

GRAN TRAK 10

**OPERATING
AND MAINTENANCE MANUAL**



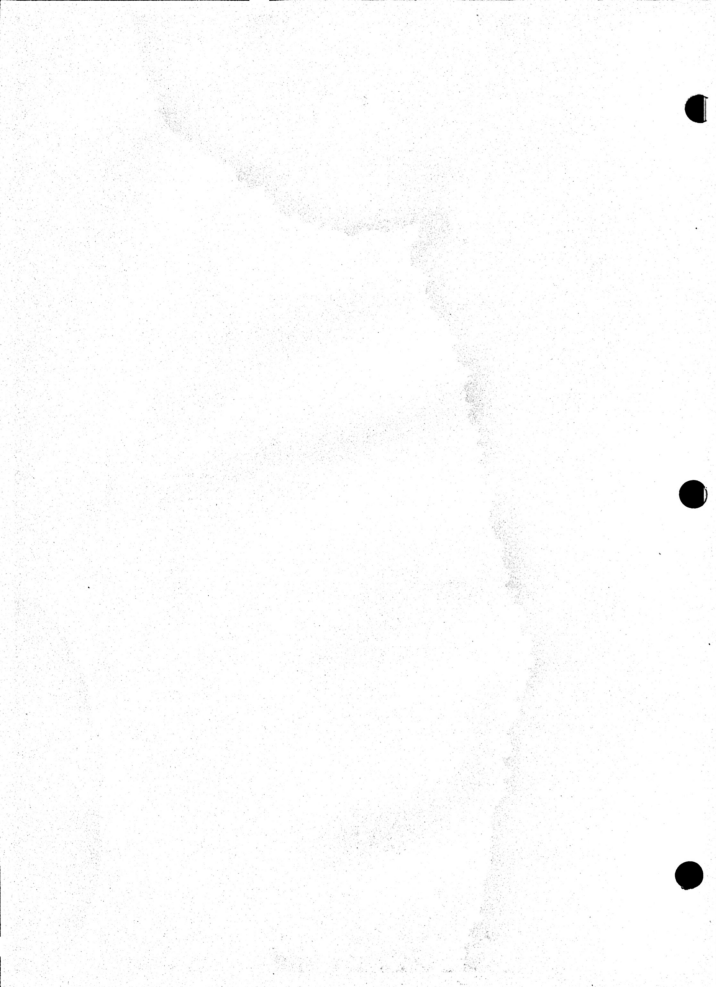


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defeat the interlock switch by pulling out the white actuator shaft. At this point the CRT (Cathode Ray Tube) should display the race track and the score after a short warm up time. Examine the CRT picture. It should be steady, sharp and exhibit the proper levels of brightness and contrast.

4. Insert several old and new coins into each coin acceptor. No genuine coin should be rejected. Pressing the game credit switch (start switch) advances the coin counter one digit. Operate both coin rejector handles and check for any signs of binding or sticking. Finally, check to see that both acceptors are firmly mounted in their frames. NOTE: Lightly spray both coin acceptors and both sets of rejector linkages with WD-40, a silicone lubricant. This bit of preventative maintenance may save a service call later.
5. Coin insertion should produce game credit, indicated by a small red light (LED) in the start switch button mounted

on the control panel between the steering wheel and the gear shifter.

6. Start a game by pressing the start switch button and check for proper game sequence making sure all aspects of the game (steering, gear shifter, accelerator, brakes, score, timer and track display) are functioning correctly. If you are not familiar with the game sequence for Gran Trak 10, read the game sequence analysis.
7. Adjusting play time modifies crash mode. The play time is pre-set at the factory for approximately 1 minute 40 seconds, and should not be changed.
8. Both doors (rear and cash) should open and close without binding, and both door locks should turn to the "locked" and "unlocked" positions freely.
9. Check the rear door interlock switch to see that it turns off the machine when the door is opened.

D: THE GAME SEQUENCE

With the game plugged in and the rear door installed, the CRT will display the *attract* mode. The attract mode for Gran Trak 10 displays the race course and a stationary race car positioned where the last player ended, plus the score of the previous game and the game timer (which should read 0).

