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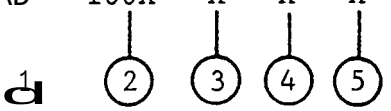
Information for the 1000 Series Dart Game

The following pages are being made available to those that need technical information on our older dart games. We realize that it is not in any way complete, and that some of the information is hand drawn, but we are furnishing what we have in case it will help someone. There are no parts available for these older games, nor is anyone at Arachnid familiar with them. We hope that what we can provide will be of some assistance.

AD-1000 SERIES DART GAME - MODEL TYPE CLASSIFICATION

This classification consists of 5 sections AD - 100X - X - X - X



1. AD- for Arachnid Darts

2. 4 numbers - the appearance of the game etc.
   - 1000 = flat top to lower cabinet mat type score inhibit.
   - 1001 = sloping top to lower cabinet 'Player Change' score inhibit.
   - 1002 = wall mounting vending game
   - 1003 =
   - 1100 = homegame board - numbers embossed on spider

3. 1 letter - the type of game available
   - A = 301 Game
   - B = Round the Clock
   - C = Count up from Zero
   - D = 301 Game ending on a Double Score
   - E = 301 Game starting and ending on a Double
   - F = Cutthroat
   - G = Games A, D, and E - pre-set with links
   - H = Games A, B, C, D, E, and F

4. 1 number - the type of dartboard
   - 1 = diaphragm & switches type
   - 2 = diaphragm & switches type with 'free' segments
   - = conductive rubber type 301 game only
   - 2 = conductive rubber type all games Eu double bullseye
   - 5 = permanently fixed segments, no switches, etc.

5. 1 letter - the electronics package
   - A = 9 P.C. cards on motherboard
   - B = 8 P.C. cards on shorter motherboard
   - C = 1 logic card with microcomputer

As an example:

Vending Machines	1 - 25 are type	AD-1000-A-l-A
	26 - 50 are type	AD-1001-A-l-A
	51 - 200 are ty e	AD-1001-A-2-B

The low cost homegame is type AD-110 -H-5.

THE 1000 IS A 301 ONLY. NO GAME SELECTS

COPY NO. 161

ISSUE; TO: Joyce
Voltage measurements LDPS

-ADVANCE ISSUE-

OPERATORS DATA BOOK

ENGLISH MARK DARTS MODELS 1000 and 1001

CONTENTS

CAUTION: This information must be treated as preliminary and may be subject to revision by subsequent documents.

PREPARED BY: MTL INC for:
Paddy, Inc.
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SECTION 2 MACHINE OPERATION

2.1 THE 'Game of Darts: the 301 game rules

'The players start with a score of 301 and each dart's score' subtracted from it. The players total therefore decreases and approaches zero as the game progresses. Player takes turn at throwing three darts. As each dart scores, its score is subtracted from that players total and his new total is displayed

'After a player has thrown all his three darts the player changebutton is pressed, he takes his darts out of the board and the next person takes his turn.

To WIN a game, a player has to make a score which reduces his score to zero exactly. This may happen 'with the first, second or third dart of his turn. When a player's score equals exactly ZERO the machine will: -

(i) set up a GAME OVER situation
(ii) indicate that payer has WON
(iii) prevent any inputs from having any effect, except for coin insertion
(iv) drive a gong

As a players score approaches ZERO, he may hit a number which is greater than he requires to WIN. As with a WIN, this could happen on the first, second or third dart. This situation is called a BUST. When a BUST situation occurs then the.machine will: -

(i) recall the player's score immediately prior to his present turn and display it. If a player BUSTS on his first dart, he will not notice any change in his score but busting on darts 2 or 3 he will notice that his score reverts to what it was before throwing the first dart.
(ii) turn on the "BUST" lamp
(iii) drive a buzzer
(iv) prevent any further score from being recorded.

After achieving a bust the player then abandons his turn, presses the plaver change button and recovers his darts from the board. With this action the next player is brought into the game and the BUST lamp is cleared. (The score for the player who bust is not changed by pressing the player change button).

The Displays on the English Mark Darts machlne.

(i) four sets of three decades (hundreds, tens and units) of LED (light emitting diode) displays--are for each player. These show the players score during the course of the game. Further they indicate how many players are in a game as the players score is only displayed if sufficient coins have been inserted.

(ii) four 'Player Turn' indicator lamps

(iii) four 'WIN' indicator lamps, are associated wfth each player

(iv) one "BUST' indicator lamp

(v) one 'GAMEOVER' indicator lamp

2.3 Other Outputs. Alonge .

The Bust buzzer and the Win gong are both inside the upper cabinets and the Board Illiumination lamp has a socket on the right hand side of the upper cabinet.

The Board Illumination lamp is turned .on after the first coin is inserted and goes off about 1 second after the game has been won.

2.4 The Action of the Coin Mechanism

The first coin inserted after either

a) the machine has been switched on, or

b) the machine is in a WIN (or GAMEOVER) condition, or

(cl the 'player change' button has been pressed, will set up the game for 1 player

Subsequent coins will add to the number of players in the game.

SIGNAL DESCRIPTION LISTS

NUMBERING SYSTEM

All signals going into or coming out of the individual circuit cards have been designated a unique number.

- The simple code has either a P or an L initially and this signifies whether the ACTIVE portion of that signal is long term or transitory.
- The second digit is either a 0 or a 1. Again this designates the ACTIVE part of the pulse or level to be a logic 0 or a logic 1.
- From then on they are listed numerically.

CARDS AND PIN NUMBERS

Underneath each card type is a bracket number. That is the pin number associated with that signal. On occasions where there are 4 similar signals, going to, or coming from, the 4 PSD cards the signals are subscripted a,b,c,d. In these cases 4 pin numbers appear in the listing an these are in the sequence of a,b,c,d.

SECTION 3 CABINET AND FIXTURES

3.1 Cabinet

The machine. comprises an upper and lower cabinet. The lower cabinet houses solely the coin mechanism and is accessible only from the front in the coin door. All the remainder of the game is contained within the upper cabinet. Access to this is through the door on the rear.

The wiring diagram, drawing SAD01 6, provides a schematic representation of the wiring within the cabinet and also gives the colours of the individual wires in the cableform.

The Component Parts List details all the major items in the cabinets and from these two data sheets, the essential features of this machine can be recognized.

3.2 Transformer

All the low voltages used in this machine are derived from the one transformer mounted in the base of the upper cabinet. It has been conservatively rated and is unlikely to fail. However if it is necessary to check it, an A.C. voltmeter ought to give a 10 volt reading between red/yellow lead and both of the yellow leads and a 12 volt reading between the green/yellow lead and both of the green leads.

3 . Buzzer and Gong

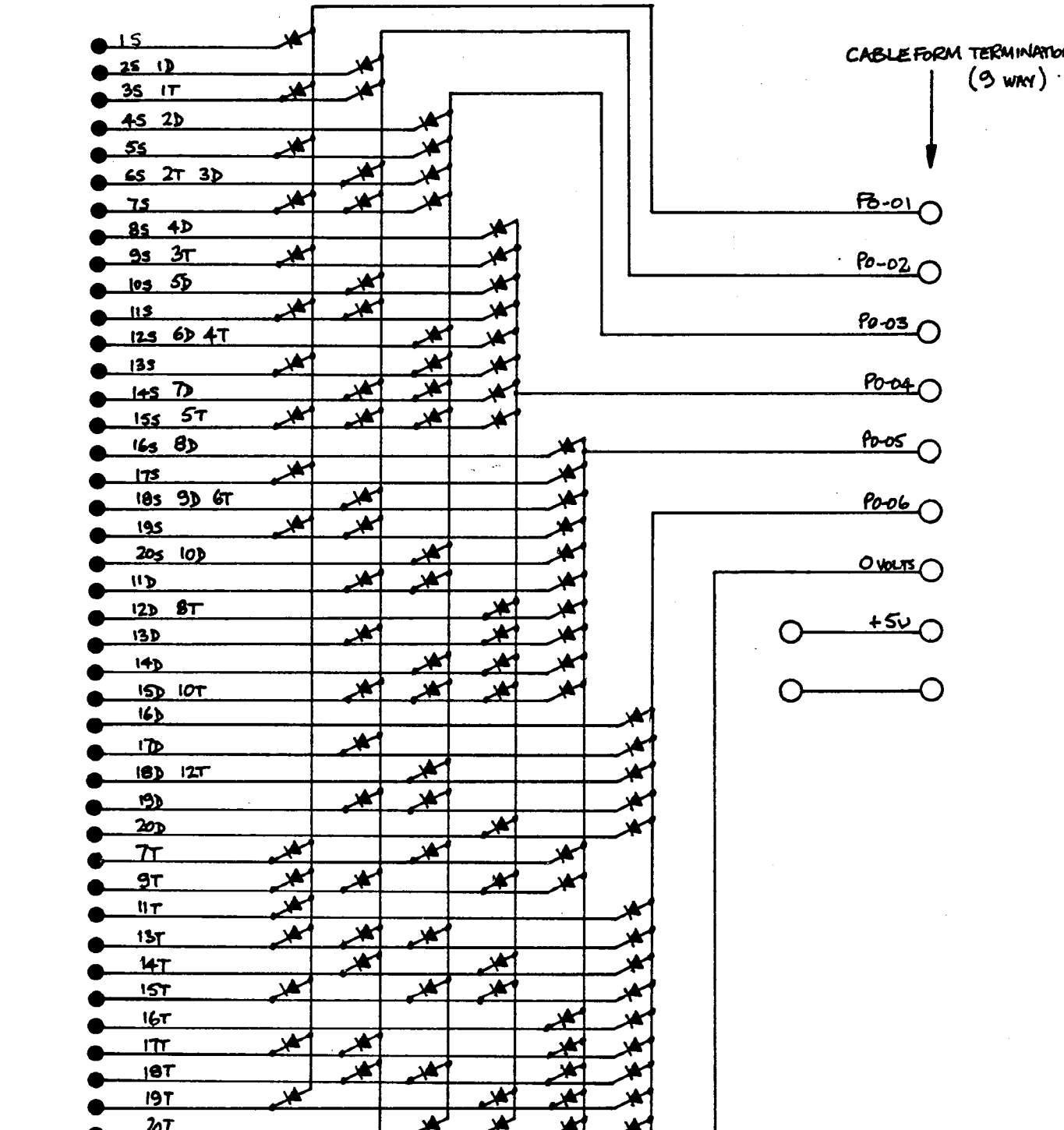
The two devices are activated during the course of a game, the buzzer to tell the player that he has gone beyond zero and the gong to tell him that he has achieved zero.

The buzzer is driven from a 115V A.C. signal and may need occasional adjustment of the screw holding its mounting bracket to the cabinet (the lower of the two screws) to obtain the loudest buzz.

The gong is driven from a 24V A.C. signal and has no'means of adjustment.

3.3 Coin Mechanism

The need for regualr cleaning of this item is the same as for coin mechanisms generally in vending machines. (Notes on this are to be found in section 7). The optional resistor Rl of 100 ohm shown on the cabinet wiring schedule (Drwing number SAD0126) prevents the [machine from giving free games when the coin door is hit violently, causing the microswitch to make a momentorary contact.



SCHEMATIC DM1 BOARD
DRAWING SAD 0121 ISS1 9/75

DM 1

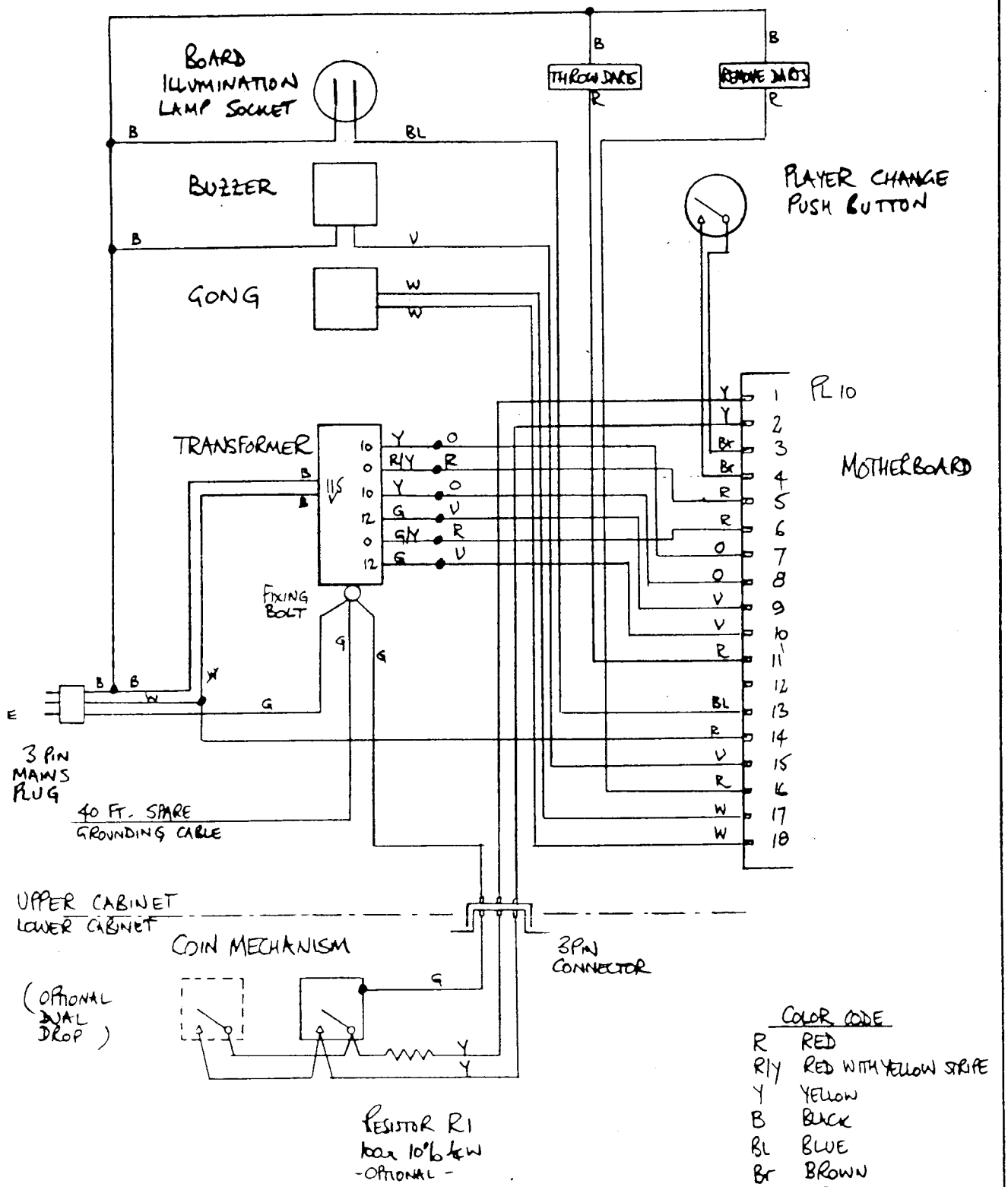
4.4 Diode Matrix

Each segment's switch contacts are connected to a printed circuit card which is assembled to encircle the outer ring of switches. (The card is 21/2" wide by 48" long when laid flat prior to assembly).

