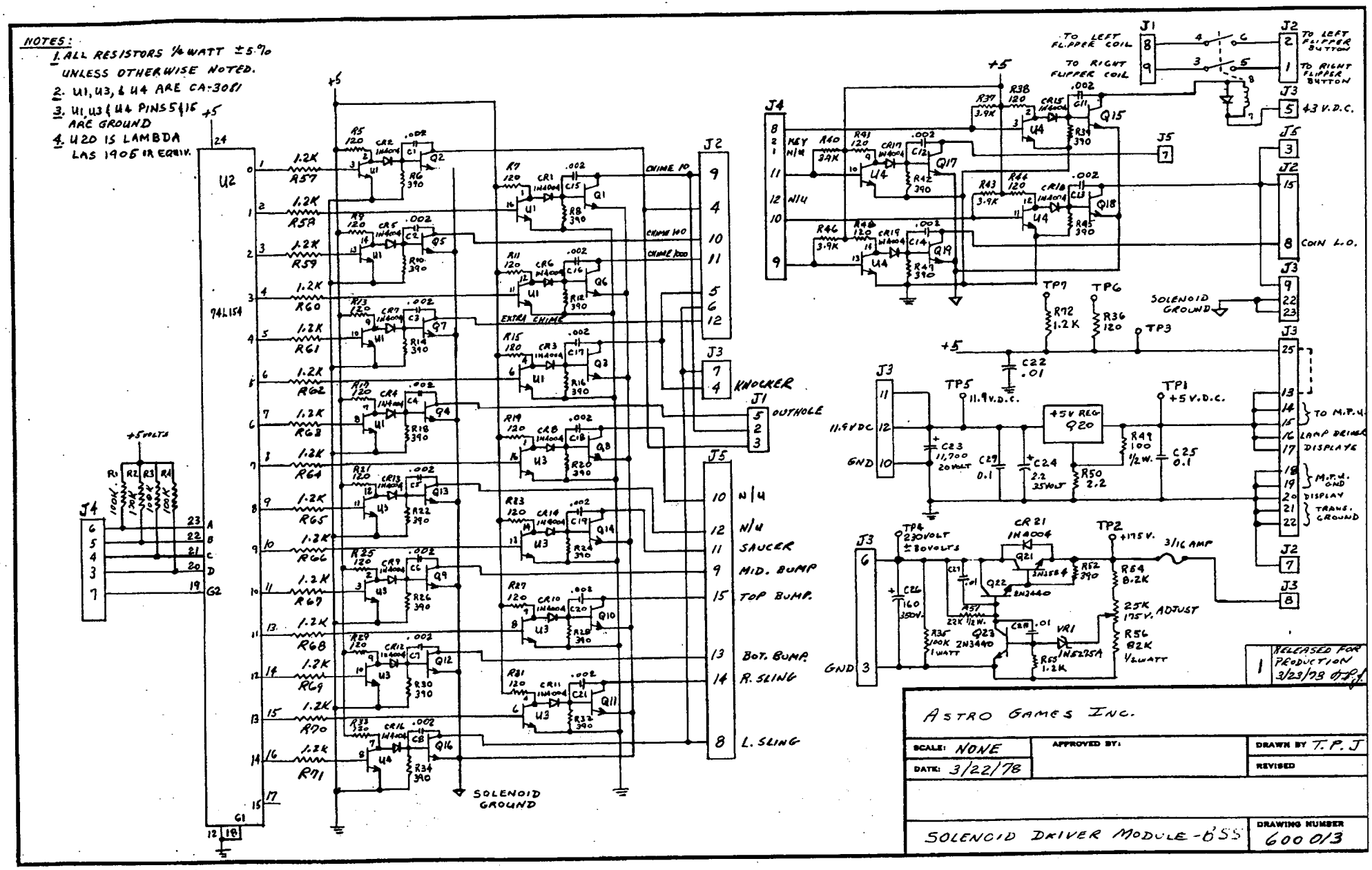
NOTES:

1. VOLTAGES ARE SHOWN FOR GAME IN POWER ON CONDITION.
2. CONNECT TERMINAL #1 TO EITHER A, B, OR C DEPENDING ON LOCAL LINE VOLTAGE
   - 1 TO A FOR 105 VAC
   - 1 TO B FOR 115 VAC
   - 1 TO C FOR 125 VAC