Coin insertion lights the credit light in the start switch button and the game commences when this button is pressed. At the point the score is reset to 0, the timer begins counting down from 78 by 2s, the car engine begins idling and is ready to be driven.

The controls of the machine and the movement of the car image simulate those of a real car. Once accelerated, the car becomes increasingly difficult to stop the faster the car is moving.

Turning the steering wheel causes the car to turn in the direction of rotation. The car will turn only while the steering wheel is being rotated.

The gear shifter works exactly like that of a real car. Use reverse gear to back off of the pylons after a crash. Then shift into first, rotate the steering wheel to turn the car so it will continue in the proper direction and step on the accelerator pedal. Once the engine has revved to its limit, shift into second and once the engine has revved to its limit, shift into third. The speed of the car will climb as you shift through the gears. Keep in mind, though, that the engine will "bog" down if you shift up too fast or start out in the wrong gear (2nd or 3rd).

Both the accelerator and brakes have only two positions: on or off. When the accelerator is depressed, the engine will rev up. Stepping on the brake pedal will bring the car to a screeching halt and if the steering wheel is turned as the brakes are applied, the car will skid realistically.

Points are scored only by passing the course check points in the proper sequence as indicated by the arrows on the CRT. The score is displayed in the pit area next to the game timer.

If the car is driven into any of the pylons, a crash will result (provided that the PCB slide switch, S1, is set to the crash mode position). The crash is accompanied by a crash sound, uncontrolled spinning of the car during which time the car cannot be driven. As soon as the crash sound has ended, shift into first and continue driving the car in the proper direction. The game continues in this fashion until the game timer reaches 0 at which point the controls become "dead" and the machine is reset to the attract mode.

Players are given an indication of their skill by matching their score (points) against the 'rating card' located at the lower right-hand corner of the glass covering the video display. This rating system is based on a game playtime of approximately one minute and forty-five seconds (as adjusted prior to shipment). The rating card reads:

YOUR SCORE

0-10	License Revoked
11-20	Backseat Driver
21-30	Good
31-40	Excellent
Above 40	Real Pro

If game playtime is readjusted by the operator, this point/rating system is no longer valid and should be changed.

International shipments of Gran Trak 10 are supplied with a blank card on which to copy the above rating card in local languages.

F: THE ANTENNA WIRE AND ANTI-STATIC MODIFICATION

An *electronic latch* circuit has been incorporated in the Gran Trak 10 computer. One function of this circuit is to turn off or prevent game credit if a player tries to obtain free games by inducing a static charge in the machine. The antenna wire is an integral part of this system.

When a static discharge occurs, an electric current is induced in the antenna wire. This impulse is transmitted through the antenna wire to the electronic latch circuit which turns off game credit and resets the computer to the attract mode.

The antenna wire is a length of white wire approximately 12 inches long. One end of the antenna is connected to pin K of the PCB edge connector and the other end has been intentionally left not connected.

The length of the antenna wire has been pre-adjusted by the factory to the overall optimum length, however some environments may require more or less critical adjustment.

Lengthening the antenna wire increases the sensitivity of the circuit; cutting the wire shorter decreases the sensitivity.

If players are obtaining free games by inducing static charges in the machine, lengthen the antenna wire (add a piece of wire) by a few inches so that a lesser charge will turn off game credit. If you have problems with static charges accidentally turning off game credit during the progress of a legitimate game, try cutting the antenna shorter in increments of 1-2 inches. Try to cut only the minimum amount off the antenna, otherwise players may be able to obtain free games.

The anti-static modification may be tested during a game by touching the end of the antenna wire with your finger as the body usually has enough capacitance to actuate the electronic latch. If the game is shut off, the circuit is functioning correctly.

F: TOP SECTION SUB-ASSEMBLIES: SERVICE PROCEDURES

Use the following procedures to replace the general illumination lamps, the plexiglass screen and bezel and to service the T.V. monitor.

1. **GENERAL ILLUMINATION LAMPS:** Eight 6 volt lamps are mounted on a PC board behind the plexiglass screen to illuminate the Gran Trak 10 logo. To replace burned out lamps, reach in the rear door and unscrew the four lamp PC board mounting screws [#21, Fig. 1] and unplug the 2 wires which are attached to it at the plugs located in the upper right inside area of the cabinet. Remove the panel and replace burned out lamps with GE44 or GE47.