The singles, doubles and triples are connected by red, blue and white wires respectively. A common line joins all other contacts of the 81 switches.

This printed circuit card contains an encoding diode matrix which encodes each score into a plain binary word of 1,2,4,8,16 and 32. Drawing number SAD0121 illustrates this technique.

A cableform connects this matrix to PL9 of the Motherboard.



COLOR CODE	
R	RED
R/Y	RED WITH YELLOW STRIPE
Y	YELLOW
B	BLACK
BL	BLUE
Br	BROWN
O	ORANGE
V	VIOLET
W	WHITE
G	GREEN
G/Y	GREEN WITH YELLOW ST.

SCHEMATIC CABINET WIRING
DRAWING # SAD 0126

SECTION 5 ELECTRONICS PACKAGE

5.1 Component Parts

The electronics package comprises 8 plug in printed circuit component cards (daughter cards) approximately 8" x 5". Which fit into a printed circuit motherboard. The motherboard is approximately 21" x 8" and houses the 4 sets of the 7 segment displays, the lamps which illuminate the various captions and edge connector to connect to the cabinet cable.forms.

Of the 8 plug in cards, 4 are identical. Giving 5 different card types. Each type is described in the sections following the motherboard description.

Each of the card types has a keying slot in the connector edge to prevent incorrect insertion of either the wrong card type or that plug or the right card type but inverted.

5.2 The Motherboard

The Motherboard is a printed circuit card containing all the interconnecting links of the 8 daughter boards and the links to the LED displays. It also serves as a fixing point for the reservoir capacitor for the major +5 volt logic supply line.

Two edge connectors, PL9 and PL10, connect it to the cabinet cableform and 8 ½" screws fix the motherboard to the front of the upper cabinet.

The description of the operation of the electronics package is contained in mainly the individual sections for each card type but here signals appear on the motherboard, then these signals are assigned a code and are described fully in the subsequent signal description lists. This has been made part of the section on the motherboard for convienience.

SIGNAL DESCRIPTION LIST

SIGNAL CODE	SOURCE AND DESTINATICIN	CHARACTERISTICS AND FUNCTION (TTL LEVELS WHERE NOT OTHERWISE STATED)
PO-01	Matrix to SP'C (13	Decoded binary 1 of score. Noisy due to severe' conta t bounce. 50 msec to be
PO-02	" (11	" 2 allowed for bounce.
PO-03	" (9	" 4 (1=+5v 0=+0.7v)
PO-04	" (7	" 8 "
PO-05	" (21	" 16 "
PO-06	" (213	" 32 "
PO-07	SPC to GPM (I) (44)	15 msec when ANY score is made. Sets IC19 on GPM to control loading 'number of players playing' register (IC18).
Pl-08	SPC to TSO (15) (2)	Pulse train, number of 'pulses equals score. Used to load 3 decade counter (3 x 74192's) on TSD. Approx 10KHz. --Only used in AD1000 Models with Temporary Score Dis lay
Pl-09	SPC to GPM (17) (53)	as P1-08. Ultimate destination is one of 4 PSD's controlled by 'Players turn' register (IC11 on GPM).!
PO-10	Coin Mechanis to GPM (41)	A closing contact to 0 volts for a coin inserted into into mechanism. Significant bounce/noise to be ex- pected. (Exact amount dependent on mechanism).
PO-11	Player change switch to GPF (20)	A push button contact to 0 volts to sequence 'player turn' register round by 1 (IC11 on GPM). Bounce dependent on contact type.
PO-12	GPM to WBD (34) (12)	15 msec. Derived from 'coin inserted'. Resets WIN register, IC13, on WBD.
PO-13	GPM to WBD (33) (33)	15 msec. Derived from 'switch on reset' circuit. Se s WIN register.
P1-14		number not allocated.
PO-15	GPM to PSD (9,12,11,(55) 10)	15 msec. Derived from both 'coin inserted' or 'switc on reset'. Clocks 3 decade counters (3 x 74192's) on PSD for a parallel load. If L1-31 is a 1 then 301 is load into counters (see PO-20 for other condition).
Pl-16	GPM to TSD (28) (I)	15 msec. Derived from both 'coin inserted' or 'playe change'. Resets 3 decade counters on TSD to zero. --Only used in AD1000 Models with Temporary Score Dis ly
PO-17	GPM to WBD (13) (35)	15 msec. Effectively Pl-16. Resets BUST register (I 15 on WBD and produces reset or transfer pulses onwards 3 PSD (see PO-19 and PO-20).
P1-18	GPM to PSD (18,21 22,23) (2)	Pulse train. Derived from SPC, gated on GPM. Used t count up the 3 decade counters on the selected PSD.
PO-19	WBD to PSD (10,9,7,8) (3	15 msec. Derived from PO-12 and 'Reset Bust Register (PO-17. Transfers new valid score into display regis er (3 x 7475's) on PSD.

SIGNAL DESCRIPTION LIST

SIGNAL CODE	SOURCE AND DEST NATION	CHARACTERISTICS AND FUNCTION (TTL LEVELS WHERE NOT OTHERWISE STATED)
PO-20	WBD to PSD (20,27, (59) 21,20)	15 msec. Derviced from PO-17 if Bust situation exist Clocks 3 decade counters on PSD for parallel load. Loads last score if Ll-31 is at 0.
PO-21	WBD to GPM (18 (50)	80 msec. Occurs when BUST detected.
Pl-22	WBD to LDPS (43) (40)	20 msec. Occurs when WIN situation detected. Drives RL2 on LDPS to activate gong. (Used in current sink mode, hence little voltage change if monitored. (logic 0 typ. 0.3v logic 1 typ. 0.7v)).
PO-23	to WBD 37)	Not currently used. If' pulse applied to WBD wi11 create a BUST situation.
Pl-24	GPM to LDPS (19) (39)	Inverse of PO-21. Drives relay RL1 on LDPS to activa e Buzzer. Used in current sink mode (as P1-22)
Pl-25	GPM :o LDPS (61) (41)	Pulse of 5 seconds following 'player change'. Drives RL1 on motherboard to change captions' illumination from 'Throw Darts' to "Remove Darts'.
PO-26	LDPS to RL1 (9) (M-B)	Drive signal to RL1 resulting from Pl-25.
	LDPS	for Blowing Fuses change TR 22 on power board (2N4059)
	"	jumps score card by LDPS. TR 11-2N4400
	"	jumps players card by LDPS. TR 11-2N4400

SIGNAL DESCRIPTION LIST

SIGNAL CODE	SOURCE AND DEST NATION	CHARACTERISTICS AND FUNCTION (TTL LEVELS WHERE NOT OTHERWISE STATED)
LO-01	GPM (38,36,35,1)	Signals not used
L1-02	GPM to PSD (2,3,4,40) (54	Derived from 'number of players in game' register. Drives (via PSD and out on L1-30) associated LED disp ay Used in current sink mode.
L1-03 L1-04 L1-05 L1-06	GPM to LDPS (29 " (51) (54 " (49) (37 " (47) (5) " (45)	Derived from 'players turn' register on GPM. Used to drive associated caption lamps indicating whose turn it is to play. Players 1 thru 4 run in sequence as L1-03 thru L1-06. Used in current sink mode.
L1-07 L1-08 L1-09 L1-10	GPM(14 WBD 29 (15 23 (16 22 (17 19	Derived from 'players turn' register. Used on WBD to gate out pulses etc to correct PSD.
LO-11		Not allocated.
LO-12	PSD to WBD (50) (16,15 14,13)	Occurs if a score exceeding 0 detected in decade counte on PSD. Used to clock WIN and BUST register. If score is 0 then LO-12 is a level at 0 and win register clocke If score exceeds 0 then LO-12 is a pulse 100msec long and BUST register clocked.
L1-13	WBD to LDPS (41) (38)	Occurs when first coin is inserted and lasts till 1 sec after WIN detected. Drives 'Board Illumination Lamp' via RL3 on LDPS. Used in current sink mode.
L1-14	WBD to LDPS (1) (43)	Occurs when WIN registered. Cancelled by insertion of first coin. Drives GAMEOVER lamp via LO-40. Used in current sink mode.
LO-15	WBD to SPC & GPM (2) (5) (27	Inverse of L1-14. Used on SPC to prevent registering further scores after a win and stops 'player change' from working on GPM.
L1-16 L1-17 L1-18 L1-19	WBD to LDPS (6) " (50) (5) " (48) (4) " (46) (3) " (44)	Gated output of WIN and which players turn it is. Used via LO-33, LO-35, LO-37, and LO-39 (and LDPS) to drive associated WIN caption lamps.
O-20	WBD to SPC (12) (3	Occurs in a BUST situation. Used on SPC to prevent registering further scores in a BUST situation. Reset by 'player change' being pushed.
L1-21	WBD to LDPS (11) (42)	Inverse of LO.-20. Drives BUST lamp via LO-41 on LDPS. Used in current sink mode.
LO-22	GPM to SPC (59) (19)	Inhibits scoring on SPC for 5 seconds after 'player change.' has been pushed.

SIGNAL DESCRIPTION LIST

SIGNAL CODE	SOURCE AND DESTINATION	CHARACTERISTICS AND FUNCTION (TTL LEVEL WHERE NOT OTHERWISE STATED)
LO-23	to PSD(4) and TSD(15	not connected. Potential use as Lamp Test facility for all 7 segment displays.
LO-24 LO-25 LO-26	TSD to 7 seg displays	units tens hundreds (F segment omitted) drives used to sink current from appropriate LED displays of Break Score. (common anode displays). --Only used on AD-1000 Models with Temporary Displays
LO-27 LO-28 LO-29	PSD to 7 seg disp ays	units tens hundreds (F segment omitted). As above. The 4 PSD sources drive the respective players score.
L1-30	PSD to displa (19 & 51)	Derived from appropriate L1-02. Supplies current (fr m 10v FWR) to common anode of associated players displa S
L1-31	GPM to PSD (39, 6 (61) 7,8)	Set to 1 by inserting first coin. At 0 by either 'switch on reset' or 'player change' (PO-11) or 'firs date' (PO-01). In 1 state allows parallel entry of 301 into 3 decade co-unters on PSD. In 0 state allows parallel entry of last score as held in display register.
	DPS to captio	
LO-32	19) " lamps	Player 1
LO-33	18) "	" win
LO-34	17) "	Player 2
LO-35	16) "	" win
LO-36	15) "	Player 3
LO-37	14) "	" win
LO-38	13) "	Player 4
LO-39	12) "	" win
LO-40	11) "	Gameover
LO-41	10) "	BUST

