



SERIES 6000 PARTS MANUAL



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INTRODUCTION

This manual contains description, unpacking/assembly, operation, and troubleshooting information for the model 6000 English Mark Darts machine.

The purpose of this manual is to provide the user with a basic installation and field service guide. If you should encounter a problem that is not covered, please call the factory using our toll-free number, 8004353319. In Illinois use 815-654-0212.

SECTION 1 - GENERAL DESCRIPTION

The 6000 series English Mark Darts machine is a patented microprocessor controlled dart game (patent #40571 251) where players may select one of eight different games. It is a coin operated game offering players a choice of quarter games or more challenging fifty-cent games.

Occupying only 2.5 square feet of floor space (see Figure 1), this unit uses a revolutionary sealed switch matrix scoring system behind the dart face. As the darts strike the target, the machine's computerized digital scoring system gives the player an instantaneous displayed score.

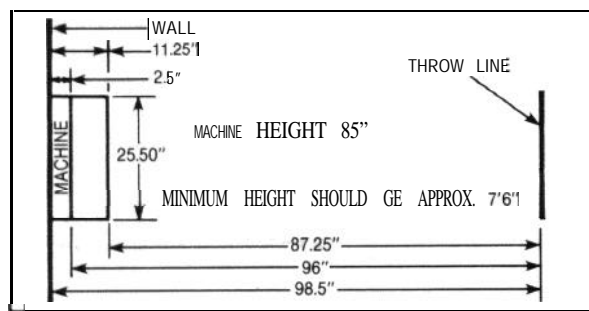


Figure 1] Plan view of the 6000 Series play field.

SECTION 2 - UNIQUE FEATURES OF THE 6000 SERIES GAME

There are several features that are unique to the 6000 series English Mark Dart Game from previous series games, such as:

1. The first eight games listed (A-H) are standard on the 6000 series game. On the Plus Version Cutthroat and Baseball are replaced by Tic Tad Darts and Horse.
 - A. **301** — 25 cents per player
A count down game for one to four players where each player starts with 301 points and must hit zero exactly first to go out (win).
 - B. **Count up** — 25 cents per player
A 24 dart game for one to four players where each player tries to score the most points in 24 darts thrown three at a time.
 - C. **Cut Throat** — 25 cents per player
One to four players where each player shoots one dart to establish their number. On subsequent turns each player is given three darts to shoot at the opponents number where seven hits eliminates that player.
 - D. **501 Team Doubles** — Open in/open out. 50 cents per player.
One to four players or teams, played the same as 301. This is usually played by two-person teams.
 - E. **701** — Open in/double out. 50 cents per player.
One to four teams, played the same as 301 except to go out a double or a bullseye must be hit. Count down game popular with three or four person teams.
 - F. **301** — Double in/double out. 50 cents per player.
This is for the more experienced players. One to four players, played the same as 301 except the player must start counting down and end the game by hitting a number in the outer double score ring, or by hitting bullseyes.
 - G] **Baseball** — 50 cents per player
A U.S. game where two players play nine innings of baseball. The first inning the only scoring number is the "one." Each subsequent inning the number used corresponds to the inning. On any of the three darts per inning a single number gives a single, a double a double, a triple a triple. The last scoring dart of every three can be thrown for the Bull's eye which scores a home run. The winner is determined by the player with the highest score at the end of nine innings.

- H. **Cricket** — 50 cents per player
Two players or teams per game. The game of Cricket is played with the numbers 15 through 20 and the bullseye. Each player must hit a number three times to close the number and score before the number is closed by the opponent. The winner is the first person to close all the numbers and have the highest score.
- I. **Tic Tad Darts** — 25 cents per player
A game for two players. The numbers will come up random to start the game. To mark an X or O a player must hit a number 4 times. Hitting a number more than 4 times will score points for that player. Singles score 1 hit, doubles score 2 hits, and triples score 3 hits. When one player gets 3 X's or 3 O's in a row, he wins. In case of a tie game where it is not possible to have 3 in a row, the high score wins. The bull is always in the center.
- J. **Horse** — 50 cents per player
A game for 2 thru 4 players. Played as the basketball game. The first player throws, the first hit being the set hit. Additional hits will determinethe total number that the opponent must hit to match or steal. Singles score 1 hit, doubles score 2 hits, and triples score 3 hits. The next player must at least equal the number of hits or he will get a letter. If the second player hits it more times than the set player he steals and becomes the set player. This means he will shoot two rounds in a row.

2. **Warm up mode.** The target light comes on when quarters are inserted. The microprocessor counts the number of quarters and will allow three free warm-up shots (for each quarter inserted) after which the target lamp is turned off. The player can then select game to be played at which time the target lamp will come back on and stay on till the game is finished.
3. **Attract mode** continuously displays messages and sample game screens. Following completion of a game, attract mode starts again after about a minute and a half.
4. **Reset mode.** If there is no play within a 10 minute period, the game will reset as if it had just been turned on. This will help when a player leaves the game, as other players will know that no one is currently playing.
5. **Target lamps** surround the target head with light. Darts already stuck in the board no longer cast shadows on other segments. In the "off" condition, the lamps go dim, just enough to let the dart player see the target without giving him enough light to play for free. The level of light is adjustable internally to suit the ambient light conditions at the location. The fact that the lamp doesn't get "cold" gives longer life as the surges of current when turned on are reduced (i.e. a warm bulb has a higher resistance than a cold bulb).
6. **External video** is available for displaying the scores to large crowds at tournaments or to attract other player's attention. Section 5.8 shows how to do this.
7. **Electronic popularity meter and coin meter** to keep track of statistics. You can tell how many times each game was selected and total number of coins inserted. See section 4.1 Test Mode for further information. A mechanical counter is mounted inside the coin door as well due to the fact that the electronic meter can be reset.
8. **Stuck segment indication** on screen to immediately let the player know to check for broken tips or any other foreign objects holding a segment back. It also indicates which segment is closed (i.e. S1 for single one; D3 for double three; T20 for triple 20] and Bull for Bullseye).