1	RELEASED FOR PRODUCTION 3/24/78 T.F.J.

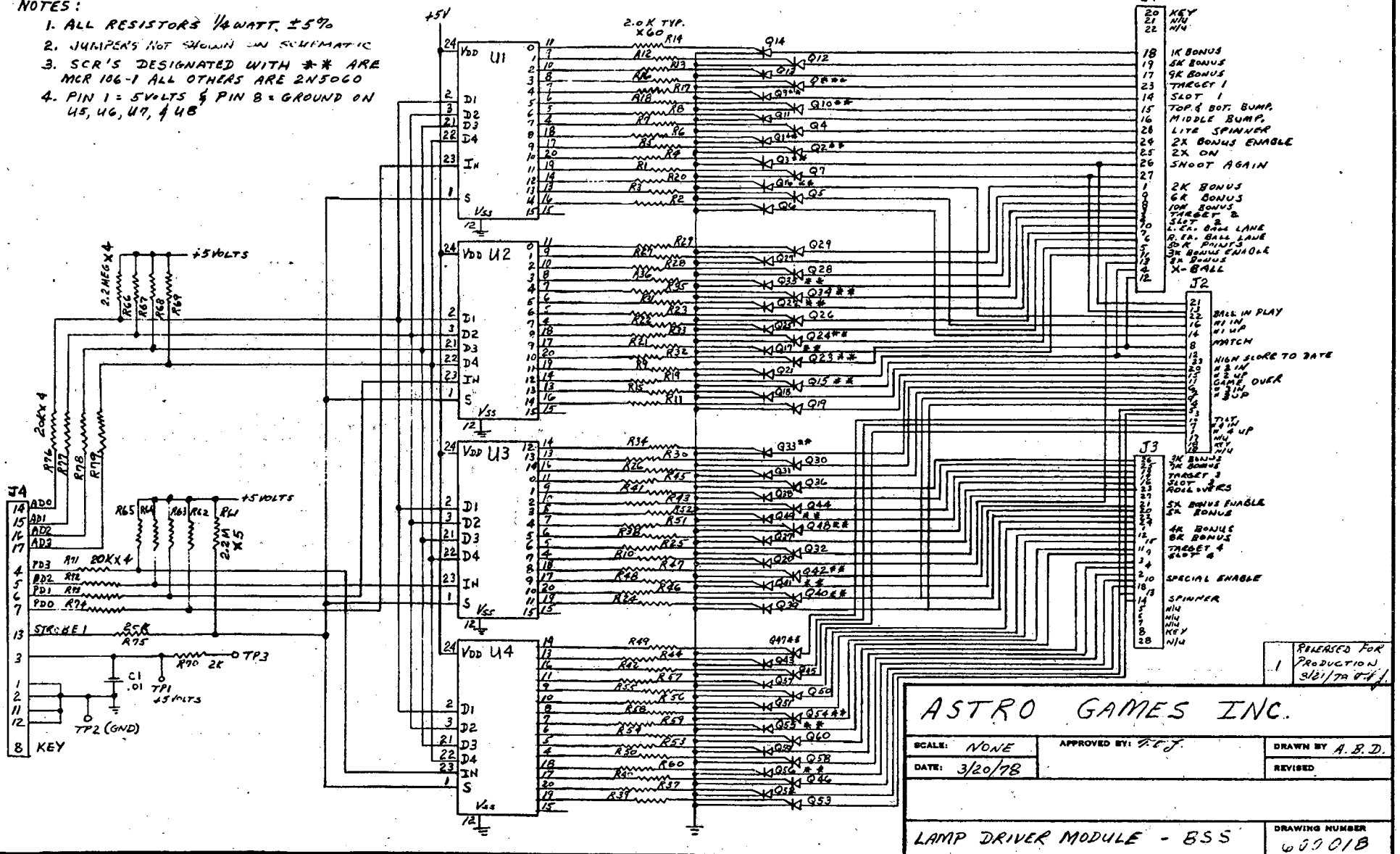
ASTRO GAMES INC.