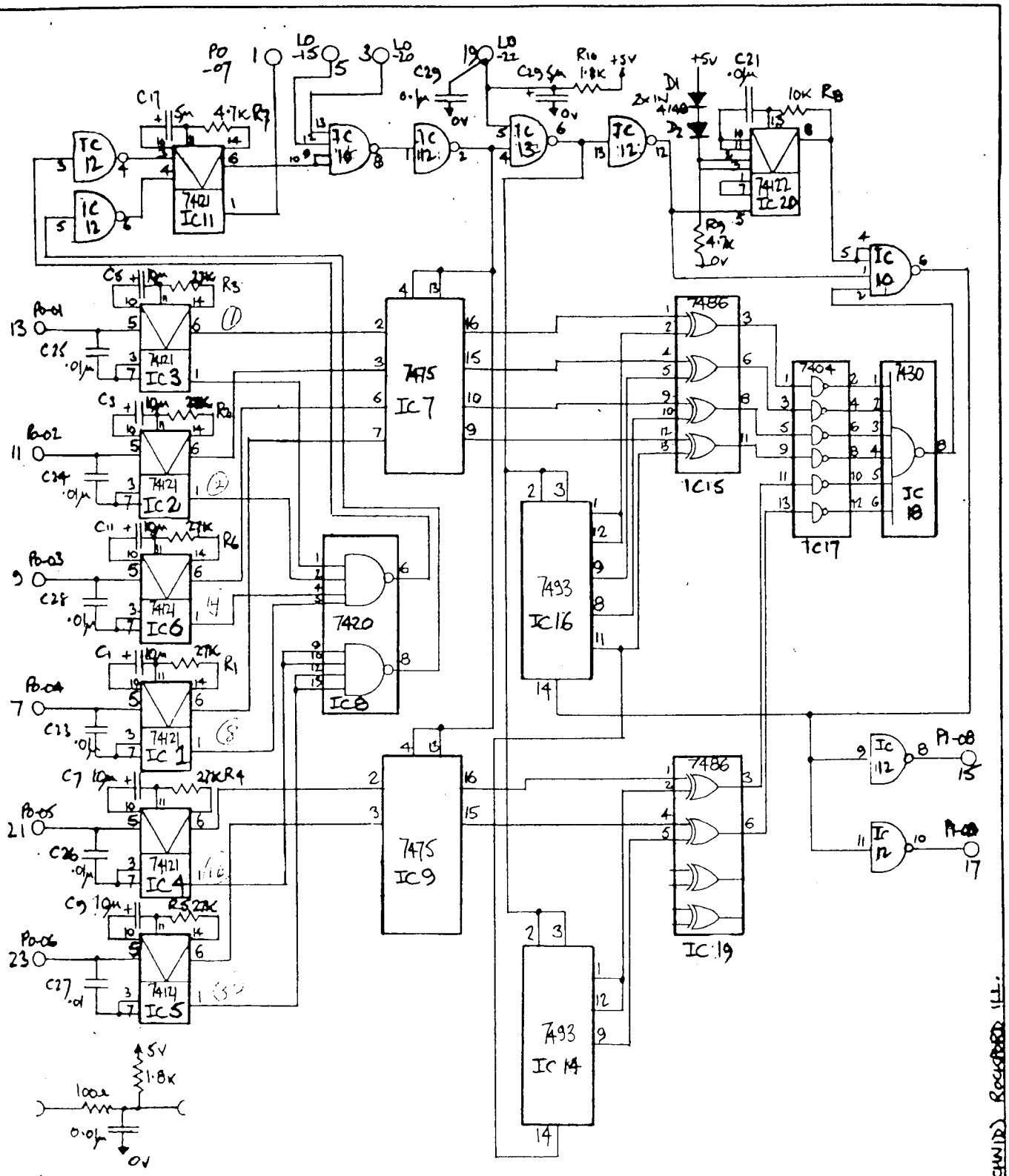
5.3 The Score-to-Pulse Conversion (SPC) Card (PL1) on Motherboard)

The 6 encoded inputs PO-01 through PO-06 (weighted 1,2,4,8,16,32 respectively) from the dartboard and its diode matrix are the prime inputs to this card. Because of the non uniform nature of the dartboard signal, each of these six are conditioned into uniform pulses, around 50 milliseconds long, by monostables (IC's 3,2,6,1, 4, and 5 resply).

The outputs of these monostables are- clocked into registers IC7 and IC9 by means of a clock pulse from IC11. This clock pulse can be inhibited by LO-15 and LO-20 and these are used to prevent a score registering in the case of a win or a bust.

When a score is made, IC20, a 10KHz oscilletor is gated to start. Pulses from it fill up a counter, (IC16 and IC14) and when the number in it is the same as the score, then a 6 bit comparator (IC15 and IC19) stops the oscilletor.

Pulses are output from this card on pins 15 and 17 as P1-08 and Pl-09. Only P1-09 is used and is routed to the GPM card.


PO -07
LO -15
LO -20
LO -22
C29 0.1μ
C29 5μ
R10 1.8K +5V
+5V C21 .01μ
D1 2x IN 4148
D2
10K R8
IC 12
IC 10
IC 13
IC 11
IC 16
7402 IC11
7422 IC 20
R9 4.7K 0V
C17 5μ 4.7K R7
C5 10μ 27K R5
C3 10μ 27K R3
C11 10μ 27K R6
C1 10μ 27K R1
C7 10μ 27K R4
C9 10μ 27K R5
PO-01
PO-02
PO-03
PO-04
PO-05
PO-06
13
11
9
7
21
23
C25 .01μ
C24 .01μ
C28 .01μ
C23 .01μ
C26 .01μ
C27 .01
7421 IC 3
7421 IC 2
7421 IC 6
7421 IC 1
7421 IC 4
7421 IC 5
7475 IC 7
7475 IC 9
7420 IC 8
7486 IC 15
7486 IC 19
7404 IC 17
7430 IC 18
7493 IC 16
7493 IC 14
PI-08
PI-09
15
17
5V
1.8K
100Ω
0.01μ
0V
6 FILTER CIRCUITS IN LINES BETWEEN PO1-01 & IC 3 PINS 5; ETC.
+Vcc
C13, C19, C25
C21, C22
10μ C22
0 Volts
5x 0.01μ
30
31
32
24
25
SCHEMATIC SPC CARD
DRAWING NO SAD 0120 ISS 1 6/76
SPC
MTL INC (APACHE) ROCKFORD ILL.

COMPONENT PARTS LIST- SPC CARD

M T L #	NO.OFF	CCT.REF.	COMPN. TYPE	DESCRIPTION
#053	1	IC 13	SN-7400	TTL INTEGRATED CIRCUIT
054	2	IC 12,17	SN-7404	"
055	2	IC 8,10	SN-7420	"
056	1	IC 18	SN-7430	"
060	2	IC 7,9	SN-7475	"
061	2	IC 15,19	SN-7486	"
062	2	IC 14,16	SN-7493A	"
064	7	IC 1,2,3,4,5, 6,11	SN-74121	"
066	1	IC 20	SN-74122	"
001	2	D1,D2	IN 4148	SI. SIGNAL DIODE
022	6	R1,2,3,4, 5,6,	27KΩ	RESISTORS-GENERAL PURPOSE 1/4W, 10%
023	2	R7,9	4.7KΩ	"
024	1	R8	10KΩ	"
032	1	R10	1KΩ	"
010	6	R12,13,14,16 17,18	100 Ω	"
027	6	R11,15,19,20, 21,22	1.8KΩ	"
001	20	C 2,4,6,8,10, 12,13,16,17, 18,19,20,21, 14,23,24,25, 26,27,28	0.01μF25V	CAPACITOR, MONOLITHIC CERAMIC -RADIAL LEADS -TEMP. CHARACTERISTICS NOT CRITICAL -TYPICAL TOLERANCE +80%, -20%
002	2	C 15,19	5μF (OR 4.7μF) 25V TYP.	CAPACITOR, MIN. A L . ELECTROLYTIC -AXIAL LEADS -TEMP. CHARACTERISTIC NOT CRITICAL -TYPICAL TOLERANCE +100%, -20%
003	7	C 1,3,5,7,9, 11,22	10μF, 25V TYP.	"
SP502			SPC CARD (Complete Assembly)	

5.4 The Game and Player Management (GPM) card (PL2) on the Motherboard)

The major function of this card are:

(i) to count the number of coins and hence the number of players in the game.

(ii) to sequence the players' turn when the player change button is pressed

(iii) to distribute the score pulse train (from the SPC card (PO-09) to the appropriate PSD card).

(iv) to reset the game to a 'GAMEOVER' condition with power on.

The pulse from the coin mechanism, PO-10, triggers a monostable IC12 which clocks a 4 bit shift register IC18. With suitable buffering, the 4 outputs of this register leave the card as LO-02 (a) through (d) and are routed to each PSD card. (There they allow currents to pass through the players score LED's). Pin 6 of IC18 is a 'mode control' input and will allow IC18 to shift right or to have a parallel input. The parallel input is 1000 and occurs when the first coin is inserted (see sect 2.4). A register, IC19, controls this, it being set by a 'player change' signal (PO-11) or by the machine being powered up. It is cleared by the coin mechanism pulse.

Operation of the 'player change' button will trigger a 5 second monostable, IC24 which, if LO-15 is a logic 1, will trigger monostable IC22. During this 5 second delay, signal LO-22 inhibits scoring as the SPC card and signal P1-25 operates, via a relay driver circuit on the LDPS card, RL1 on the Motherboard. (This controls the caption'lamps, changing THROW DARTS to REMOVE DARTS as the illuminated caption for the 5 seconds).

IC22 output is or-ed with the coin mechanism pulse in IC6 gate 1 and buffered in IC3 gate 1 to give PO-17. This pulse feeds the WBD card to reset the BUST register. This output from IC6 gate 1 also is used as the clock for a second 4 bit shift register, IC11. The combination of gates using IC's 16 and 20 and parts of IC's 15, 4 and 17 control the 'mode control' input of IC11. Essentially they allow a parallel entry of 1000 for the first player and then a shift right every time the 'player change' is pushed. If 2 players are playing, IC11 cycles through 1000, 0100, 1000,0100 etc. If 3 players are playing it cycles 1000, 0100, 0010, 1000, 0100, 0010 etc. and for 4 players it cycles 1000, 0100, 0010, 0001, 1000 etc. from IC11 via suitable buffering Ll-07 through L1-10 are output to the WBD card to signal which player is taking his turn and L1-03 through Ll-06 is output. These letter 4 drive, via lamp drivers on the LDPS card the caption lamps indicating whose turn it is.

COMPONENT PARTS LIST – WBD BOARD

MTL #	NO. OFF	CCT. REF.	DESCRIPTION	SUPPLIER/ORDERING INFO
#053	3	IC 2,7,8	SN-7400	TTL INTEGRATED CIRCUIT'
054	2	IC 1,3	SN-7404	"
055	5	IC 4,5,9, 10,13	SN-7420	"
059	1	IC 11	SN-7474	"
064	5	IC 6,12,14 15,16	SN-74121	"
010	1	R7	100Ω	RESISTORS-GENERAL PURPOSE 10%, 1/4W
027	1	R6	1.8KΩ	"
028	1	R3	2.7KΩ	"
029	1	R4	5.6KΩ	"
024	1	R2	10KΩ	"
031	2	R1,5	22KΩ	"
001	11	C 2,3,5,6, 7,9,10,12 15,16	0.01μF, 25V	CAPACITOR, MONOLITHIC CERAMIC -RADIAL LEADS -TEMPERATURE CHARACTER. NOT CRITICAL -TYPICAL TOLERANCE +80%, -20%
002		C8,11,13,14	5μF (OR4.7μF) 25V	CAPACITOR, MIN. AL. ELECTROLYTIC -AXIAL LEADS -TEMP. CHARACTERISTJCS NOT CRITICAL -TYPICAL TOLERANCE +100%, -20%
003	1	C1	10μF 25V TYP.	"
005	1	c4	50μF 25V TYP.	"
SP504			WBD CARD (Complete Assembly)	

The WIN and BUST Detection (WBD) card. (con't)

The second register of IC11 is the BUST register. It outputs L1-20 to the SPC card to prevent any further scoring and L1-21 to the LDPS card and thence to the BUST lamp. It also triggers monostable IC15 which provides a pulse to drive the buzzer.

The pulse from IC15 is also used with gating from the appropriate 'player turn' signals (L1-07 to 10) to produce PO-20 a through d. These are routed to the 4 PSD cards and become clock pulses to effect a parallel load of the 3 decade counters. (In a bust condition they are loaded with the players last score).

Pulse PO-17 is fed from the GPM card to this card and is used to trigger monostable IC12 and reset the Bust register. (This monostable is also triggered by the WIN register being set). The resultant pulse from IC12 is gated with the inverted output of the Bust register and the previously mentioned 'players turn' signals (Ll-07 through 10) to produce PO-19 a through d. PO-19 is routed to the PSD cards and clocks into a 3 decade register the players current score. Hence when a player has notbusted then his 'last' score is updated. PO-19 is also generated in a win condition such that the winning player has a presented score of zero.

5.6 The Players Score and' Display (PSD) card
(Plugs 4,5,6 and 7 on the Motherboard)

A three decade counter, IC's 6, 10 and 9 (units, tens and hundreds respectively) is fed by a pulse train P1-18 from the SPC card. The output from this counter feeds 3 binary-to-7 segment display decoders (IC's 2,3 and 5) whose outputs are taken in turn to LED's on the Motherboard.

IC's 12,13,14,15 and 16 are multiplexes whose output.is controlled by Ll-31. Their outputs feed the 3 decade counter and with Ll-31 at a (which occurs at the start of a game) and PO-15 occurring, 301 is loaded into the counters. With Ll-31 at a 0 and PO-20 occuring then the players last score is loaded into the counters. (This is the result of a BUST condition).

Pulse PO-19 is derived from the WBD card and loads the players last valid score into IC's 1,8 and 4 when he has finished his turn and he has not bust.

Signal L1-02 turns on TR1 and TR2 to supply the players LED score displays with current so that only those players who are taking part have their displays illuminated.