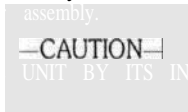
Figure 2. Stuck segment indicator display

9. **Instructions** can be read at any time a game is not being played by pressing "ENTER" to bring up the instruction menu, selecting the game you want to see instructions on with "SELECT", and pressing "ENTER" again. Return to attract mode is automatic after approximately a minute and 30 seconds or by inserting a coin or pressing "ENTER." After inserting coins, instructions can still be selected as it is the last item on the menu.

SECTION 3 • UNPACKING/ASSEMBLY

3.1 Unpacking

- Using a sharp knife, cut around top edge and remove
- Take out bag containing darts, tips, manuals, and bolts/nuts.
- Slit all four sides from top to bottom allowing the sides of the container to fall away from the machine. The machine is



3.2 Assembly

- Remove back to top unit.
- Feed ribbon cable and lamp plugs through the hole in center of bottom.
- Attach top assembly into base assembly as shown in Fig. 2 using four 1/4-20 carriage bolts and nuts and two 1/4" hex cap bolts as shown in Fig. 3A.
- Feed speaker connector up through hole in base of top assembly and connect (Fig. 4).
- Bring power cord out round hole in back of game and plug into a 120V AC (or proper input voltage for your country) GROUNDED wall outlet. The machine is now ready for power up sequence.

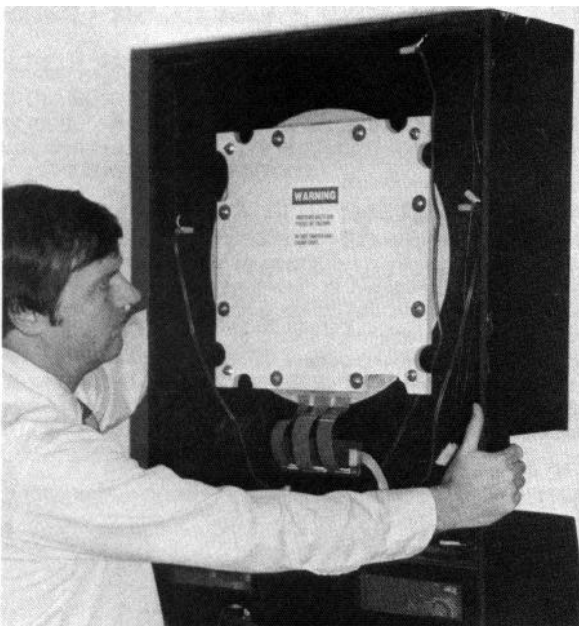


Figure 3. Attaching top assembly to base

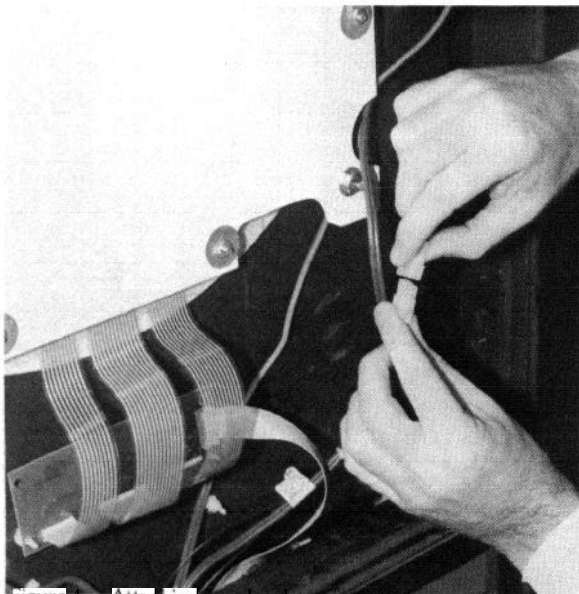


Figure 4 Attaching speaker harness

SECTION 4 • OPERATION

4.1 Power Up, Checkout, and Test

- Turn on dart machine using on/off switch on the back of the machine. The remove darts/throw darts lamps should start to flash alternately. After a few seconds, the monitor should come on displaying the attract sequence.
- Inside the coin doors you will find a slam switch, Fig. 5, which when activated will cause the game to reset, and a slide switch which will put the game into test mode when depressed and released.
- Slide the test switch down and release. The screen will show a hatch test pattern plus a message that the lamp test is starting. At this time all lamps on the machine will illuminate to check for proper operation. These lamps are:

- 11 target lamps (3)
2. remove darts (2) on PC board
3. throw darts (2) on PC board
4. select pushbutton lamp
5. enter/player change lamp

While the lamps are lit, the sounds of the game are played. Next the lamps will go out and the message "DART HEAD TEST" will appear at the top and "PRESS ENTER FOR TEXT INPUT" and "PRESS SELECT FOR REPORT" at the bottom. If you press any segment at this time, the score should appear in the center of the screen (Fig. 6).