2. **PLEXIGLASS SCREEN:** Use procedure #1 to remove the lamp PCB. Then remove the three wing nuts and carriage bolts [#23 & 34, Fig. 1] which hold down the upper aluminum plexiglass screen retainer [#10, Fig. 1] and lift out the plexiglass.

3. **BEZEL:** Use procedures #1 and #2 to remove plexiglass and the bezel [#8, Fig. 1] will lift out.

4. **T.V. MONITOR:** To remove the entire T.V. monitor assembly [#2, Fig. 1], remove the four carriage bolts [#26, Fig. 1] found on the top of the monitor frame and the four Phillips head bolts found on the sides. *Do not remove the aluminum angle brace at the bottom.* Disconnect the electrical connector to the T.V. and lift the monitor out very carefully. **DISCHARGE THE SECOND ANODE BEFORE SERVICING.**

5. **T.V. MONITOR ADJUSTMENT:** The T.V. monitor and

its adjustment controls function like any normal T.V. set with the exception of the sound which is adjusted on the PCB (see page 5). The monitor is serviced through the rear door of the machine. See figure 4 on Page 12 for the locations of the following adjustments:

a. **Brightness:** Adjust the brightness *before* the contrast. Adjust so that the CRT background is as *dark as possible*.

b. **Contrast:** The contrast is adjusted so that the CRT images are as *bright as possible* against the pre-adjusted dark background *without being blurred*.

c. **Vertical Hold:** Adjust only *if the picture appears to be rolling up or down* the screen. Adjust for a stable centered picture.

d. **Horizontal Hold:** Adjust *if the picture is slightly off center horizontally*, if the images appear *warped* or if the picture is *broken into a series of diagonal lines*.

e. **Vertical Size:** Adjust only *if the top and bottom of the race course is cut off* from the screen or if there is too much distance between the edge of the course and the edge of the screen, which will appear as an extra set of horizontal dotted lines on the top and bottom of the CRT display. Adjust for maximum picture size.

f. **Vertical Linearity:** Change this adjustment *only if the top of the picture seems compressed*.

g. **The Yoke:** *The yoke should never need adjustment unless the adjusters have been tampered with* or the machine damaged. If yoke adjustment is indicated, adjust

both yoke rings *simultaneously* for optimum centering of the race course on the CRT.

h. The A.C. Voltage Switch: Set this switch to the 115 Volt position ("115" visible on the switch) if the machine is connected to a 115 Volt source. *The T.V. monitor will not function if this switch is misadjusted.*

G: THE COIN DOOR: SERVICE PROCEDURES

All coin handling equipment is accessible through the front door. To collect the coins, open the door, remove the coin box and record the meter reading.

The Gran Trak 10 is equipped with two coin acceptor assemblies so the entire machine will not be out of service if one acceptor is malfunctioning.

Please keep in mind that proper adjustment and lubrication of the coin handling equipment will help minimize your service calls.

1. THE DOOR LOCK: The lock cylinder can be withdrawn and replaced after the rear retaining nut and the lock cam are removed. If the coin door does not fit tightly or the lock does not turn freely, try bending the lock cam slightly with a pair of pliers. **NOTE:** The lock cylinder should be lubricated once every three months or so with graphite or WD-40.

2. THE REJECT LINKAGE: A separate handle operates the wiper lever of each coin acceptor. When this handle is pressed down, the wiper lever (#17, Fig. 6d) of the coin acceptor is operated which should dislodge any coins "stuck" in the acceptor. The rejector handles cannot be removed. **NOTE:** Lubricate the rejector linkage with silicone grease when you receive the machine and thereafter at approximately six month intervals.

3. THE COIN MICRO SWITCHES: To remove a malfunctioning micro switch, unscrew the two retaining screws (#1, Fig. 6a), record the wire positions and pull off the slip-on connectors.

4. THE COIN ACCEPTORS: The coin acceptor can be removed for servicing after the retaining screw (#2, Fig. 6b) has been removed.