COMPONENT PARTS LIST – PSD CARD

MTL#	NO.OFF.	CCT.REF.	COMPN. TYPE	DESCRIPTION
#053	1	IC 11	SN-7400	TTL INTEGRATED CIRCUIT
054	1	IC 7	SN-7404	"
057	3	Ic 2,3,5	SN-7447A	"
058	5	Ic 12,13,14, 15,16	SN-7451	"
060	3	IC 1,4,8,	SN-7475	"
066	3	IC 6,9,10	SN-74192	"
095	20	R1 THRU R20	390Ω	RESISTOR- GENERAL SUPPLY 1/2W, 10%
028	1	R22	2.7KΩ	RESISTOR 1/4W, 10%
030	2	R21,23	10KΩ	" " "
003	1	C1	10μF, 25V TYP.	CAPACITOR, MIN. AL. ELECTROLYTIC -AXIAL LEADS -TYPICAL TOLERANCE +100%, -20%
001	7	C2 THRU C8	0.01μF 25V	CAPACITOR, MONOLITHIC CERAMIC -RADIAL LEADS -TEMP. CHARACTERISTICS NOT CRITICAL -TYPICAL TOLERANCE +80%, -20%
040	1	TR1	2N3708 (TI)	TRANSISTOR -SI, N-p-N, PLANAR
042	1	TR2	2N4402 (MOT)	TRANSISTOR -SI, P-N-P, MED. CURRENT $-V_{CE}$= 30V $-I_C$ = 1/2A TYPICALLY
096	1	-	HEATSINK FOR #042 (TR2)	TO-92 HEATS INK -RCA TYPE KM3413
SP505			PSD CARD (Complete Assembly)	

5.6 The Lamp Driver and Power Supply (LDPS) card (PL8 on the Motherboard)

The lamp driving parts of this card consist of 10 identical circuits (T1 through T10 and associated components)which have a drive capability of 500mA. The specific lamps they drive are detailed elsewhere (notably in the signal description lists).

Four further circuits, identical except for the addition of a single suppression diode across the drive transistor, (T11 through T14 and associated components) are relay drives. Three relays are mounted on this card and the fourth is on the Motherboard, as RL1, and controls the illumination of the 'Throw Darts! and 'Remove Darts' captions.

The +5 volts power supply regulator is an amplifier consisting of T21,20,19,17 and 18 in that sequence. The latter being the output transistors and are mounted on the heatsinks. Adjustment to the 5 volts is made by RV1, an anticlockwise movement of which will increase the voltage. The stability of the 5 volt supply is determined by the reference voltage derived from D12 and D13 circuitry and will maintain the output within 50 millivolts from no load to 4 amps.

Overcurrent protection is provided by the circuitry around T15 and T16. Normally those are off and only when the current through R17 and R33 is sufficiently high to cause the voltage drop across R17/33 to exceed about 2½ volts will T15 and T16 conduct. Once conducting they latch themselves on and cause T17 and T18 to be held OFF. Only by disconnecting power from the machine for about 5 seconds and then reconnecting will the power supply circuit be reset for normal operation.

Over voltage protection is provided by the 'crowbar' circuit T22 and SCR1. Normally there are OFF but if the monitored voltage, the 5 volt line, rises to around i-5.5 volts then T22 will conduct and five SCR1. Having fired, the 5 volt line is pulled down and either the overcurrent protection circuit will trip or fuse FS1 will slow..

A further small overvoltage protection for very fast transients is provided by zener diode D15 of 5.6 volts, which is strapped across the 5 volt line.

COMPONENT PARTS LIST - LDPS CARD

MTL#	NO.OFF	CCT.REF.	COMPN. TYPE	DESCRIPTION
#041	14	T1 THRU T14	2~4400 (TI)	TRANSISTOR -N-P-N, SI PLANAR $-V_{CE}$ = 30V -1, = 1A PEAK -TO5 OR TO92 CASE
043	3	T15, T20, T22	2N 4059 (TI)	TRANSISTOR-P-N-P, SI PLANAR V_{CE} = 30V $-I_C$ = 200MA, TO92 CASE
040	3	T16, T19, T21	2N 3708 (TI)	TRANSISTOR-N-P-N SI PLANAR $-V_{CE}$ = 30V $-I_C$ = 200MA -TO92 CASE
044	1	T19	TIP 31 (TI)	TRANSISTOR- NPN SI POWER $-V_{CE}$ = 40V $-I_C$ = 3A -TO 220 AB CASE
045	1	T18	2N 3055	TRANSISTOR- NPN SI POWER $-V_{CE}$ = 60V $-I_C$ = 10A -METAL CAN TO3 CASE
048	4	D1, D2, D3, D16	IN 4001	DIODE - SI RECTIFIER -1 = 1.5A, V_{PIV}=50V, -D&41 CASE
049	6	D4 THRU D9	IN 1200	DIODE - SI RECTIFIER $-I_F$= 10A, V_{PIV}= 100V -STUD ROUNTING CASE
047	2	D11, D13	IN 4148	DIODE - SI SIGNAL
050	1	D14	IN 751A	DIODE -ZENER $-V_Z$= 5.1V $-P$ = 400MW
051	2	D12, D10	IN 746A	DIODE -ZENER $-V_Z$ = 3.3V -P = 400MW
052	1	D15	IN 752A	DIODE -ZENER $-V_Z$ = 5.6V -P = 400MW
046	1	SCR1	TIC 106F (TI) C122D (GE)	SCR $-I_F$= 5A, V_{PIV}= 50V -TO 220-AB CASE
039	1	LED1	RL-4850 (LIT) 5082-4850 (MP)	LIGHT EMITTING DIODE
035	1	R25	82Ω	RESISTOR--GENERAL PURPOSE 10%. 1/4W
010	2	R30, R31	100Ω	"
011	1	R27	180Ω	"
012	2	R28, R32	220Ω	"

MTL#	NO.OFF	CCT.REF.	COMPN.TYPE	DESCRIPTION
013	1	R26	330Ω	RESISTOR--GENERAL PURPOSE 10%, 1/4W
014	14	R1 THRU R14	390Ω	"
015	3	R18,R23,R15	470Ω	"
016	2	R24,R29	680Ω	"
017	2	R21, R22	1.2KΩ	"
018	1	R20	2.2KΩ	"
019	1	R19	3.9KΩ	"
024	1	R16	10KΩ	"
020	2	R17,R33	1Ω	RESISTOR -WIREWOUND, 5W 10% -TRW POWER WIREWOUND RESISTOR TYPE 1A MALLORY 5W, 5AE POWER RESISTOR
021	1	VR1	500Ω	POTENTIOMETER -PC MOUNTING (HORIZONTAL) -CARBON TRIMMER -CTS (TRW) U201-R501-B
002	1	C4	5μF 25V	CAPACITOR -MIN. AL. ELECTROLYTIC -AXIAL LEADS -TYP. TOL. +100%, -50%
003	1	C1	10μF 25V	"
006	1	C3	1μF 25V	"
007	1	C2	1000PF 25V	CAPACITOR -MONOLITHIC CERAMIC -TYP. TOL. +80%, -20%
037	1	FS1	5A FUSE	FUSE -GLASS BODY TYPE -5A FUSE -1/4" LONG, 1/4" DIA.
038	2		FUSECLIPS	FUSEHOLDER, P.C. MOUNTING -LITTLEFUSE PART # 102068 STD.. EARTYPE CLIP BUILT-IN FUSE STOP.
036	3	RL1,RL2,RL3	12 VOLT COIL 1 CHANGEOVER CONTACT 2A RATING	RELAYS -MIN. GENERAL PUR. -AMF/POTTER &BRUMFIELD R10 SERIES R10-E2-Y2-V185 (OR X2)
067		-	HEATS INK	THERMALLOY INC. TYPE 6169 SERIES -5" LENGTH
096		-	INSULATING KITS	1.MICA WASHERS + INSULAT. SLEEVES FOR D4 THRU D9. 2.MICA WASHER +INSULATIN SLEEVES FOR T 18.
SP506			LDPS CARD (Complete Assembly)	

SECTION 6 FAULT'DIAGNOSES

6.1 Machine 'Dead'

If the lamps behind the 'Player Change' caption are not lit then this indicates a lack of power to the machine.

Check--preferably in this order:

(i) the main outlet socket supplying the machine and any extention cord if one may be used. A significant number of 'machine' faults are attributable to a lack of 115V ac.

(ii) plug 9 is correctly mated with the Motherboard (PL 9 is the 18 way plug interfacing the cabinet cableform to the electronics package and is at the left hand edge of the motherboard.)

If the lamps behind the 'Player Change' caption are lit but no scores are indicated and no other captions are lit, then probably the protection devices on the power supply have been triggered.

Check the small LED lamp on the top of the LDPS card (the one with the big heat sink attached). If it is not lit then unplug the machine--WAIT 5 SECONDS--and plug it in. (This delay allows the protection circuitry to reset itself.)

Most machines have-this power supply card fixed to the aabinet by means of a steel bracket. However if the machine doesn't have this, then occasionally the power supply card works its way loose. Check therefore that it is well located in its connector.

NOTE: The 5 amp fuse on the Power Supply is not in the main circuit. It is only protection for the 5 volt line.

6.2 Machine 'live' but not recognizing coins

Look first at the coin mechanism and check that the coins pass properly past the microswitch. A paragraph on the care and cleaning of this mechanism will be found in Section 7.

Failure of the microswitch to put up players may be traced to the 3 pin plug connecting the upper and lower cabinets not being properly mated. A further check can be made at Plug 9 at the left hand side of the Motherboard. With a short length of bare-tinned copper wire, carefully short together pins 1 and 2 of PL9 when it is connected in circuit. This will simulete the action of the microswitch.

If this last test works then a faulty microswitch has been identified. If it still fails to put up players then replace the GPM card.

6.3 Machine giving more than one player per coin

Most machines have a 100 ohm resistor connected in series with the coin mechanism microswitch contacts and the electronics. This together with C21 on the GPM card forms a filter which only allows pulses of the right duration corresponding to coins passing the switch. Hence violent hitting of the front of the coin door, although it will cause the snap action microswitch to jump over and make momentary contact, will not put-up 'free' games.

Where the occasion arises that one coin will put up two players then the GPM card has to be replaced. It is often a failure of IC18 on this card which causes this fault.

6.4 Machine not scoring properly

This can be caused by faults in the electronics or problems, with the Dartboard Assembly and the technique is to ascertain which of these two are giving trouble.

Set up 4 players in a new game and score a single 13 for each. (Take care not to hold down the 13 segment too long so that it could be recorded twice over). Check the displayed score reads 288 for each.

If one of the segments of a display are missing, for instance it could read 280 if the middle bar of the units was not lit, switch off power and exchange that players PSD card with anothers and repeat' the test.

If the fault 'follows' the PSD card then the card is faulty and needs replacement. If the fault stays in the same position then the display needs replacing. The replacement proceedure is outlined in section **6.11**

After checking the displays, disconnect the Dartboard from the Motherboard by removing PL10 from the Motherboard. Plug Test Assembly TA1000 into the PL10 position on the Motherboard.

With a player up on the machine, operation of TA1000 should give a score of 63 points. (This will be 63 points deducted from whatever score that player started with for example if -he started at 301 the new score would be 238).

A correct indication that 63 points have been scored confirms that the electronics is good and it is the dartboard which has the fault. In either case remove the simulator and reconnect the dart-board.

6.4a Dartboard mis-scoring

Each segment on the dartboard has a score value which is encoded into a binary code for the electronics to recognize. The code consists of the numbers 1,2,4,8,16 and 32 and each score is broken down into a unique combination of these numbers. A score of 20 will therefore activate the 4 line and the 16 line and a score of 5 will activate the 1 line and the 4 line.

If by a deliberate action the single 5 and single 20 were to be pressed simultaneously, the numbers 16,4 and 1 would be activated. (The 4 line although appearing in both can only be activated once.) The electronics will recognize these numbers and register the sum of them -which is in this case would be 21.

With this prior explanation of the encoding technique the process of deducing the location and type of fault on the dartboard can be undertaken.

Three types of fault are predictable on the dartboard assembly:

- -an oversensitive switch or even a switch that is always closed,
- -an undersensitive switch including one that never makes contact,
- -a bad diode on the 'wrap around' diode matrix.

Assuming that only one fault is present the procedure is one of elimination.

6.4a Dartboard mis-scoring (con't)

Press in turn, and taking note of the recorded score at each time, the segments: singles 1,2,4,8,16 and double 16.

If any of these numbers fail to record, note the ones which are bad, add these missing numbers together and investigate those switch contacts (for permanently made contacts) whose value is this sum total of missing scores. (It is best to repeat this proceedure to confirm that a missing score is not caused by an undersensitive switch on one of those segments pressed). A permanently closed contact on one of the switches will prevent any of those lines to which it is connected from being recognized. Assume that the single 9 switch is sufficiently out of adjustment such that it is always closed. This will tie down the 8 and the 1 line. Adopting the proceedure outlined above whereby the 1,2,4,8,16 and double 16 segments are pressed, only, in this case, the 2,4,16 and "32" will be shown. The 8 and 1 are missing indicating that a segment with a score of 9 is causing trouble.

A number of the segment switches are tied together where their scores are the same. Typically triple 3 is tied to single 9. This linking is done on the matrix board. Care should therefore be adopted in following the checkout proceedure outlined above in case there may be more than one switch tied to that line.

Returning to the example given, with an 8 and a 1 missing it could be either of the two single 9 segment switches or the triple 3 segment switches. Careful examination will rapidly identify the fault.

Obtaining correct indications of 1,2,4,8,16 and 32 will eliminate the possibility of permanently closed switches.

The next stage of the elimination process is to press each segment in turn to check that they are neither supersensitive, in which case the blades of the switches should be eased apart, nor undersensitive, in which case the blades should be moved closer.

If a segment fails to score even with the contacts closing then cleaning the contacts with a paper towel moistened with a mild solvent should be tried.