After testing the segments in the dart head, pressing select will display the report screen (Fig. 7). From this screen, you can tell how many times each game has been played. The last item is an electronic coin counter. The numbers displayed on the report screen can be cleared by pressing the Bull's eye while in this mode.

Information on the popularity screen is retained when the power is turned off (see Section 5.2.6).

Pressing ENTER instead of SELECT will put you into the SPIDER WRITER mode. See SPIDER WRITER page (Fig. 10) for more information.

Pressing the test switch, inserting a coin, closing the slam switch, or turning power off and on will cancel test mode.

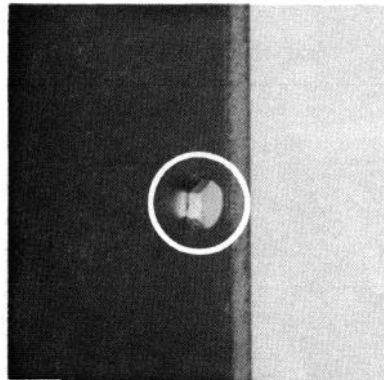


Figure 3A. Hex cap bolt holding top to bottom

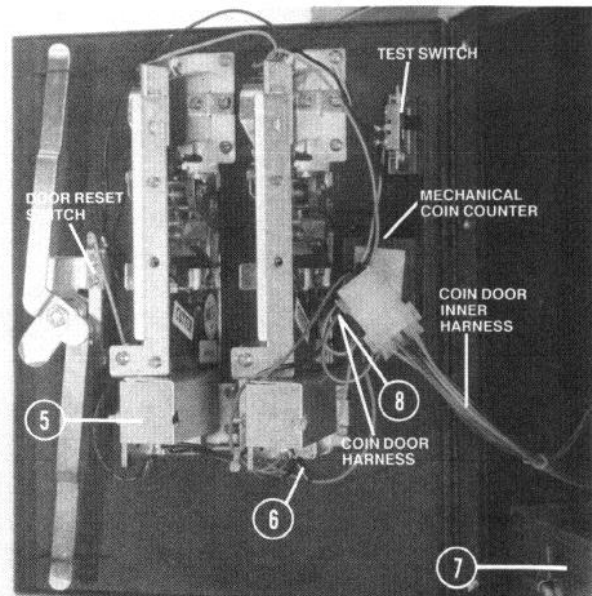


Figure 5. Coin door open showing coin mechanism, reset switch, and test switch

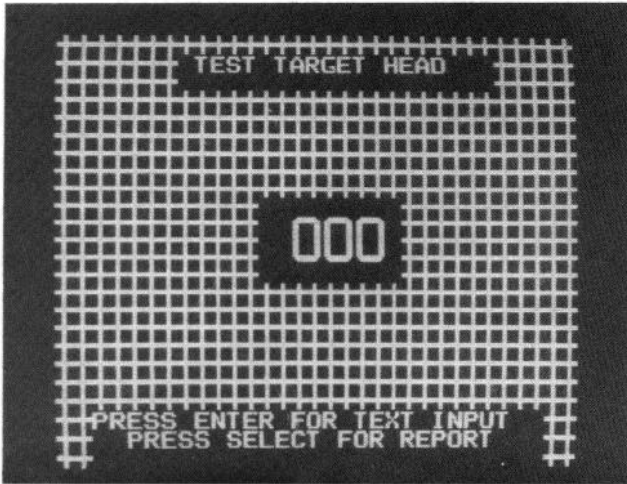


Figure 6. Test mode ready for dart head test

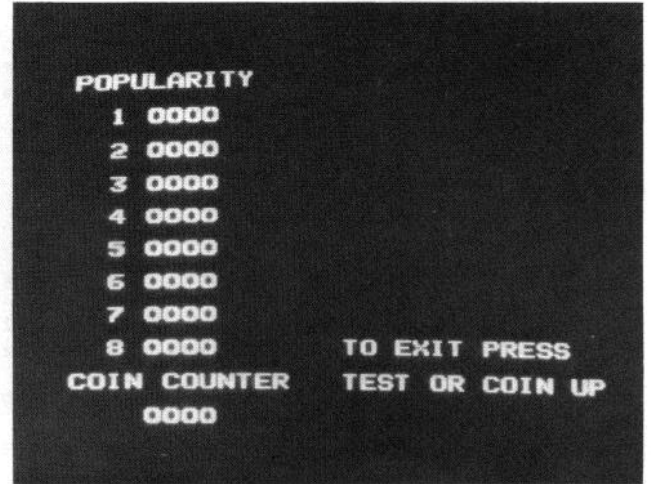


Figure 7. Report Screen

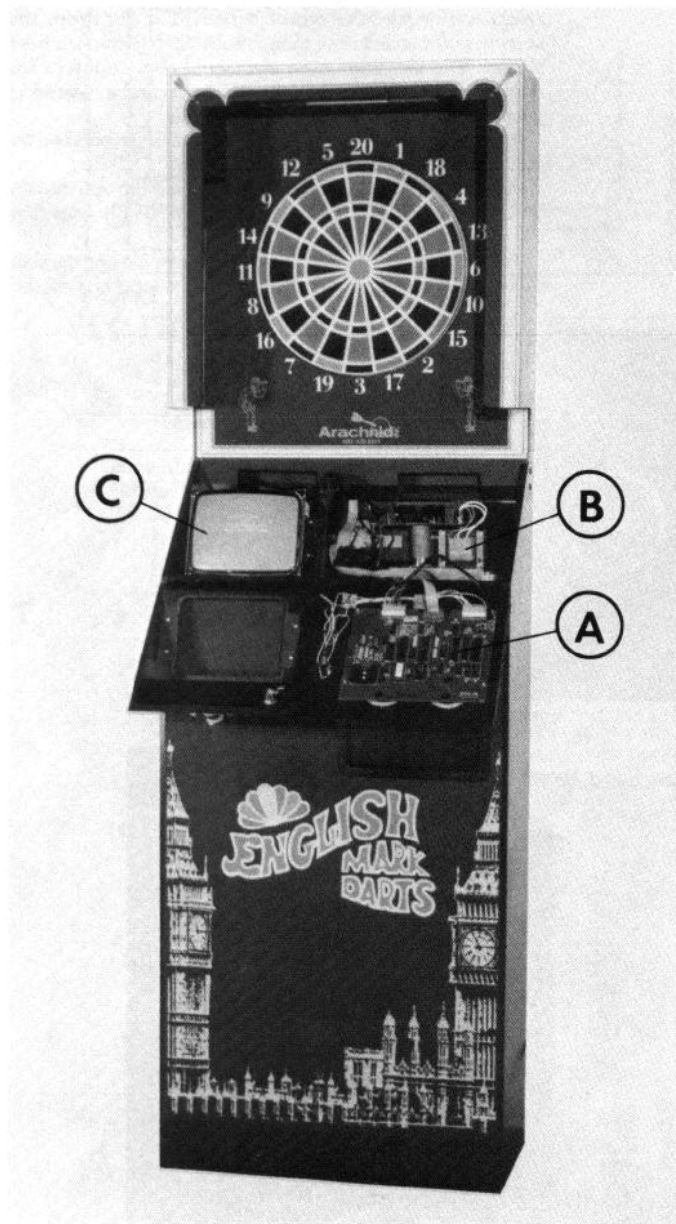


Figure 8. Front view of 6000 series game