5. ACCEPTOR ADJUSTMENT AND MAINTENANCE:

ADJUSTMENT: All coin acceptors leave the factory adjusted for maximum performance. However, if more critical adjustments are necessary or if the unit has been completely disassembled for service, the following adjustment procedure is suggested:

(These tests and adjustments are performed with the acceptor in a vertical position on a level surface [the rest position].)

i. The T.V. Monitor Fuses: Two 8/10 Amp, 125 Volt Slo-Blo fuses (313 3AG) protect the T.V. monitor from electrical overload. Replace blown fuses *only* with those which have the above rating. **NOTE:** The T.V. is not fused by the fuse on the electronics tray.

KICKER AND SEPARATOR

1. Set the unit with the back of the acceptor facing you in the test position.

2. Loosen the screws holding the kicker [1] and the separator [3] and move both the kicker [2] and the separator [4] as far to the right as they will go. Tighten the screws.

3. Insert several test coins (both old and new) and note that some are returned by striking the separator.

4. Loosen the separator screw and move the separator a slight amount to the left. Tighten the screw.

5. Insert the test coins again and, if some of them are still returned, repeat Step #4 until all the coins are accepted.

6. Loosen the kicker screw and move the kicker as far to the left as it will go. Tighten the screw.

7. Insert the test coins and note that some are returned.

8. Loosen the kicker screw and move the kicker a slight amount to the right.

9. Insert the test coins again and, if some are still returned, repeat Step #8 until all the coins are accepted.

10. Be sure that both screws are tight after the adjustments have been made.

THE MAGNET GATE

1. Set the acceptor with the front of the unit facing you in the test position.

2. Turn the magnet gate adjusting screw (#12, Fig. 6d and #3, Fig. 6a) out (counterclockwise) until none of the coins will fit through.

3. With a coin resting in the coin entrance of the acceptor (#4, Fig. 6c), turn the adjuster in (clockwise) until the coin barely passes through the magnet gate.

4. Test this adjustment using several other coins (both old and new) and, if any of them fail to pass through the magnet gate, repeat Step #3 until all of the coins are accepted.

5. Fix the magnet gate adjusting screw in this position by tightening down the magnet gate screw lock nut.

ACCEPTOR MAINTENANCE: Depending on the environment in which the acceptor is used, periodic preventive maintenance should be performed.

The mainplate [#5, Fig. 6d] may be cleaned with any non-abrasive household cleaner. Rinse and dry thoroughly to remove deposits and film.

Remove all metal particles from the magnet by guiding

the point of a screwdriver along the edges of the magnet.

Remove the transfer cradle [#9, Fig. 6d] and clean the bushing and pivot pin. A pipe cleaner is an effective cleaning tool. Apply powdered graphite or pencil lead to the pin and bushing and reassemble.

Spray the entire unit lightly with WD-40 or a similar silicone lubricant.

H: ELECTRONICS TRAY SUB-ASSEMBLIES: SERVICE PROCEDURES

(PULL OUT THE POWER CORD WHILE PERFORMING PROCEDURES 1-4.)

1. FUSE REPLACEMENT: First remove the AC protective cover and replace the bad fuse with a Slo-Blo fuse rated at 1 Amp, 125 Volts (313 3AG).

2. TRANSFORMER REPLACEMENT: To remove a malfunctioning transformer remove the AC protective cover, record all wire colors and their positions, unsolder the wiring and unscrew the retaining screws. **NOTE:** When installing the new transformer, be sure to reconnect the chassis ground wire (lugs fastened with wood screws that mount the transformers to the wood electronics tray).

3. INTERLOCK SWITCH: To remove the switch, pull off the push-on connectors, squeeze in side tabs on the switch and push it through the mounting bracket.

4. PRINTED CIRCUIT BOARD: To remove the PCB, disconnect the PCB edge connector, remove the four retaining screws and carefully lift out the board. PCBs are

extremely fragile and require very careful handling.

5. PCB ADJUSTMENTS:

a. Volume: This adjustment is made by a small blue trim pot marked "volume" near PCB position L8. Adjust the volume to the preference of the location but keep in mind that the machine will sound louder with the door off.

b. Play Time: This adjustment is located near A8 and it adjusts both the total play time and the crash time period. Playtime is pre-set before shipment and *should not be adjusted* due to interrelationships with other game functions (i.e., crash time, rating system).