If one of the encoding diodes in the 'wrap-around' matrix board has become open circuit then its component of the score wiil be missing. Again an example: single 15 comprises 1,2,4 and 8. If the diode to the 2 line is open circuit the score will be encoded at 1,4 and 8 giving 13.

6.4b Electronics mis-scoring problems

The six encoded lines from the matrix pass immediately into the SPC card. The SPC card converts the score into a pulse train which is fed to one of the four PSD cards. depending upon whose turn it is. The majority of mis-scoring problems in the electronics is therefore in the SPC or the PSD cards.

The proceedure to narrow down the fault identification is recommended to be:

(i) put four players up on the ma-chine with number 1 player up

(ii) activate the bad score

(iii) put player 2 up by pressing the player change button and again score the affected-score

(iv) if the same bad score appears on both player 1 and player 2's score then the SPC-card would be bad and would need-. replacing.

(v) if the bad score was only on one of the 4 players score then that players PSD -card is-suspect. Switch off power, exchange the suspect card with a good one already in the machine and go through the above proceedure again.

(vi) if the fault 'follows' the PSD card then it i-s definitely that PSD card which is faulty.

(vii) if the fault stays in the same location after shifting the PSD cards around then the-GPM card needs replacing.

6.5 Machine not either Winning, or Busting, or Both

In the electronics package, signals from all 4 players score cards (PSD) feed the Win and Bust Detection card. If therefore only one player is experiencing difficulty in winning or busting it could be his PSD card or the WBD card. The answer is ascertained by switching off the machine and swapping the suspected PSD card with a good one and repeating the test. If the fault is still in that same position, the WBD card is at fault but if the fault follows the PSD card then it is the PSD card at fault. Replacement of the appropriate card is the cure.

After detecting that a player has won or bust the WBD card activates a number of caption lamps etc. These are not driven directly from the WBD card but go through lamp or relay drivers on the power supply card (LDPS). For instance Player 2's WIN lamp may fail to come on when he wins but the game may show 'GAMEOVER' lit, the gong activated and the Board Illumination Lamp turned off. This could be caused by the lamp itself burning out and needing replacing, or the lamp driver circuit on the LDPS card not operating or the appropriate signal not coming out of the WBD card. Selective replacement of each card in turn would identify the cause of the problem.

Similarly for gong and buzzer problems. A failure of either of these may be caused by the component itself not functioning properly or the relay and driver on the LDPS card or the appropriate signals from the WBD card.

6.6 Machine not changing players

The player change push button feeds only into the GPM card. Problems therefore with the machine not changing players concern only these related items.

Check first that the push button is making proper contact. As the body of the switch is transparent and also removable from the 'pusher' this can be accomplished. The two wires from the player change puch button enter the motherboard on PL10 pins 3 and 4. Check therefore that this plug is fully mated. Substitution of the GPM card by one that is known to work is the remaining action necessary to identify the location of this fault.

6.7 Machine not changing players smoothly

This is almost invariably a problem on the GPM card. Substitution of the existing GPM card by another wili effect a cure.

The most likely source of this problem on the GPM card is IC24 and IC22.

6.8 Machine not switching between 'Throw Darts' and 'Remove Darts'

The Player Change pushbutton initiates this sequence whereby for 5 seconds after pressing it, the dartboard is de-activated (so that players can remove their darts without giving themselves false scores) and the 'Throw Darts' caption goes out and the 'Remave Darts' caption comes on. After 5 seconds the machine reverts to its normal mode.

The relay PL1 on the Motherboard (lower left hand side underneath Cl) controls these 2 caption lamps. They are supplied with 115V ac and are 3 watt bulbs. The relay when going over will give quite an audible 'click' and can be heard from the front of the machine. If no 'click' is heard than the GPM card may need changing. If a 'click' is heard then probably one or both of the bulbs need replacing.

6.9 Machine not locked out after switch on.

The machine is designed to set 'GAMEOVER' upon first applying power. In this condition no scores will be recognized and the player change push button will have no effect.

After switch on and before any coin is inserted, the only guaranteed caption lamp to be on will be this 'GAMEOVER' lamp. If this is not on and if the machine can be played without a coin being inserted then the GPM card would need replacing.

6.10 Machine not locked-out after Bust and Win

The machine will not recognize any scores when a player has bust or won. Until either in the case of a bust, the player change pushbutton is pressed or in the case of a WIN, a coin is inserted. If either of these conditions are not being met then the GPM card would probably be at fault.

6.11 Replacement of a faulty 7 segment LED score display

A rapid check of all the segments on the 4 players score displays is to set the machine to 4 players and score 13 for each. This will present a score of 288 and in this condition all the segments are driven and missing one is immediately apparent.

Switch off power and remove the 8 printed circuit cards from the Motherboard. Disconnect the two connectors at either end of the Motherboard and remove the 8 ½" screws fixing it to the cabinet.

Using a solder sucker and a temperature controlled soldering iron, remove the solder from the legs of the faulty display and then gently ease the display from the motherboard.

Replace with a display of a matching type and check after soldering that no solder splashes or bridges are present.

Replace the motherboard in the cabinet using the reverse proceedure outlined above.

6.12 Replacement of a caption lamp.

Use the proceedure given in section 6.11 for the removal of the motherboard and after its removal, extract the dead lamp.

The replacement lamps come supplied with sockets on their 2 leads. There should be discarded, the leads bent over and the lamps inserted such that they point UP if they are on the upper half of the motherboard and DOWN if on the lower half.

Replace the motherboard and check the machine for proper operation.

SECTION 7 MAINTENANCE

7.1 The Coin Mechanism

Periodically clean the mechanism by using a screw driver with a cloth over the blade of the screw driver. The mechanism must be free of any foreign matter which may cushion the bounce of the coin.

Keep all magnets clean of all foreign matter. When ever necessary, the acceptor should be cleaned with hot water and a cleanser. The steps are as follows:

1. Place acceptor in boiling water and allow to soak for about 10 min.
2. After soaking, use a brush and kitchen cleaner to clean foreign matter.
3. Again, rinse in boiling water.
4. Dry throughly by using filtered compressed air.

   NOTE: Hot water is recommended as it evaporates rapidly and speeds the drying process.

5. Use powdered graphite on only the moving parts of the acceptor. Use care to keep the powdered graphite away from the paths that are followed by the coins. DO NOT USE OIL.

7.2 The Dartboard Assembly

The occasional adjustment of the switches to ensure that each segment has the same sensitivity as all the others. The procedure outlined in section 6.4a where problems of mis-scoring with the dartboard, is applicable here for proper switch alignment.

7.3 The Electronics Package

As all. the controls are performed by digital logic there is no adjustments or maintenance required in this area.

At each service call all this is required is to ensure that all 8 cards are firmly located in their sockets and have not worked loose.

On the LDPS card there is a small potentiometer which has been factory set and locked into position. This presets the control power supply at +5 volts. Providing that this supply is within 4.75 volts to 5.25 volts then no adjustment is necessary. If this voltage is to be monitored then an accurate dc voltmeter can be connected across' Cl of any of the 7 logic cards.

7.4 The Buzzer

Adjusting the lower fixing screw of the Buzzer mounting plate controls the volume of the buzzer. It needs to be screwed in so that the head of the fixing screw of the buzzer itself just lightly rests against the cabinet,

7.5 The Servicemans Kit

The following items will be necessary as particular needs to this machine. A normal complement of screwdrivers, wrenches, wire, etc. is assumed to be already a part of the kit.

(i)	Special Tools			
	--7/16" open ended wrench for the removal of the dartboard			
	--temperature controlled soldering iron			
	--solder sucker			
	--Dartboard simulator		MTL#TA	1000
(ii)	Spare Parts (for 1 kit)			
	--SPC card	(1off)	MTL#SP	502
	--GPM card	"	MTL#SP	503
	--WBD card	"	MTL#SP	504
	--PSD card	"	MTL#SP	505
	--LDPS card	"	MTL#SP	506
	--7 segment LED displays (red or green as appropriate)	(6off)	MTL#	080
	--12 volt caption lamps	(60ff)	MTL#	070
	--Relay (RL1 on Motherboard)	(1off)	MTL#	099
	--115V 3 Watt lamps	(2off)	MTL#	257
	--Buzzer	(1off)	MTL#SP	508
	--Gong	(1off)	MTL#	227
	--Bulbs for Board Illumination. Lamp	(2off)	MTL#	258
	--Coin Mechanism (acceptor)	(1off)	MTL#SP	509
	--Switches for Dartboard contacts	(10off)	MTL#	208
(iii)	Optional Items			
	--Dart Tips	50	MTL#	247
	--Complete Darts	10	MTL#SP	517

1000

ARACHNID, INC.
2500 North Main Street
Rockford, Illinois 61103

November 30, 1978

Re: Changes for new Motherboard by P&P Design

(1) Etchwork on backside of Motherboard (blue) is much too close to I.C. pads.

(2) Plated through holes, parallel etch work too close together for diameter of hole used.

(3) Should have plated through hole on connector edges.

(4) Capacitors Cl & C3 are electrolytic; holes are set for disc ceramic, paper.

(5) No holes for Cl5 (schematic), electrolytic.

(6) No holes for C30 (schematic), electrolytic.

(7) R144 is etched to -5 Volt, schematic calls for pull-up to Vss.

(8) Use single etch run from junction of pins 18 & 19 of I.C. #23 to junction of R4 & C40.

(9) Q35's collector is open, L7 * L8 are tied to Q35's base.

(10) I.C. #5, TIL 112, pin #6 is tied to R129 a 5.6K ohm pull-up to Vss should be no connection. Notice that Q51 is mounted one set of holes too high. Move R129 from pin 6 to pin 5.

(11) Mounting eyelets around I.C. #40 are set too close together, R119 much too close to each other, C34 eyelets appear to be set for a disk capacitor, much too close for the electrolytic 25 microfarad that we use.

(12) R58 to R70 even, eyelets are to close together for 2 watt resistors, eyelets are set too close to LED - seven segment displays, had to mount resistors on backside of board, they belong on the topside - front of board.

(13) Install 220 ohm resistor, ¼ watt onto collector Q51 in series.

(14) c29, 33, 41 eyelets are set for disks, these capacitors are electrolytic, therefore eyelets are set too close together.

(15) Q42 is underneath L21 - move Q42 to left enough to clear L21 when folded down against board.

(16) Connect V_{SS} to C7

(17) Break R9 from V_{SS} and tie to VDD

(18) Tie pin #2 of IC #6 to pin #5 of IC #8

(13) Tie the output of IC #8 pin 6 to IC #47 pins 13, 2, 4 and IC #'s 35 & 36 pins 13, 2, 10

(20) On parts layout sheet IC #47 is a 7405, schematic calls for 7408

(21) Tie pin 9, IC #47 to pin 5, IC #35

(22) Tie junction R1-0 and R99 to base Q29

(23) Data Bus Line Ø3 should be tied to the buffer IC #29, pin 8. Instead it is tied to pin 8 of IC #30

(24) Connect VCC and ground to IC's #24 & 25 & 41

(25) Connect pin 10, IC #25; to pin 3, IC 41

(26) IC 111 reverse the etchwork on pins 1 & 2, pin 1 is the input and pin 2 is the output

(27) IC #39 pins 2 & 3 should be tied to IC #15, pin 9

(28) Data Bus Line Øo not connected. Tie IC #29 pin 12 to pin 2 of IC's 42, 44, 46, 48 and 50

(29) Pin 3 of IC #44 has been falsly tied to pin 7 of same XC. Schematic calls for IC #42 to be tied that way

(30) Data Bus $Ø_1$ is not connected. Tie IC #29 pin 2 to pin 3 of IC's 44, 46, 48 and 50

(31) Tie R114 to collector of Q46 to drive LED decimal points

(32) IC #45 pin 5 should be connected to IC #42 pin 10, and not IC #50 pin 10

(33) Pin #13 of IC #21 should be tied to pin #5 of IC #21. Pin #13 of IC #21 should not be tied to pin 10 of IC #21.

(34) IC #19 is labeled incorrectly.

(35) Pin #10 of IC #17 should be tied to pin #6 of IC #22 and pin #2 of IC #20. Pin #10 of IC #17 should not be tied to pin #1 of IC #17

(36) Connect pin #8 of IC #28 to -5v

(37) C36- make it a 5uf electrolytic like the breadboard, set holes accordingly

(38) Tie pins I's 8 & 10 of IC #28 to pin #12 of IC #28

(39) Tie pin #7 of IC #37 to -5v

(40) Tie IC #41 pin #9 to IC #42 pin #15, not pin #16

(41) Tie IC #22 pin #11 to -5v

(42) Tie collect Q45 to L21

(43) Reverse etchwork on IC #48 pins #'s 9 & 10, pin #9 should be tied to IC ii43 pin #5; pin #10 should be tied to IC#43 pin #11

(44) Change value of R142 from 680 to 100 ohm

(45) Tie L5 between Q34 coll. and V_2

(46) Tie IC #29 pin #8 to IC's #42, 44, 46, 48, 50 pins #7

(47) Tie etch from R46 to LED's ii's 13, 14, 15 pins 812 not pins #4

(48) Tie IC #40 pin #14 to V_{CC}

(49) Redesign counter logic for the Remove Darts and Game Select lights. The Coin O.S. should not stop the Game Select strobe. The Remove Darts latch suppiy is being sunk by a NAND driver. These logic levels should be gated.

(50) IC #42 pin #3 should be part of Data Bus Line ϕ_1. Why was it tied to Line ϕ_3?