SECTION 5 - TECHNICAL DESCRIPTION

5.1 General

Figure 8 and Figure 9 show the main components of the game.

- a) Main CPU Board
- b) Power Supply
- c) 9" Monitor
- d) Target Interface Board
- e) Dart Head Assembly

The assembly containing the main board, monitor, and power supply is designed for easy access as shown in Fig. 8. Most service can be performed by swinging the front door open. However, if desired, the component tray can be removed entirely by unscrewing three screws in the bottom of the tray, disconnecting target lamp wires (3), ribbon cable, and coin harness. This way the unit can be bench tested by attaching a dart head w/target interface, a low wattage (40W) lamp, and switches to simulate the coin in, test, and reset.

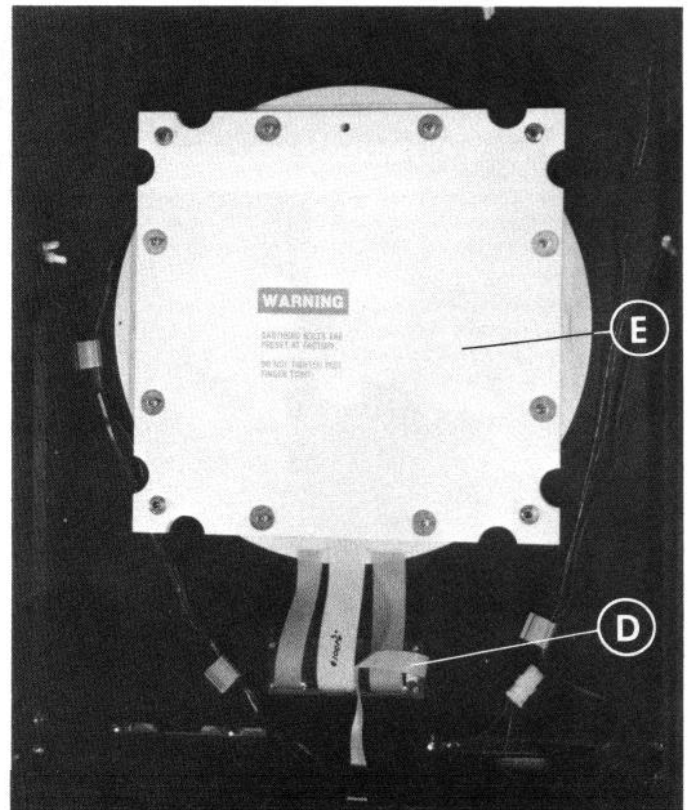


Figure 9. Rear view of 6000 series game



SPIDER WRITER INSTRUCTIONS: EASY AS 1 2 3

1] Put the Super 6 into the test mode by depressing the slide switch inside the coin door. At the end of the test mode the message "press Enter for text input - press Select for report" will appear. Press the Enter button.