If you have the following symptoms, recalibration of one or more of the cemented pots is indicated and you must return the board to your distributor:

1. If the car seems to move too slowly
2. If the sound of the engine revving up is distorted
3. If the sound of the car coming to a stop with the brakes applied (the "screech" sound) is distorted.

I: THE CONTROL PANEL: SERVICE PROCEDURES

1. CONTROL PANEL: To service the rear of the control panel, remove the four wing nuts and the panel will swivel out and be held by the chain. To remove the control panel completely, disconnect wiring and chain and lift out panel assembly. Note wire color and position for reconnection.

2. GEAR SHIFTER ASSEMBLY: To remove gear shifter from the control panel, first swivel out the control panel as per procedure #1. Then record the wire colors and their positions or later reference and pull off all the slip-on connectors to the shift switches. Shift assembly can be withdrawn through the front of the control panel after the four retaining screws have been removed.

To open the gear shifter assembly, remove the four machine screws [Fig. 7] while holding the housing halves together with your fingers. Split the housing halves carefully so internal parts will not spring out and become

lost. With the housing halves separated, the gearshift rod [#3, Fig. 7], spring [#7, Fig. 7], ball [#15, Fig. 9], detent [#4, Fig. 7] and switch actuators [#5, Fig. 7] will all be accessible. **NOTE:** When re-assembling the unit, lubricate the ball with a small amount of silicone grease and be sure that you replace the housing screws the same way they came out.

3. THE PEDAL ASSEMBLY: The pedal assembly must be removed to replace the brake and accelerator switches. Reach in the rear door and remove three wing nuts [#35, Fig. 2]. From the front of the machine, grasp the protruding lip of the pedal assembly and pull out the entire unit.

To replace switches [#9; Fig. 8] or pedals [#2, Fig. 8], remove the four pedal retaining screws and lift off pedal. Be sure to record all wire colors and

positions before removing them from the switches.

4. STEERING WHEEL ASSEMBLY: To service or remove steering wheel assembly, swivel the control panel out as per procedure #1. To replace the wheel, remove the shaft end nut [#14, Fig. 9]. Lift off the slotted tack ring [#16] and withdraw the steering wheel through the front of the control panel. If only the wheel needs replacement, remove the cap [#2] and the shaft [#4]. The cap will lift off when retaining screws [#6] are removed and the shaft can be disassembled when retaining nut [#9] is removed. **NOTE:** When reassembling the unit, lubricate the bearings

[#11 and #12] with a small amount of silicone grease and when re-installing the shaft, be careful not to push out the rear bearing. Tighten shaft end nut.

To replace the steering assembly PCB, remove shaft end nut and tack ring. The PCB can be replaced after the retaining screws [#7, Fig. 9] are removed.

To replace the steering wheel bushing assembly, use procedure 4 to remove the steering wheel, then remove the six retaining screws which hold the backing plate to the control panel. Withdraw the bushing assembly through the front of the panel.

J: GENERAL MACHINE MAINTENANCE

Due to its solid state circuitry, your GT-10 will require very little maintenance other than periodic cleaning, lubrication and T.V. monitor adjustment.

The cabinet and plexiglass screen may be cleaned with any non-abrasive household cleaner. The coin acceptors,

jector linkages and the lock cylinders should be lightly sprayed once every three months with WD-40 or a similar silicone lubricant. The T.V. monitor is adjusted *only* if the CRT picture is distorted or if the contrast or brightness are out of adjustment.

K: TROUBLESHOOTING PROCEDURES

The first step in any troubleshooting procedure is to correctly identify the observable symptoms of the malfunction. With these clues in mind, examine the areas of the machine which might cause these symptoms.

It is helpful for troubleshooting purposes to isolate three areas:

1. THE T.V. MONITOR: Many T.V. problems can be rectified with proper T.V. adjustment. However, if the problem persists or if the T.V. is undoubtedly malfunctioning, contact your distributor or remove the T.V. monitor and take it to a competent local T.V. repair shop. Complete T.V. monitor repair manuals are available free of charge from the Atari Customer Service Department, 14600 Winchester Blvd., Los Gatos, Ca. 95030. Phone: (408) 374-2440/Telex: 357-488.