(51) Install hysterises buffers on inputs from dartboard

52 [illegible]

53j

SERIAL NUMBERS 100-160

VALID FOR CIRCUITS
ISSUES 1
SILKSCREEN
ISSUES 1

TEST PROCEDURE LDPS BOARD

-WITH LDPS TEST SET-

TEST NUMBER		TEST ROUTINE
1.	a.	Check visually that no joints are unsoldered or look cold and that there are no solder splashes.
	b.	Apply serial number to card, with permanent marker.
2.		Use ohm-meter to check for good insulation between heat sink and the cases of all components mounted on it.
3.	a.	Turn RV1 fully clockwise.
	b.	Insert 5 Amp fuselink into holder.
	c.	On test set, set SW1 and SW2 to positions 1 (fully clockwise); Set SW3, 4,5,6 and 7 to the UP (off) position.
	d.	Connect voltmeter to test - set terminals, select 10V range on a DVM or 25V range on a conventional meter.
	e.	Connect power to test set.
	f.	Insert LDPS card under test into socket with component side of board facing forwards.
4.	a.	Set SW3 and SW4 to ON. Meter to read 10 to 11 volts.
	b.	Rotate SW1 to position 2. Meter to read 9 to 10 volts.
	c.	Rotate SW1 to position 3. meter to read 13 to 14 volts.
	d.	Rotate SW1 to position 4. Adjust RV1 on LPDS board. so that meter reads 5.10 volts.
5.	a.	Set SW5 to the ON position. Meter will indicate a slight drop (to about 4.9V) in voltage. Leave for 1 minute.
	b.	After 1 minute touch the body of TR18 and also the surrounding area on the heat sink. Both should be gently and equally warm.
	c.	Set SW6 to the ON position. Meter will indicate a further slight drop in voltage. (to about 4.8 volts)
6.	a.	Short circuit the output terminals with a piece of wire or screwdriver. Meter to read about zero (less than 1/4 volt). LED1 will be out.
	b.	Set SW6, 5, 4 and 3 to the OFF position. Wait for 5 seconds.

TEST PROCEDURE LDPS-BOARD

TEST NUMBERS - TEST ROUTINE

7. a. Set SW3 and SW4 to the ON position. Meter to read previously pre-set value.

b. Turn SW1 to position 5.
Rotate RV1 slowly anti-clockwise noting the point at which the supply trips out; indicated by the voltmeter reading going to zero, the LED going out and the relays releasing.
This voltage should be between 5.3 and 5.16 volts.
Rotate RV1 a few degrees clockwise, switch SW3 and SW4 OFF.
After 5 seconds switch SW3 and SW4 ON and readjust RV1 such that the voltmeter reads 5.10 volts.

8. Rotate SW1 to position 6.
Voltage should be in range 5.1 to 5.7 volts.
Return SW1 to position 1.

9. a. With SW2 in position 1 press and release push button, the lamp should go on and then go off.

b. Repeat a further 10 times with SW2 in positions 2 thru 11.

c. Rotate SW2 to position 12, pressing push button will cause RL1 to operate.

d. Repeat 'c' with SW2 in positions 13 and 14, activating RL's 2 and 3 respectively.

e. Return SW2 to position 1.

10. Remove board and apply a small quantity of sealant on RV1 taking care not to disturb the adjustment of RV1.

11. a. Clean the contacts. of the board.

b. Paint colored stripe on board over its serial number.

SERIAL NUMBERS 101-

VALID FOR CCT ISSUES 2,3,and 4
SILKSCREEN
ISSUES 2,3,and 4

TEST PROCEDURE - WBD BOARD (With Motherboard)

TEST NUMBER		TEST ROUTINE
1.	a.	Check visually for unsoldered joints, joints that look cold and for solder splashes.
	b.	Clean contacts.
	c.	Mark serial numbers on board with black marker.
2.	a.	Insert WBD board into appropriate position on motherboard.
	b.	Switch ON - Check "GAMEOVER" lamp is on and that neither the "GONG", "BUZZER" or "ILLUMINATION BOARD" lamps are ON, on the motherboard test set.
	c.	Check that no score is registerd when any of the score push-buttons are operated.
3.	a.	Operate "COIN INSERTED" pushbutton once. Check "GAME OVER" lamp goes out and that "BOARD ILLUMINATION" lampoon test set goes ON. Check score of "Player 1" showing 301.
	b.	Operate COIN INSERTED" pushbutton 3 more times. Check scores of players 2, 3 and 4 show 301 as the pushbutton is repeatedly pressed.
4.	a.	Score 16. Check score of player 1 is 285. Press 'Player Change'.
	b.	" " " " 2 " " "
	c.	" " " " 3 " " "
	d.	" " " " 4 " " "
5.	a.	Score 288 (9 x 32). Check "BUST" lamp on motherboard comes ON and check' BUST lamp on test set flashes once. Check that player l's score returns to 285. Check that operation of any of the score pushbuttons has no effect.
	b.	Press 'Player Change'. Score 288, and check player 2's score to 28
	c.	" " " " " " 3 's " " "
		" " " " " " 4 's " " "
6.		Score 285 (8 x 32 + 16 + 8 +4 i-1). Check "GAME OVER" lamp comes ON. Check player l's "WIN" lamp comes ON. Check Player l's score goes to -0-. Check "BOARD ILLUMINATION" lamp on test set goes OFF about 1 second after the game is over. Check that operation of any of the score pushbuttons has no effect.
7.	a.	Operate "COIN INSERT" pushbutton twice. Operate "Player Change" pushbutton once to bring player 2 into the game. Score 301 (9 x 32, +8 +4 +1). Check Player 2's "WIN" lamp goes ON. Check player 2's score goes to -0-.
	b.	Operate "COIN INSERT" pushbutton 3 times, operate "Player Change" pushbutton to bring Player 3 into the game. Score 301 (9 x 32, +8 +4 +1). Check player 3's WIN lamp goes ON. Check Player 3's score goes to -0-.
a.		Switch off power. Remove card and paint colored stripe across serial number.

SERIAL NUMBERS 100-

VALID.FOR P.C.ARTWORK CIRCUITS
ISSUES.2 and 3
SILKSCREENS
ISSUES 2 and 3

TEST PROCEDURE - SPC BOARD

/100

(With Motherboard)

TEST NUMBER		TEST PROCEDURE
1.	a.	Check visually for unsoldered joints, cold joints and for solder splashes.
	b.	Clean contacts.
	c.	Mark serial number on board.
2.	a.	Insert card into motherboard.
	b.	Switch on power.
3.		Push "Coin Inserted" button once only.
4 :		Score 1 - Check Player l's score reads 300.
5.		Score 2 - " " " " " 298.
6.		Score 4 - " " " " " 204.
7.		Score 8 - " " " " " 286.
8.		Score 16 - " " " " " 270.
9.		Score 32 - " " " " " 238.
10.		Press Player Changeebutton and within the 5 second delay press various scores - check no score registered.
11.	a.	Score sufficient number to "BUST".
	b.	Check after BUST no further scores are recorded.
12.	a.	Push "Blayer Change" and score sufficient numbers to win game. (Game over lamp will come on)
	b.	Check after WIN, no further scores are recorded.
15.	a.	Switch off power.
	b.	Remove oard frommmotherboard.
	c.	Strike colored line across serial number.

TEST PROCEDURE -- PSD BOARD (With Motherboard)

TEST NUMBER		TEST ROUTINE
1.	a.	Check visually for unsoldered joints, joints that look cold and for solder splashes.
	b.	Clean contacts.
	c.	Mark serial number on board with indelible marker.
2.	a.	Load 4 PSD boards into appropriate places in motherboard..
	b.	Sitch power on.
	c.	Press "COIN INSERT" button once - check player 1 display reads 301.
	d.	Press "COIN INSERT" button 3 more times - check players' 2, 3, and 4 displays read 301.
3.	a.	Score 1, press "PLAYER CHANGE" once, check player 1 display reads 300.
	b.	" " " " " " " " 2 " " 300
	c.	" " " " " " " " 3 " " 300.
	d.	" " " " " " " " 4 " " 300,
4.	a.	Score 2, " " " " " " 1 " " 298
	b.	" " " " " " " " 2 " " 298
	c.	" " " " " " " " 3 " " 298.
	d.	" " " " " " " " 4 " " 298.
5.	a.	Score 4, " " " " " " 1 " " 294
	b.	" " " " " " " " 2 " " 294
	c.	" " " " " " " " 3 " " 294
	d.	" " " " " " " " 4 " " 294
6.	a.	Score 8, " " " " " " 1 " " 286
	b.	" " " " " " " " 2 " " 286
	c.	" " " " " " " " 3 " " 286
	d.	" " " " " " " " 4 " " 286
7.		Press "COIN INSERT" button 4 times and check each players display reads 301.
a.	a.	Score 10 (8 + 2) Press "PLAYER CHANGE" once, check Player 1 " " 291.
	b.	" " " " " " " " " 2 " " 291.
	c.	" " " " " " " " " 3 " " 291.
	d.	" " " " " " " " " 4 " " 291.
9.	a.	Score 20 (16+4) " " " " " " 1 " " 271.
	b.	" " " " " " " " " 2 " " 271.
	c.	" " " " " " " " " 3 " " 271.
	d.	" " " " " " " " " 4 " " 271.
10.	a.	Score 40 (32+8) " " " " " " 1 " " 231.
	b.	" " " " " " " " " 2 " " 231.
	c.	" " " " " " " " " 3 " " 231.
	d.	" " " " " " " " " 4 " " 231.

/100

TEST PROCEDURE -- PSD BOARD (With Motherboard)

TEST NUMBER		TEST ROUTINE	
11.	a.	Score 80 (32+32+16) Press "PLAYER CHANGE" once,	player 1 disp.reads 151.
	b.	" " " " " " "	2 " " " 151.
	c.	" " " " " " "	3 " " " 151.
	d.	" " " " " " "	4 " " " 151.
12.	a.	Score 100 (32+32+16+16+4) " " " "	1 " " 51.
	b.	" " " " " " "	2 " " 51.
	c.	" " " " " " "	3 " " 51.
	d.	" " " " " " "	4 " " 51.
13.	a.	Score 64 (32+32) " " " "	1 " " 51*
	b.	" " " " " " "	2 " " 51*
	c.	" " " " " " "	3 " " 51*
	d.	" " " " " " "	4 " " 51*

* AND THAT BUST LAMP IS ON BEFORE PUSHING PLAYER CHANGE.

14.	a.	Press "COIN INSERT" button 4 times.	
	b.	Score 200 Press "PLAYER CHANGE" once,	check player 1 disp.reads 101.
	c.	" " " " " " "	2 " " 101.
	d.	" " " " " " "	" " " 101.
	e.	(NOTE: A 200 SCORE IS SIX 32's AND ONE '8)	" " 101.

15. Switch off power. Remove boards. Enter details on appropriate card card index files. Mark with colored marker over serial number.

16. Remove the type number off all the integrated circuits.

PSD BOARD TEST PROCEDURE CHANGES

FOR TESTS 1-3, 4, 5, 6

8, 9, 10, "

12, 13, 14

THE APPROPRIATE PLAYERS SCORE WILL CHANGE TO THAT SHOWN IN THE TEST PROCEDURE BEFORE THE PLAYER CHANGE BUTTON IS PUSHED

SERIAL NUMBERS 100 -

VALID FOR CIRCUIT ISSUE 2,3,4
SILKSCREEN ISSUE 2,3,4

TEST PROCEDURE GPM BOARD With Motherboard

TEST NUMBER		TEST ROUTINE
1.	a.	Check visually for unsoldered joints, joints that look cold and for solder splashes.
	b.	Clean contacts.
	c.	Mark serial number on board.
	d.	Check 100 ohm resistor and 5mF capacitor have been added.
	e.	Check R3 is 10K ohms.
2.	a.	Insert GPM board into appropriate position on motherboard.
	b.	Switch ON. Check 'GAME OVER' lamp is ON.
	c.	Press 'Player Change' pushbutton and check that -it bas no effect.
3.	a.	Press 'Coin Insert' pushbutton once. Check 'GAME OVER' lamp goes out, Player l's score reads 301, player l's lamp is ON and that no other displays are ON on the motherboard (except for the 2 at the lower right hand side which permanently illuminate the 'Push' for Player Change' caption.)
	b.	Press 'Player Change'. Check it has no effect on the status of the motherboard displays.
	c.	Check 'Throw Darts' lamp on test set goes out and 'Remove Darts' lamp comes on, for about 5 seconds and then returns to original status. (Valid for cards circuits issues 2 and 3 with appropriate modifications).
4.	a.	Press 'Coin Insert' pushbutton once. Check that machine status as described in 3a is present.
	b.	Press 'Coin Insert' a second time. Check that players 2's display reads 301.
	c.	Press 'Player Change' a number of times and check that machine cycles through players' turns 1-2-1-2- etc as indicated by their respective lamps. (To speed up the testing process a resistor value 47K ohms can be placed across R9, for the duration of the remainder of the testing).
5.	a.	Press 'Coin Insert' pushbutton once. Check that only player 1 is registered (status as described in 3a).
	b.	Press 'Coin Insert' pushbutton twice more. Check that players 2 and 3 are now registered.
	c.	Press "Player Change' a number of times and check that the machine cycles thru players' turns 1-2-3-1-2-3 etc.
6.	a.	Press "Coin Insert" button once. Check that only player 1 is registered as before.
	b.	Press 'Coin Insert' button three more times and check all 4 players are now registered.
	c.	Press 'Player Change' pushbutton a number of times and check the machine cycles thru players turns 1-2-3-4-1-2-3-4 etc.
7.	a.	Press 'Player Change' pushbutton appropriately to activate player 1.
	b.	Score 16- check player l's score is 285.
	c.	Repeat 7b for the other 3 players, checking that each in turn receive a score of 285.