2. A cursor will appear in the upper left corner of the screen. Use the dart head as a "keyboard" to move the cursor around and to enter your custom message. The diagram to the right illustrates which symbols are represented by segments in the single, double and triple rings.

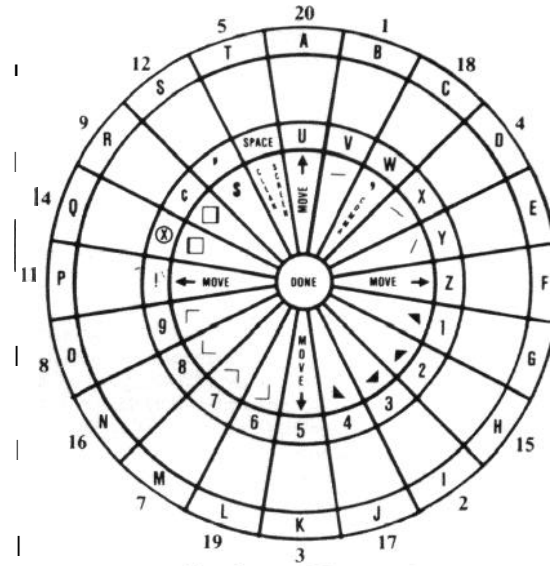
3. Press the bullseye when you are satisfied with the screen you have created. The Spider Writer will remain in the input mode for ten minutes before returning to normal game operations. If time expires while you are entering a screen, simply put the game back in Test mode and continue where you left off. The screen you were working on was automatically saved.

HELPFUL HINTS:

Use the 32x16 grid below to create the screen on paper before putting it on the "Super 6". It will save you time in deciding where to place words or graphics. Make copies of this original and draw on the copies, saving the original to make additional copies from.

Be careful of the Single 5! It clears the screen completely and should only be pressed when you wish to change the entire screen.

Note: A game that is not properly grounded may place strange characters in random locations on the screen. Please make sure the ground plug on the wall receptacle is properly connected.



Keyboard Legend

Each Segment in the Singles, Doubles, and Triples rings correspond to the letter, number or graphic represented on the diagram above. Use "Move" segments to position the cursor on the screen. Be careful of the single 5 - it clears the screen completely.



SPIDER WRITER WORKSHEET

Use this grid to design your custom screen



| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
|----|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 10. Spider Writer instruction page

5.2 Main CPU Board

The main CPU board (Figure 19, page 11) contains a 6809 microprocessor and associated IC's consisting of:

- TMS4416 16KX4 Dynamic Memory . U12, U13
- TMS9118 Video Generator . U11
- 74LS32 2 Input OR Gate . U10
- MK48Z02 2KX8 Memory W/Battery . U23
- 27256 32K Eprom . U15
- 74LS04 Hex Inverter . U1
- 556 Dual Timer . U2
- 6821 Peripheral Interface Adapter . U4, U17
- 74LS138 3 Line to 8 Line Decoder . U14
- LM7815CT 15V Regulator. U22
- LM383T Audio Amp . U21
- 6840 Programmable Timer . U16
- ULN2003 Transistor Network . U7, 18, 24
- Capacitor Network, 01UFDX8 . U8, 9
- Resistor Network 2KX8 U5
- Resistor Network 10KX8 . U19, 20
- Diode Network, IN4148X8 . U6

5.2.1 Monitor - See monitor manual

5.2.2 Player Change - Select

The player change and select pushbutton is located on the front slanted panel. When the player change is closed, pin 3 of U17 is shorted to ground. When select is closed, it shorts pin 2 of U17 to ground. When the switches are open, the inputs are held high by 10K OHM resistor network. C22 and C23 (.01ufd) are used for noise suppression.

5.2.3 Sound Circuit

Sound is generated in U16 by programming timer 1 (of three timers) to free run at specific frequencies. The sound is output at pin 27 (01) and is fed thru R9 which is the volume control accessible from the top of the main PC board. U21 (LM383T) is an 8 watt audio power amplifier whose gain is controlled by the ratio of R23 and R24. The voltage for U21 is controlled by U22 (LM7815CT) a 15 volt regulator. Input should be 21 to 24 volts DC depending on line voltage.

5.2.4 Reset

The microprocessor can be reset either by shutting off power for a few seconds and then turning back on, or by closing the slam switch inside the coin door.

- a) The slam switch on the coin door is buffered with two sections of U7. When the switch is closed, pin 2 of U7 is grounded. U7 inverts this signal twice so the effect on the reset line is that it goes low. C6 is used for preventing electrical noise from triggering a reset.