SCALE: NONE	APPROVED BY: T.F.J.	DRAWN BY T. F. J.	
DATE: 3/24/78		REVISED	
POWER MODULE, XFORMER SCHEMATIC		DRAWING NUMBER 600008	


NOTES:
1. ALL RESISTORS ¼ WATT ±5% UNLESS OTHERWISE NOTED.
2. U1, U3, & U4 ARE CA-3081
3. U1, U3 & U4 PINS 5 & 15 ARE GROUND
4. U20 IS LAMBDA LAS 1905 OR EQUIV.
U2
74L154
+5
+5 VOLTS
SOLENOID GROUND
CHIME 10
CHIME 100
CHIME 1000
EXTRA CHIME
KNOCKER
OUTHOLE
N/U
SAUCER
MID. BUMP
TOP BUMP.
BOT. BUMP.
R. SLING
L. SLING
TO LEFT FLIPPER COIL
TO RIGHT FLIPPER COIL
TO LEFT FLIPPER BUTTON
TO RIGHT FLIPPER BUTTON
+3 V.D.C.
COIN L.O.
SOLENOID GROUND
11.9V.D.C.
+5V REG Q20
+5 V.D.C.
TO M.P.U.
LAMP DRIVER
DISPLAYS
M.P.U. GND
DISPLAY
TRANS. GROUND
230VOLT ±30VOLTS
+175 V.
3/16 AMP
25K 175V. ADJUST
82K ½WATT
RELEASED FOR PRODUCTION 3/23/78
ASTRO GAMES INC.
SCALE: NONE
DATE: 3/22/78
APPROVED BY:
DRAWN BY T.P.J
REVISED
SOLENOID DRIVER MODULE-DSS
DRAWING NUMBER 600013

NOTES:

1. ALL RESISTORS 1/4 WATT, ±5%
2. JUMPERS NOT SHOWN ON SCHEMATIC
3. SCR'S DESIGNATED WITH ** ARE MCR 106-1 ALL OTHERS ARE 2N5060
4. PIN 1 = 5 VOLTS & PIN 8 = GROUND ON U5, U6, U7, & U8