2. THE PCB COMPUTER: Most PCB malfunctions will not be within your scope to repair. If you can positively determine that your PCB computer has failed, contact the distributor from whom you purchased the game for repair or replacement instructions. Please be aware that some symptoms which might appear as PCB malfunctions may be the result of improper T.V. monitor adjustment or misadjustment of the small blue trim pots located on the PCB. *Do not attempt to repair the PCB yourself unless you have been specifically instructed to do so by your distributor.* To do otherwise will void your PCB warranty.

3. THE WIRING HARNESS: For troubleshooting purposes, the harness includes the line cord, the fuse, the A.C. line filter, the transformers, the interlock switch, the antenna wire, the start and coin switches, the steering assembly, the gear shifter, the pedal assembly, the PCB edge connector, the T.V. monitor, the speaker and all the interconnecting lengths of wire. A wiring enclosure diagram of the wiring harness and associated components has been included at the end of this manual to aid in troubleshooting.

4. SUGGESTIONS: Following are some specific instructions and suggestions for troubleshooting your Gran Trak 10. To perform even the most simple troubleshooting procedures, you must have a VOM (Volt-Ohmmeter) and, if possible, a VTVM (Vacuum Tube Volt Meter) or digital voltmeter. It is also very helpful to have another GT 10 game (or a spare T.V. monitor and PCB) available for substitution purposes.

For many problems, *substitution* may be the easiest way to troubleshoot the machine. For example, if you suspect a PCB malfunction, try substituting another and known-to-be-good PCB. If the malfunction disappears, the first PCB must have been cause. Conversely, if the malfunction persists, the cause of the malfunction must be located in either the T.V. or the harness.

The T.V. monitor can also be checked by substitution.

Simply connect the game to a known-to-be-good monitor and if the malfunction is cleared up, the first monitor must have been the cause.

Harnesses must be checked by elimination. Substitute a known-to-be-good T.V. and PCB, and if the malfunction persists, the harness and associated mechanical or electronic equipment must be at fault.

5. T.V. MONITOR TROUBLESHOOTING: Some typical T.V. problems are distorted display, raster only or no video at all.

If you do not have a raster (a raster is a lighted but blank T.V. screen with the brightness turned all the way up), begin checking the power supply to determine if the T.V. is getting power. If the general illumination lamps of the machine are lighted, at least you know that power is reaching the machine. If not, check your line cord, interlock switch, fuse, etc.

If it is A.C. powered, go around to the back of the machine and with the rear door open (and interlock switch defeated) listen for a hum emanating from the monitor. If there is a hum, the monitor is powered and you may have a defective CRT or similar problem. Another test (and one which can be performed in a noisy environment) is to measure the voltage between the T.V. fuses and ground. If your voltmeter reads 110 volts or more, you know the monitor is powered. If not, check the fuses, the T.V. connections and the harness to see why power is not reaching the monitor. If the T.V. is powered but still not functioning, check the T.V. AC voltage switch which should be set to the "115" position ("115" visible on the switch) if it is connected to a 110 volt line source.

If you have the correct voltage after the fuses, but the monitor still will not function, you have two choices: 1). Remove the monitor and take it to a specialist, or 2). turn to the T.V. schematic (page 20) and start exploring the monitor with a VTVM and an oscilloscope.

If you do have a raster, you must determine why there are no video signals being displayed on the screen. These video signals are generated by the PCB computer and enter the monitor through pin (#1) of the T.V. monitor connector.

6. STEERING ASSEMBLY TROUBLESHOOTING: Two small red LEDs have been included on the main PCB near position H8 to aid in troubleshooting the steering electronics.

Mounted on the small steering assembly PCB are two phototransistors and two infrared light emitting diodes. The phototransistors are mounted behind the tack ring in such a way that the slots in the wheel break up the light emitted from the diodes. This generates pulses which are used by the computer to determine how quickly and in which direction the wheel is being turned.