1105

TEST PROCEDURE GPM BOARD (With Motherboard)

TEST NUMBER		TEST ROUTINE
a.	a.	Press 'Player Change' sufficient times to activate'player 1.
	b.	Score 288 (9 x 32). The machine will indicate a BUST situation. Check that player l's score returns to 285.
	c.	Repeat Bb for the remaining 3 players ensuring that their score returns to 285.
9.	a.	Score 285 (8 x 32 t16 +8 t4 +1) and check that the 'GAME OVER' lamp is ON.
	b.	Press 'Player Change' pushbutton and check that it has no effect.
10	a.	Switch OFF power. Remove card and paint a colored stripe on its serial number. (Remove the temporary 47K ohm resistor if it has been used).

INSTRUCTION SHEET NO. 2

ASSEMBLY INSTRUCTIONS FOR HEATSINK- ON LDPS CARD

STAGE 1 -Inspect heatsink for good clean, burr-free mounting surface

STAGE 2 -Lightly countersink 12 holes on PC card that coincide with heatsink holes, on component side of the card.

STAGE 3 Diodes IN1200 (D4 thru D9)
-Silicon grease on both sides of mica washer
-Mica washer on diode
-Insulating sleeve (maximum length 1/8") on diode
-Diode- through heatsink and p.c. card
-Plain washer
-Locking washer
-Nut
-Do not tighten at this stage-
Repeat for 5 more diodes

STAGE 4 Transistor 2N3055 (TR18)
a. -Silicon grease on mica washer and mica washer on transistor
-Sleeves on 2 leads (maximum length 1/8")
b. -2 bolts (1/2 or 3/4", 6-32) with locking wabber then plain washer
-Through p.c. card and heatsink
-2 insulating sleeves (max. length 1/8") on bolts on heatsink side
c. -Mount transistor
-Locking washers and nuts
-Do not tighten - Do not solder-

STAGE 5 Transistor TIP31 (TR17) and SCR TIC 106P(SCR 1)
a. -Bend leads of devices to fit p.c. card holes
-Silicon grease on mica washers and mount mica washers on devices
b. -2 bolts(1/2 to 3/4", 6-32) with locking washer then plain washer
-Through p.c. card and heatsink
-2 insulating sleeves (max. length 1/8") on bolts
c. -Mount devices with leads in p.c. card
-Locking washers and nuts
-Do not tighten - Do not solder-

STAGE 6 Tighten TR18 bolts
-Tighten diodes' nuts
-Tighten TR17 and SCR bolts

STAGE 7 Solder leads TR18, TR17 and SCR
-Fit appropriate wires to D4 thru D9 as per assembly drawing

1000

INSTRUCTION SHEET NO. 3.

MOTHERBOARD WIRING CHANGES

MACHINES 25 thru 50 "PLAYER CHANGE FOR 5 SECS MODN."