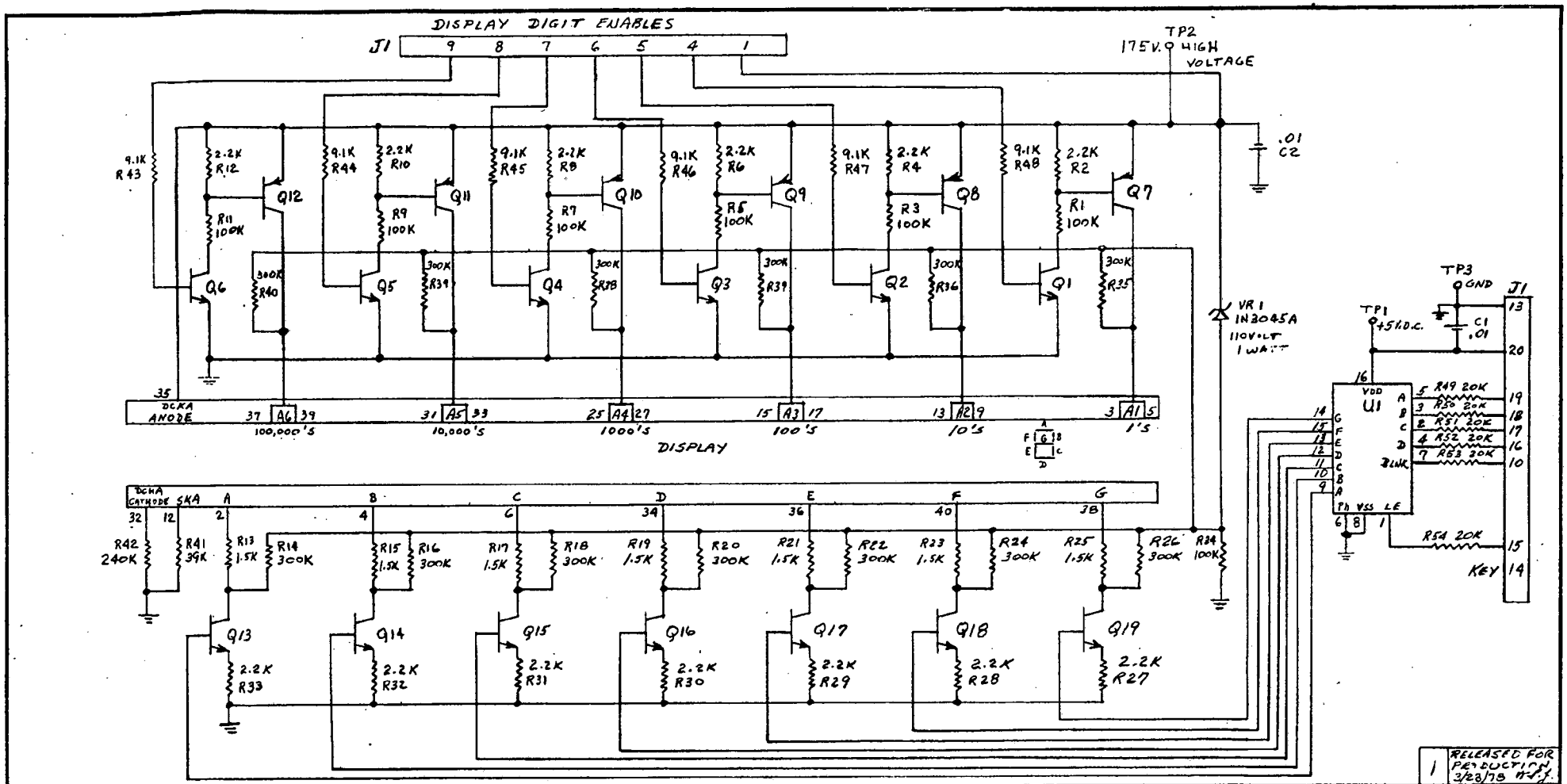


1	RELEASED FOR PRODUCTION 9/21/78	

ASTRO GAMES INC.

SCALE: NONE	APPROVED BY:	DRAWN BY A. B. D.
DATE: 3/20/78		REVISED
LAMP DRIVER MODULE - BSS		DRAWING NUMBER 605018

11X17 PRINTED ON NO. 1000H CLEARPRINT



NOTES:

1. ALL RESISTORS ARE 1/4 WATT ±5%
2. Q1 – Q6 & Q13 – Q19 ARE MPS-A42 OR EQUIVALENT
3. Q7 – Q12 ARE 2N5401 OR EQUIVALENT

1	RELEASED FOR PRODUCTION	3/28/78

ASTRO GAMES INC.

SCALE: NONE	APPROVED BY:	DRAWN BY A.B.D.
DATE: 3/23/78		REVISED
DISPLAY MODULE		DRAWING NUMBER 600023

REPLACEMENT PARTS:

Astro No.	Description:	Price Each:
SEMICONDUCTORS:		
MPU Module		
050000	IN4148 Diode	.07
050001	IN4004 Diode	.12
050009	Zenner Diode - 8.2V	1.00
050010	2N3904 Transistor	.26
050011	2N4403 Transistor	.27
075000	6800 MPU I.D.	9.95
075001	6810 RAM I.C.	4.75
075002	6820 PIA I.C.	5.15
075003	5101L CMOS RAM I.C.	5.90
075007	MC14049B I.C.	.68
075008	MC14011B I.C.	.44
075009	74L00N I.C.	.44
075010	14502B I.C.	1.61
075011	MC8602P (9602) I.C.	.98
075012	MC3459P I.C.	4.88
075013	555 I.C.	.49
125002	LED (Red)	.75
200039	.22 uH inductor	1.22
200040	3.6V Battery	7.25
200041	8 Position Dip Switch	1.95
200042	Pushbutton Switch	1.25
DA Module		
050002	Zenner Diode - 110V	.75
050003	MPSA42	.28
050004	2N5401 Transistor	.33
075006	MC14543 I.C.	2.12
125001	Gas Discharge Display	12.25
150000	25K. Linear Pot	.45
SDB Module		
030001	160 uf/350V Lytic Capacitor	3.20
030002	11,700 uf/20V Lytic Capacitor	4.65
050001	IN4004 Diode	.12
050015	2N6045 Transistor	1.45
050016	2N3440 Transistor	.98
050017	2N3584 Transistor	1.76
075015	LAS1405 Regulator	7.65
075016	CA3081 Transistor	1.65
075017	74L154 Binary Decoder	1.40
255000	Relay	6.12
TA-100 Module		
050001	IN4004 Diode	.12
050005	PK 20 Bridge Rectifier	2.84
050006	V100ZA15 Varistor	2.48
LDB Module		
050012	2N5060 SCR	.42
050013	C106Y1 SCR	.48
075014	MC14514 I.C.	2.36

REPLACEMENT PARTS:

Astro No.	Description:	Price Each:
FUSES		
SDB Module		
175008	3/16 amp, fastblo	.40
TA Module		
175002	3 amp, sloblo	.35
175003	4 amp, fastblo	.18
175004	5 amp, fastblo	.18
175005	10 amp, fastblo	.28
175006	3/4 amp, sloblo	.40
175007	2- amp, fastblo	.08
LEAF SWITCHES:		
200007	Target Switch	1.55
200008	Kickout Switch	.90
200009	Spinner Switch	.90
200010	General Playfield Switch	.85
200011	Thumper Switch	1.35
200043	End of Travel Switch	1.30
750058	Flipper Switch	1.30
800007	Slam Switch	1.10
LOWER CABINET PARTS:		
050007	Varistor, V130LA10A	1.85
200030	Line Filter APF-510L	9.79
200032	Power Switch	1.80
200036	Chime Coil	2.25
369901	Leg Bolts	.24
700005	Glass Channel Cover - Right	12.80
700006	Glass Channel Cover - Left	12.80
750011	Line Cord	4.50
750012	Glass Channel Extrusion (plastic)44"	.98
750018	Top Glass Playfield (Tempered)	9.95
750019	Leg Levelers	.75
700024	Legs	7.50
750059	Flipper Button	.36
750060	Flipper Housing	.22
700068	Ball Shooter Mounting Plate	.98
700069	Leg Mounting Plate	.99
700075	Flipper Switch Bracket	.50
700077	Chime Bar #1 - 5"	1.50
700078	Chime Bar #2 - 5 1/2"	1.50
700079	Chime Bar #3 - 6"	1.50
700080	Chime Bar #4 - 7"	1.50
700104	Coin Rejector (25¢ Version)	7.50
800001	Ball Shooter & Plunger Assembly	7.75
800004	Cash Box Assembly (including lid)	12.60
800005	Tilt Roll Assembly (complete)	5.95
800008	Front Moulding Assembly	16.75
800012	Coin Door Assembly (complete with rejectors)	69.95
800014	Plumb Tilt Assembly (complete)	1.95

REPLACEMENT PARTS

Astro No.	Description:	Price Each:
BACK BOX:		
200029	Transformer	19.95
200038	Coil only (for Knocker Assembly)	2.95
490002	Plastic Mounting Spacer (for P.C. Boards)	.05
700020	Back Glass Lift Channel	1.50
750029	Back Glass	49.95
805000	BSS MPU P.C. Assembly (complete)	119.50
805001	TA-100 Power Module P.C. Assembly (complete)	86.95
805002	SDB Solenoid Driver P.C. Board Assembly (complete)	99.50
805003	LDB Lamp Driver P.C. Board Assembly (complete)	99.50
805004	Display Assembly (complete)	39.95
810004	Replay Knocker Assembly (complete)	4.95
PLAYFIELD:		
200000	Coil (for Slingshot)	1.95
200000	Coil (for Thumper)	1.95
200001	Coil (for Kickout)	1.95
200002	Coil (for Flipper)	3.25
200016	Rubber Band 1 1/2"	.15
200017	Rubber Band, 2"	.15
200018	Rubber Band, 2 1/2"	.15
200019	Rubber Band, 3"	.15
200020	Rubber Band, 4"	.15
200024	Rubber ring	.08
200025	Rubber Rebounder	1.99
200038	Coil only	2.95
312612	Playfield plastic post fastener	.24
369900	Back Box bolts	.15
430003	Thumper body	.25
440003	Thumper wafer	.25
440004	Playfield plastic post	.18
480003	Thumper cap, blue	.50
490000	Thumper base	.10
490001	"Star" Rollover insert	.22
700055	Minipost	.30
700063	Upper ball gate	1.48
700081	Game ball	.50
750048	"Star" rollover button	.35
810002	Flipper Assembly - right (less coil)	8.25
810003	Flipper Assembly - left (less coil)	8.25
810004	Ball reset Assembly	4.95
810005	Spinner Assembly (less switch)	2.49
810006	Kickout Assembly	6.95
810007	Slingshot Assembly	6.95
800010	Thumper Assembly (complete-less coil)	6.95
MISCELLANEOUS:		
125000	#44 Light bulbs	.25
200046	Light bulb extractor	.20
700097	Roll cage ball	1.00
750091	Parts order form	N/C
760002	Contact adjusting tool	.45
750039	Operators Manual	5.00

ZERO CROSSING DETECTOR

DATA BUS

ADDRESS BUS

1	RELEASED FOR PRODUCTION 3/31/78 T.R.J.	

ASTRO GAMES INC.

SCALE: NONE	APPROVED BY: T.R.J. 3/30/78	DRAWN BY: A.B.D.
DATE: 3/29/78		REVISED
MPU CONTROL BOARD		DRAWING NUMBER 600003