The test LEDs on the main PCB will light whenever the infrared diodes are stimulating the phototransistors (i.e. whenever the diodes are "shining" through the slots in the slotted wheel onto the transistors). To test the steering

wheel assembly, simply rotate the wheel slowly in both directions while watching the two red LEDs on the main PCB. If your steering assembly is O.K., both LEDs will flicker. If both of the LEDs fail to light (or remain lit constantly) while wheel is being turned, you definitely have a malfunction *before* the main PCB, which may be either in the wiring harness or in the steering assembly PCB.

7. TROUBLESHOOTING BY SYMPTOM:

a. **No Power:** Check for correct line voltage and if O.K. then check the fuse on the electronics tray, interlock switch and the transformer primaries.

b. **No T.V. Picture:** Check for power as per procedure #1 (NO POWER) and if O.K., check T.V. connector and T.V. fuses. Measure voltage at T.V. fuses (should be 110 VAC) and if O.K., replace the T.V. monitor.

c. **T.V. Raster Only:** Check the harness and especially the PCB edge connector. If O.K., check the T.V. as per the special test under "T.V. Troubleshooting". Or check T.V. or PCB by substitution.

d. **T.V. Picture Rolls:** Adjust the T.V. vertical hold and if the rolling persists, check the T.V. or the PCB by substitution.

e. **T.V. Picture Is Wavy:** Adjust the T.V. horizontal hold and if the problem persists, try replacing the transformer (in the T.V. monitor itself).

f. **T.V. Picture Is Broken Into Diagonal Lines:** Adjust the T.V. horizontal hold and if the problem persists, check the T.V. or the PCB by substitution.

g. **No Game Credit:** Check the coin switches, the start switch, the harness and the positions of the PCB slide switches. If the problem persists check antenna wire and try substituting a new PCB.

h. **No Game Start:** Check the coin switches, the start switch, the harness and replace the PCB if necessary.

i. **Game Shuts Off Accidentally:** Try cutting the antenna wire shorter in increments of 1-2 inches.

j. **Game Credit Shuts Off or Picture Shrinks:** Check the line voltage with your VOM and be aware that a large motor starting up (i.e. an air conditioner) may drop the line voltage. Check to see that machine is firmly plugged in. If the problem only occurs at certain times of the day (especially at dusk), your trunk line voltage may be dropping.

k. **No Audio:** Check the volume control, speaker connections and for 20 volts. If the problem persists, test the speaker and if the speaker is O.K. try replacing the PCB.

l. **Game Sequence Incorrect, Parts of The Race Course, Car, Score or Timer Missing or Distorted:** Replace the PCB or check for proper power supply as described in "Troubleshooting the Power Supply."

m. **Car Will Not Steer or Turns in One Direction Only:** Check PCB LEDs as per procedure on page 7 and if O.K., then replace the PCB computer. If LED test is O.K., check steering harness and connections and for foreign matter in steering assembly. Replace steering PCB if necessary.

n. **No Brakes:** Check brake switch and wires from brake pedal switch to PCB. If O.K., replace the PCB.

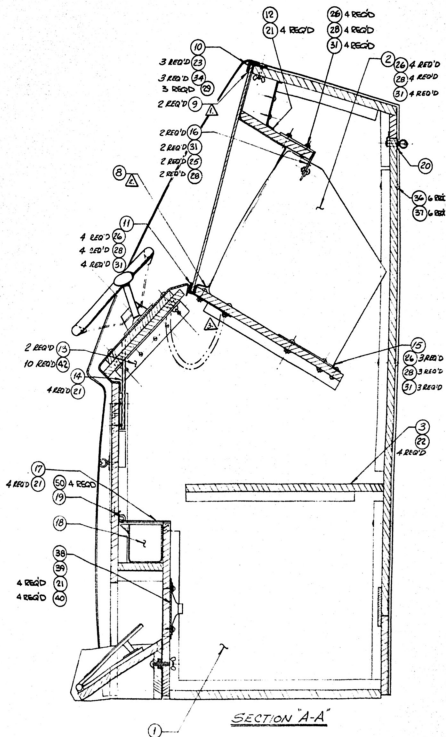
o. **Brakes All The Time:** Check brake switch for foreign material and/or shorting terminals.

p. **No Accelerator:** Follow procedure 14 for "NO BRAKES".

q. **Accelerator All The Time:** Follow procedure #15.

r. **All Four Gears Dead:** Check connections and wires from gearshifter to PCB and if O.K., replace the PCB.

s. **One, Two or Three Gears Dead:** Check the connections and harness of the malfunctioning gear(s); check the shift switch(s) for the malfunctioning gear(s). If problem persists, replace the PCB.