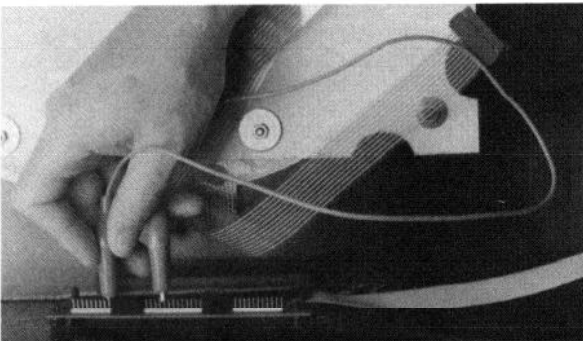


Figure 11. Target interface board with test jumper

| TABLE I Letter Designation of Scores | | | |
|---|--------|--------|--------|
| SCORE | SINGLE | DOUBLE | TRIPLE |
| 1 | DN | EN | FN |
| 2 | AL | BL | CL |
| 3 | AN | BN | CN |
| 4 | DL | EL | FL |
| 5 | AP | BP | CP |
| 6 | GL | HL | GP |
| 7 | DO | EO | FO |
| 8 | GI | HI | GI |
| 9 | AO | BO | CO |
| 10 | AI | BI | CI |
| 11 | AK | RK | CK |
| 12 | DP | EP | FP |
| 13 | AM | BM | CM |
| 14 | GK | HK | GO |
| 15 | GJ | HJ | GN |
| 16 | AJ | BJ | CJ |
| 17 | DM | EM | FM |
| 18 | DI | EI | FI |
| 19 | DJ | EJ | FJ |
| 20 | DK | EK | FK |
| BULL | | HM | |

- b) The purpose of half of the 556 timer is to give a short delay to the reset line after power up. The reset line cannot come to 5 volts at the same time as the 5 volts on Pin 7 on U3 but must be delayed a few clock cycles for reset to work properly.

5.2.5 Interrupts

The microprocessor can be interrupted in three different ways at which time it will jump to the part of the program that controls that particular interrupt.

- a) Two of the three timers (U16 - 6840) are cascaded to give approximately a ten-minute delay before an interrupt will occur, at which time the game resets as if you had just turned it on. Any activity during a game automatically resets the timer back to 10 minutes (i.e., as long as there is someone playing the game it will not reset, only if it is left unattended for 10 minutes).
- b) The coin input switch will override any game or other mode that the game may be in.
- c) The test switch will also be acknowledged any time.

5.2.6 Memory

Memory in this system consists of 2K of RAM (U23-MK4BZ02) with internal lithium batteries. This gives data retention when power is off for the popularity screen. The manufacturers data sheet (MOSTEK) states the minimum expected data retention time as 10 years based on statistical studies made by MOSTEK.

Eprom memory (U25-27256) holds the main program. The window on this IC should always be covered with our stick-on label as Eproms are erasable when exposed to ultraviolet light over a period of time.

5.2.7 Address Decoding

Address decoding is done with U14, a three line to one of 8 line decoder. This IC determines if the microprocessor is addressing memory, one of the two peripheral interface adapters, the 6840 sound IC, memory, or the video IC.

5.3 Target Interface Board

The target interface board is used to combine the 33 conductors from the switch matrix into 16 conductors. At times it can be important to know which pins on the target interface board will give a particular score. This Information is in Table 1 and Figure 12. With the game in test mode (at the end of test when the dart head is sensitive) or in game mode, shorting, momentarily, the correct pair of pins in the target interface board with a jumper wire will give a score (see Figure 11). Doing this might save troubleshooting time as you can determine if a problem is in the switch matrix or the electronics.

-NOTE-
THE SCORE WILL NOT APPEAR UNTIL THE
JUMPER WIRE IS REMOVED.

You will note from Table 1 that the 13 pin connector is common to all switches. Since the microprocessor won't score until the switch opens, pulling off the 13 pin connector while in test mode will give you the score of a stuck segment or switch. The effect is that the switch gets opened so the microprocessor can give the score. This can save troubleshooting time. Another method of operating the switch is to pull the ribbon cable from the main 6000 series board.

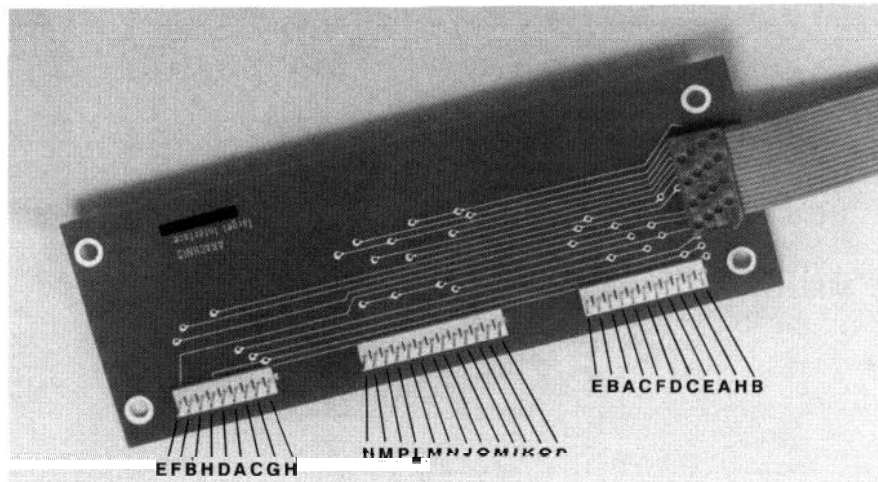


Figure 12. Target interface board letter designations

5.4 Target Illumination

The target illumination consists of three "showcase" bulbs 5-1/2" long frosted inside. These are used for illuminating the game during attract mode as well as during play. In the attract mode, the brightness of the lamps should be adjusted so the dart head is barely visible, not bright enough to allow free play. This is adjusted with a screwdriver on the base of the power supply inside the component tray (see Figure 13).