-PL2-19 Cut track to PL10-7
link PL2-19 to PL3-59

-Link PL3-61 to PL9-41

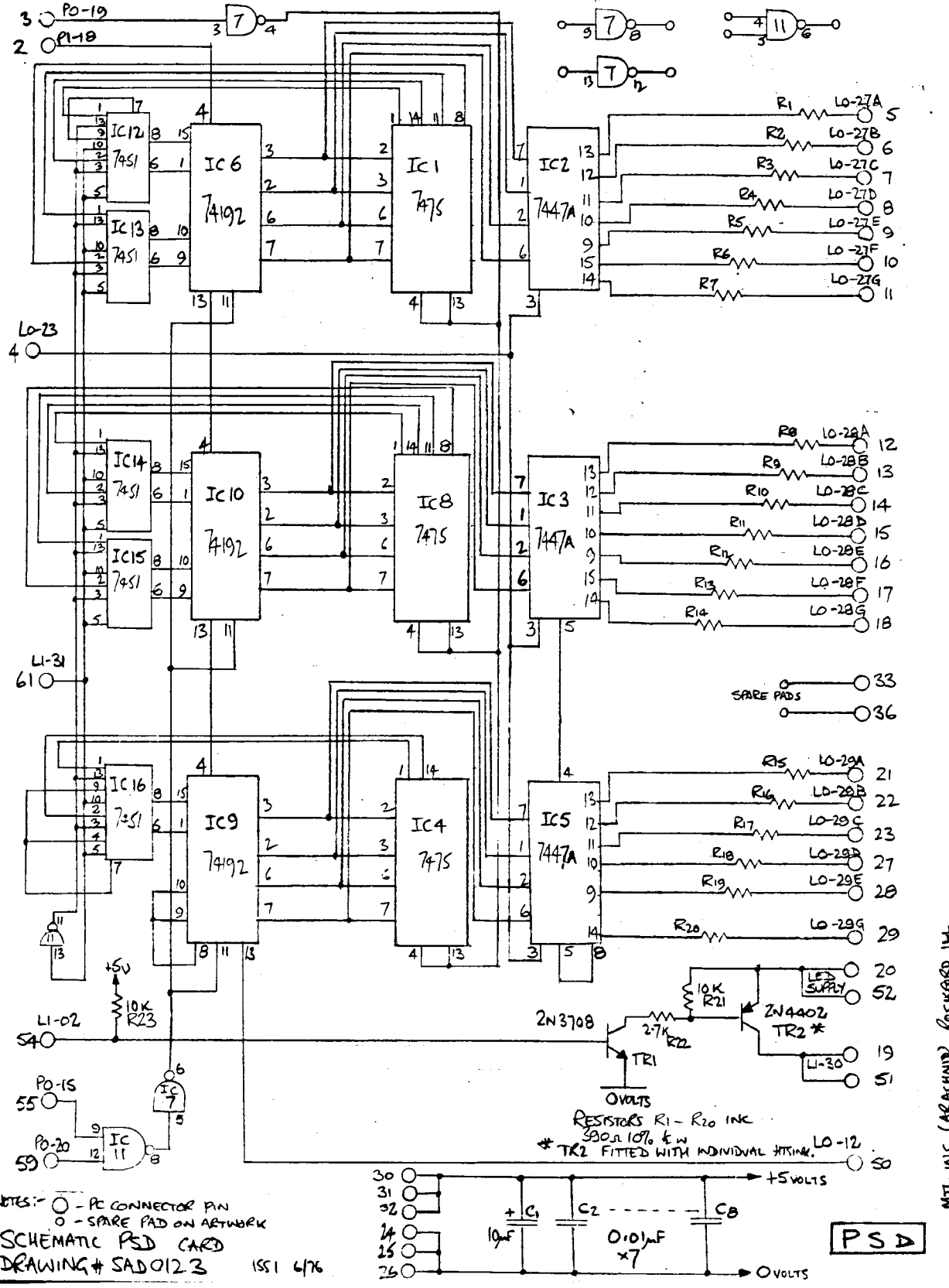
-Link PL9-9 to RL1-1
RL1-4 to PL9-28

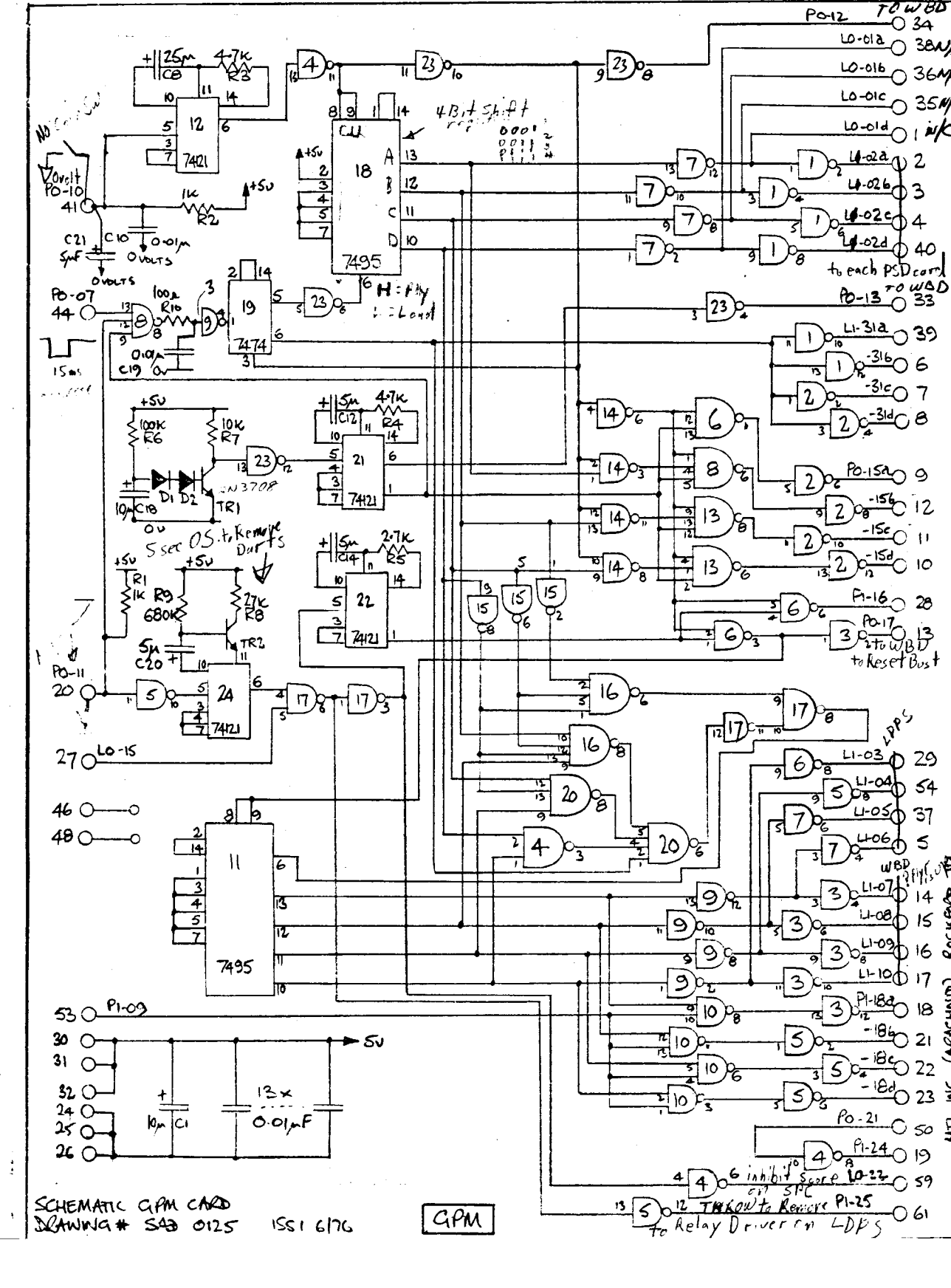
" RL1-6 to RL1-9
RL1-9 to PL9-3

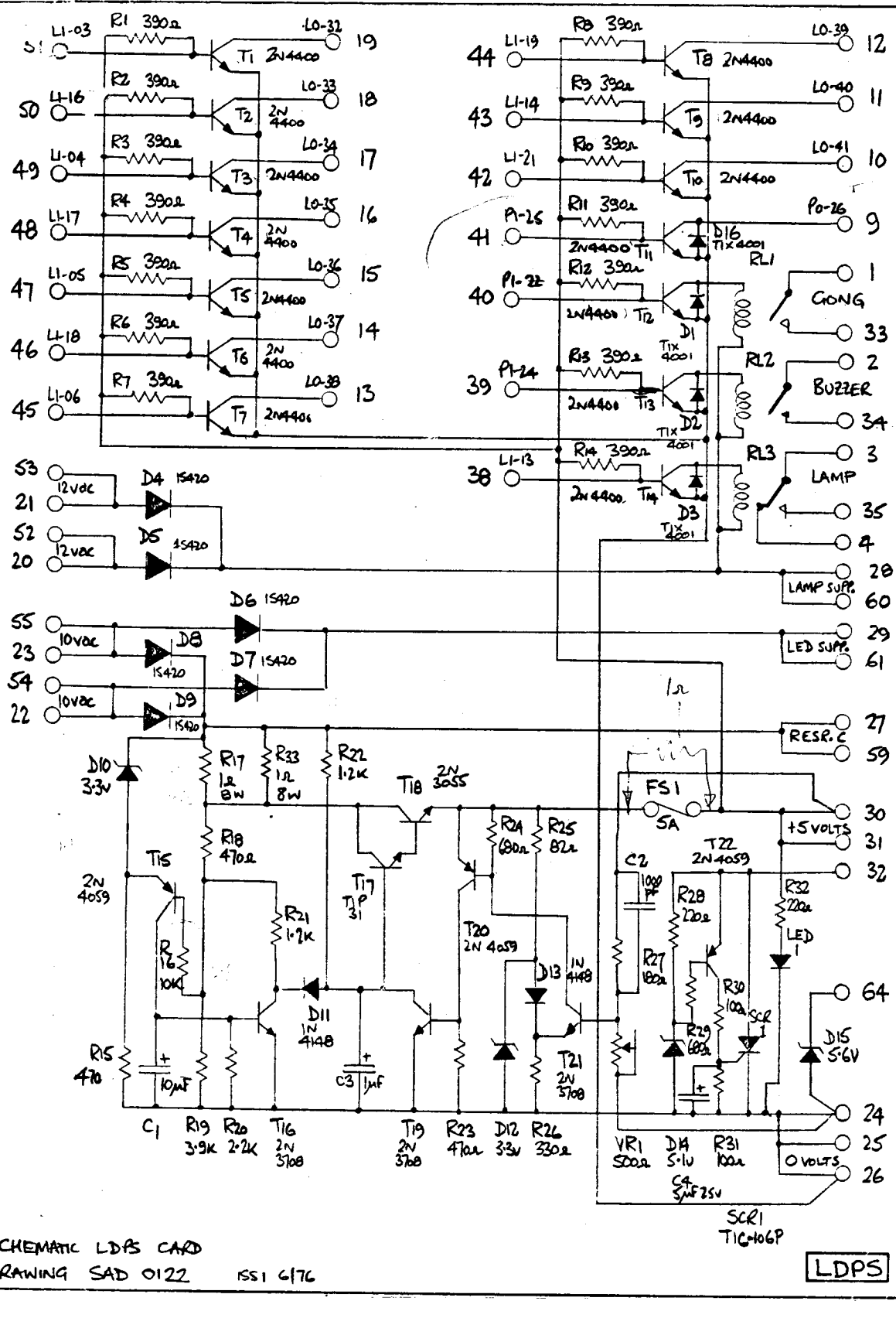
" RL1-5 to RL1-8
RL1-8 to PL11-11

" RLI-7 to RL1-10
RL1-10 to Pll-16

-RL1 Pin Arrangement


3 PO-19
2 P1-18
IC12 7451
IC13 7451
IC 6 74192
IC 1 7475
IC2 7447A
R1 LO-27A 5
R2 LO-27B 6
R3 LO-27C 7
R4 LO-27D 8
R5 LO-27E 9
R6 LO-27F 10
R7 LO-27G 11
LO-23 4
IC14 7451
IC15 7451
IC 10 74192
IC8 7475
IC 3 7447A
R8 LO-28A 12
R9 LO-28B 13
R10 LO-28C 14
R11 LO-28D 15
R12 LO-28E 16
R13 LO-28F 17
R14 LO-28G 18
LI-31 61
SPARE PADS 33
36
IC 16 7451
IC9 74192
IC4 7475
IC5 7447A
R15 LO-29A 21
R16 LO-29B 22
R17 LO-29C 23
R18 LO-29D 27
R19 LO-29E 28
R20 LO-29G 29
LED SUPPLY 20
52
+5V
10K R23
LI-02 54
10K R21
2N3708
2.7K R22
TR1
ZN4402 TR2 *
LI-30 19
51
OVOLTS
PO-15 55
PO-20 59
IC 7
IC 11
RESISTORS R1 - R20 INC 330Ω 10% 1/4W
* TR2 FITTED WITH INDIVIDUAL HEATSINK.
LO-12 50
+5 VOLTS
30
31
32
24
25
26
+ C1 10μF
C2 0.01μF ×7
C8
OVOLTS
NOTES:- ○ - PC CONNECTOR PIN
○ - SPARE PAD ON ARTWORK
SCHEMATIC PSD CARD
DRAWING # SAD0123 1551 6/76
PSD
MTL INC. (ARACHNID) ROCKFORD ILL.


PO-12 TO WBD 34
LO-01a 38M
LO-01b 36M
LO-01c 35M
LO-01d 1 N/C
LI-02a 2
LI-02b 3
LI-02c 4
LI-02d 40
to each PSD card
PO-13 TO WBD 33
LI-31a 39
-31b 6
-31c 7
-31d 8
PO-15a 9
-15b 12
-15c 11
-15d 10
PI-16 28
PO-17 to WBD 13
to Reset Bust
LI-03 29
LI-04 54
LI-05 37
LI-06 5
WBD
LI-07 14
LI-08 15
LI-09 16
LI-10 17
PI-18a 18
-18b 21
-18c 22
-18d 23
PO-21 50
PI-24 19
6 inhibit Space LO-22 59
to SPC
TO KOW to Remove PI-25 61
to Relay Driver on LDPS
4 PPS
4 BIT SHIFT REGISTER
PO-10 41
PO-07 44
PO-11 20
LO-15 27
PI-09 53
46
48
30
31
32
24
25
26
+5V
0 VOLTS
15 ms
5 sec OS to Remove Darts
7495
7474
74121
SCHEMATIC GPM CARD
DRAWING # SAB 0125 1551 6176
GPM



SCHEMATIC LDPS CARD
DRAWING SAD 0122 ISS1 6/76

LDPS

MTL INC (ARACHNID) ROCKFORD ILL.

COMPONENT PARTS LIST - GPM CARD

MTL#	NO.OFF	CCT. REF.	COMPN. TYPE	DESCRIPTION
#053	5	IC 4,6,10, 14,17	SN-7400	TTL INTEGRATED CIRCUIT
054	a	Ic 1,2,3,5, 7,9,15,23	SN-7404	"
055	4	IC 8,13,16,20	SN-7420	"
059	1	IC 19	SN-7474	"
063		Ic 11,18	SN-7495A	"
064	2	IC12,21,22,24	SN-74121	"
040	2	TR 1,2	2 N 3708(TI)	SI, N-P-N PLANAR TRANSISTOR -GENERAL PURPOSE AMPLIFIER (BROAD h_{FE}) $-V_{CE}$ = 30V $-I_C$ = 200MA
047	2	D 1,2	IN 4148	SI. SIGNAL DIODE
032	2	R 1,2	1KΩ	RESISTOR--GENERAL PURPOSE 10%, 1/4W
023	2	R 3,4	4.7KΩ	"
028	1	R5	2.7KΩ	"
024	1	R7	10KΩ	"
022	1	Ra	27KΩ	"
033	1	R6	100KΩ	"
110	1	R9	680KΩ	"
010	1	R10	100Ω	"
001	14	C 2,3,4,5,6, 7,9,10,11, 13,15,17,16, 19	0.01μF 25V TYP. TOL.	CAPACITOR -MONOLITHIC CERAMIC -RADIAL LEADS -TEMP. CHARACTERISTICS NOT CRITICAL -TYPICAL TOLERANCE +80%, -20%
002	5	C8,12,14,20, 22	5μF (OR 4.7μF) 16V TYP.	CAPACITOR--MIN. AL. ELECTROLYTIC --TEMP. CHAR. NOT CRITICAL -AXIAL LEADS -TOLERANCE TYPICALLY +100%,-20%
003	2	C 1,18	10μF 16V TYP.	"
004	1	C a	25μF 16V TYP.	"
SP503			GPM CARD (Complete Assembly)	

The Game and Player Management (GPM) card (con't)

IC11 output is used to distribute the score pulse train, P1-09 and this is output as P1-18 a through d to the 4 PSD cards.

The power-on reset circuit is controlled by TR1 and monostable IC21, after about ½ second after turning on power IC21 produces a pulse which as already mentioned, sets IC19. Also a pulse is sent to the WBD card,, PO-13 which sets the WIN register (this puts the machine in a GAMEOVER condition and so prevents any inputs from having effect intil a coin is put in) and four pulses are dispatched to the PSD cards PO-15 a through d. (On the PSD cards these are used to effect a parallel load of the 3 decade counters. In the case of power up it loads in a score of 301).

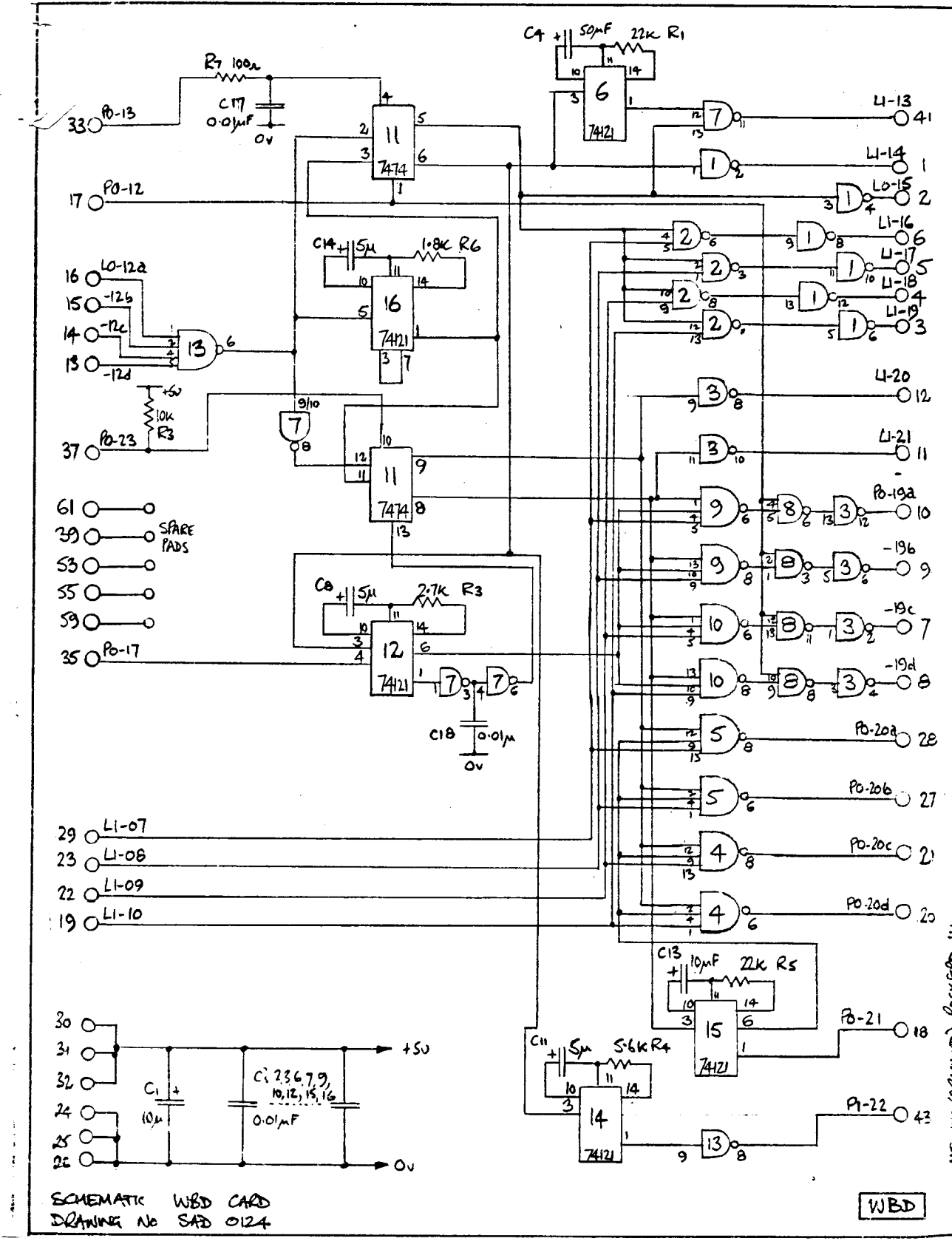
The register IC19 previously mentioned is buffered and output as L1-31 a through d to the 4 PSD cards. This controls the type of parallel entry of the 3 decade counters, for a new game it allows 301 to be entered and for a game in progress it allows the player last score to be entered.

Finally for the GPM card, PI-16 is not used and a spare gate on this card is used by a signal from the WBD card PO-20 entering and exiting as P1-24.

5.5 The WIN and BUST Detection (WBD) card. (PL3 on the Motherboard)

Inputs LO-12 a through d are from the 4 PSD cards and are the 'borrow' signal from the last stage of the score counter. Hence if a player wins, his score stands at zero and LO-12 is at logic 0. However if a player gets more than is necessary to win, LO-12 will go to zero and return to a logic 1 when the next pulse of the score occurs.

Any LO-12 signal triggers monostable IC16. The trail-ing edge of this monostable clocks into 2 registers. The signal LO-12 and its inverse. The first register of IC11 is the WIN register (having the inverse of LO-12 clocked into it). It outputs LO-15 to the SPC card to prevent any further scoring; LI-14 to the LDPS card and thence to the GAMEOVER lamp; Ll-13 (a result of AND-ing with IC6, a 1 second monostable) to the LDPS card and thence to the Board Illumination lamp; and with suitable gating with Ll-07 through 10 (which tell whose turn it is amongst the 4 players) it outputs Ll-16 through 19 to the LDPS card and thence to the appropriate WIN caption lamps. The WIN register triggers monostable IC14 to produce a pulse to drive the gong.


C4 50μF 22K R1
R7 100Ω
C17 0.01μF 0V
33 P0-13
17 P0-12
C14 5μ 1.8K R6
16 LO-12a
15 -12b
14 -12c
13 -12d
+5V
10K R3
37 P0-23
61
39 SPARE PADS
53
55
59
35 P0-17
C8 5μ 2.7K R3
C18 0.01μ 0V
29 LI-07
23 LI-08
22 LI-09
19 LI-10
30
31
32
24
25
26
C1 10μ
C2,3,6,7,9,10,12,15,16 0.01μF
+5V
0V
C13 10μF 22K R5
C11 5μ 5.6K R4
LI-13 41
LI-14 1
LO-15 2
LI-16 6
LI-17 5
LI-18 4
LI-19 3
LI-20 12
LI-21 11
P0-19a 10
-19b 9
-19c 7
-19d 8
P0-20a 28
P0-20b 27
P0-20c 21
P0-20d 20
P0-21 18
P1-22 43
74121
7474
SCHEMATIC WBD CARD
DRAWING No SAD 0124
WBD