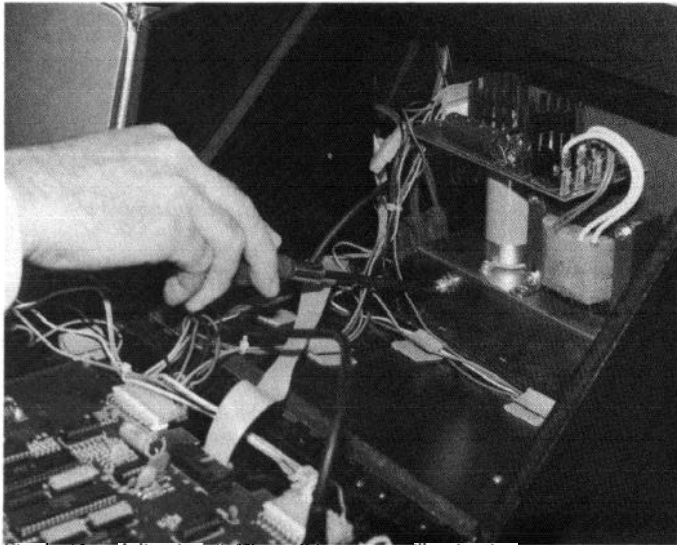


Figure 13 Adjusting "off" condition target illumination

The off brightness is a result of (see power supply schematics) R4, C10 and a ST-4 DIAC. These components turn on the gate of the Triac (SC1461D) for only a portion of each cycle of AC, the same as a wall dimmer switch would do.

When the game is coined up, the gate of the Triac is turned on all the time through the MOC3030. This off brightness also keeps the filament of the bulb warm which greatly-reduces the turn-on shock and should give longer life to the lamps and Triac.

—CAUTION—

NOTHING EXCEPT FOR THE TARGET LIGHTS SHOULD BE PLUGGED INTO THE RECEPTICALS IN THE COMPONENT TRAY AS IT HAS SPECIAL WIRING.

5.5 Power Supply

The power supply consists of three voltage levels, +5V, +12V and +21VDC. The 5V and 12V come from the same transformer output. The 12V supply consists of two regulators, a LA1612 for the monitor rated at 2 Amps and a LM340-12 for the lamps rated at 1 amp.

The 5V regulator should only vary $\pm 1\text{mV}$ with load and line. All of the logic is powered from this supply.

The +21V supply is unregulated and will vary with line and load. This supply feeds the +15V regulator located on the main PC board. The 15V regulator powers the audio circuit.

There are three fuses in the power supply. The main fuse is located on the chassis. It is a 1.5 amp 250 volt slow blow 3AG size. Nothing will function if this fuse blows.

The other 2 fuses are located on the small printed circuit board on top of the power supply. The one closest to the edge is FS1, a 5 amp 250 volt slow blow 3AG size. This protects the lamps and 5 volt circuit. The fuse next to it (FS2) protects the sound circuit. It is a .75 amp 250 volt slow blow 3AG size.

—NOTE—

THE GROUND ON THIS GAME IS FLOATING AND MUST NOT BE CONNECTED TO THE POWER SUPPLY CHASSIS GROUND.

THEREFORE, ALL VOLTAGE MEASUREMENTS SHOULD BE REFERENCED TO THE GROUND ON THE SMALL PC BOARD ON TOP OF THE POWER SUPPLY OR GROUND ON THE MAIN BOARD.

5.6 Dart Head

The dart head is set to exact specifications at the factory. The bolts that hold the board together are tightened to finger tight only. Do not tighten any further as this can close switches in the switch matrix and cause the dart head to lock up or misscore.

5.7 Dart Head Disassembly/Reassembly

To clean or replace parts in the dart head, it is necessary to disassemble and reassemble as follows:

- Remove 8 nuts holding the target back to the spider.
- Remove switch matrix.
- Remove .020" gasket.
- Remove rubber damper.
- Check for dirt and broken tips between spider and cups.
- Replace any worn or broken cups.
- Clean and re-install rubber damper.
- Re-install gasket, making sure that it is installed right side up and in the right rotation. There should be a small U shaped cutout to the left of center at the top as shown in Figure 14.
- Place the switch matrix with the tails on the left and the 9 pin connector on top.
- Clean and reinstall target back and 8 nuts, tightening only finger tight.

—NOTE—

BOLTS MUST BE FINGER TIGHT ONLY. ANY TIGHTER WILL CLOSE CONTACTS IN THE MATRIX AND CAUSE INACCURATE SCORING OR NO SCORING AT ALL.

—NOTE—

IT IS IMPORTANT TO KEEP DIRT OUT OF THE AREA BETWEEN THE SPIDER AND SEGMENTS AS THIS CAN CAUSE NON-SCORING OR IMPROPER SCORING. ON A HEAVILY PLAYED GAME IT IS A GOOD IDEA TO DO PREVENTIVE MAINTENANCE ON A REGULAR BASIS IN THE FORM OF DISASSEMBLING THE DART HEAD, CLEANING, AND REASSEMBLING. THIS CAN HELP PREVENT SERVICE CALL IN BETWEEN REGULAR VISITS.

—NOTE—

ALTHOUGH THE DART HEAD IS DISASSEMBLED AND REASSEMBLED AS IN THE PAST (WITH 4500 AND 5000 SERIES GAMES), WITH THE 6000 IT IS INSTALLED WITH THE 3 LEADS IN THE DOWNWARD DIRECTION. THIS MEANS THAT THE ".20" ON THE YELLOW SPIDER IS NOT AT THE TOP. THE PROGRAM WAS CHANGED TO REFLECT THIS CHANGE. MAKE SURE THAT IF USING A DART HEAD FROM ANOTHER SERIES GAME THAT THE RED AND BLACK SEGMENTS ARE IN THEIR PROPER PLACE (SINGLE 20 IS RED).

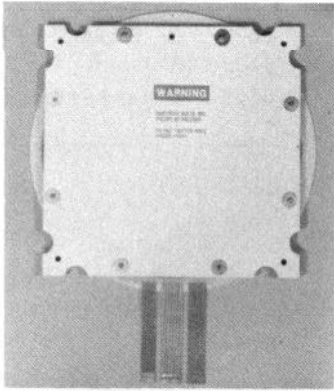
5.8 Video

The video signal is created with the TMS9118, U11 along with video RAM chips U12 and U13, TMS4416 dynamic memory. The output signal is at pin 36 of the TMS9118 and is buffered to protect the video chips with TR1.

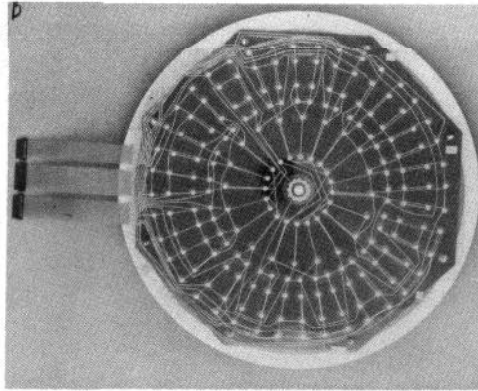
On the main printed circuit board there are two RCA style phono jacks. Either may be used for the monitor (see Fig. 15 and 16). The second is to be used if external TV's are desired to be set up. To do this, run a cable from the second video jack to an RF modulator or the video input of a VCR. The output of the modulator or VCR is usually on channel 3 or 4 and should be connected appropriately to the TV. This is a great way to display for tournaments or just to create added interest in the location.

The TMS9118 contains circuitry for an 10.7 MHz crystal and divides it by 3 to create a CPUCLK signal. This way a separate crystal is not necessary for the microprocessor.

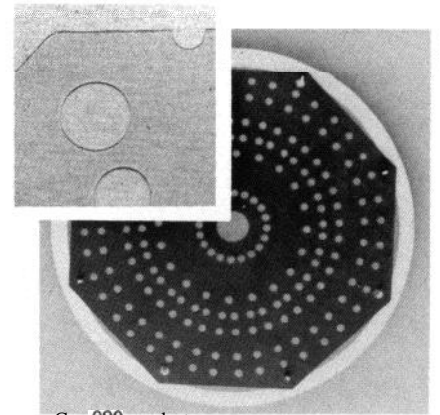
Figure 14. Dart Head Assembly



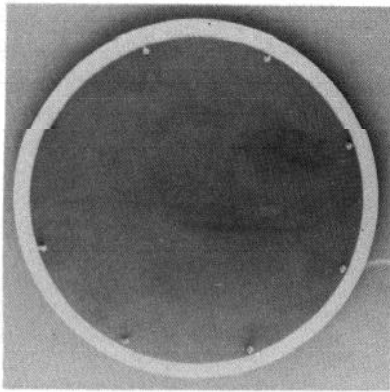
A • Complete Assembly from back



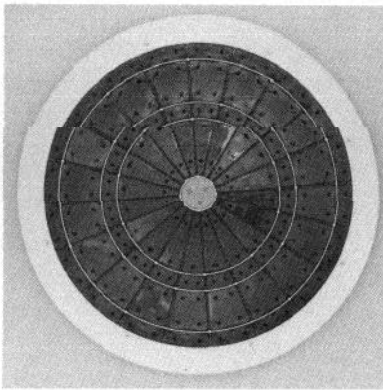
B • Matrix, on top of Dart Head Assembly



C • .020 gasket



D • Silicone Rubber Gasket



E • Spider Assembly

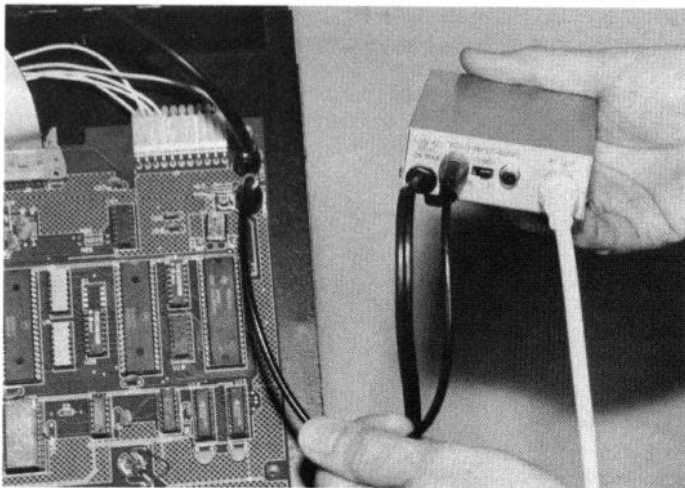


Figure 15. Hooking up a modulator for external TV



Figure 16. External TV