ITEM	PART NUMBER	QTY	DESCRIPTION
28	001060	REF	ENCLOSURE DIA
60	76304 / 16-0706	4	SCREW, WOOD, FLAT HD, #7 X 1/2 L6
51	75207 / 75-1100-4	8	SCREW, WOOD, ROUND HD, #6 X 1/2 L4

Figure 1. GT-10; Side View

LIST of MATERIALS

ITEM	PART NUMBER	QTY	DESCRIPTION	
1	A000520	1	CABINET ASSEMBLY	
2	92016	1	T.V. MONITOR, 23", MOTOROLA FM 700	
3	A000521	1	ELECTRONICS TRAY ASSEMBLY	
4	A000522	1	FEEDER ASSEMBLY	
5	A000523	1	PANEL ASSEMBLY	
6	A000524	1	CASH DOOR ASSEMBLY	
7	000525	1	GLASS, SCREENED	
8	000526	1	BEZEL	
9	000527	2	CUSHION, GLASS	
10	000528	1	ANGLE, GLASS RETAINER, TOP	
11	000529	1	CLIP GLASS RETAINER, BOTTOM	
12	A001015	1	ILLUMINATION ASSY	
13	000531	2	BRACKET, PANEL MOUNTING	
14	A000532	1	SHUTE ASSEMBLY COINGUIDE	
15	000533	1	ANGLE, TV RETAINER	
16	000534	2	BRACKET, TV RETAINER	
17	A000535	1	COVER ASSEMBLY CASH BOX	
18	000536	1	CASH BOX	
19	83035	71-301	1	STAPLE, LOCK
20	83050	71-112	1	LOCK (W/KEY & TRS)
21	78115	78-1410	16	SCREEN, WOOD, RD HD, #6 x 5/8 LG.
22	78115	78-1410	4	SCREEN, WOOD, RD HD, #6 x 1/4 LG.
23	78111	78-5124	6	BOLT, CARRIAGE, 10-24 x 1/4 LG, BLACK OXIDE
24	78809	78-5152	2	BOLT, CARRIAGE, 10-24 x 1/4 LG.
25	78113	71-1503	2	SCREEN, MACH, PAN HD, 8-32 x 5/8 LG.
26	78174	78-18105	18	SCREEN, MACH, PAN HD, 8-32 x 1/4 LG.
27	78806	71-18216	3	SCREEN, MACH, HEX HD, 1/8-20 FULL TH'D x 2 LG.
28	78150	78-0183	18	WASHER, FLAT, STEEL, #8
29	78107	78-0103	11	WASHER, FLAT, STEEL, #10
30	78131	78-0163	6	WASHER, FLAT, STEEL, #1/4
31	78105	78-1103	1/2	NUT, HEX, STEEL, 8-32
32	78106	78-1115	8	NUT, HEX, STEEL, 10-24
33	78155	78-1155	3	NUT, HEX, STEEL, 1/4-20
34	78145	78-131	3	WASHER, 10-24
35	78110	78-1135	3	WASHER, 1/4-20
36	78178	78-1133	6	SCREEN, MACH, BLEND, UD., PAN, 10-24 x 2" LG.
37	78408	78-0107	6	WASHER, OBOVAL, PATENTED #10
38	00089B		1	GRILL, SPEAKER
39	48-001		1	SPEAKER
40	78171	78-0183	4	WASHER, FLAT, DEG. PATTERED # 6
41	78176	78-5114	1	BOLT, CARRIAGE, 10-24 x 1/4 LG, BLACK OXIDE
42	78121	78-1810	11	SCREEN, WOOD, RD HD, #6 x 5/8 LG.
43	83258	83-258	1	DECAL TIME
44	83259	83-259	1	DECAL MILES
45	83260	83-260	5	ARROWS
46	001009	REF		CRT DECAL LOCATIONS
47	001002	1		CARD, MOUNTED
48	000875	REF		BOGOMATIC DIA.

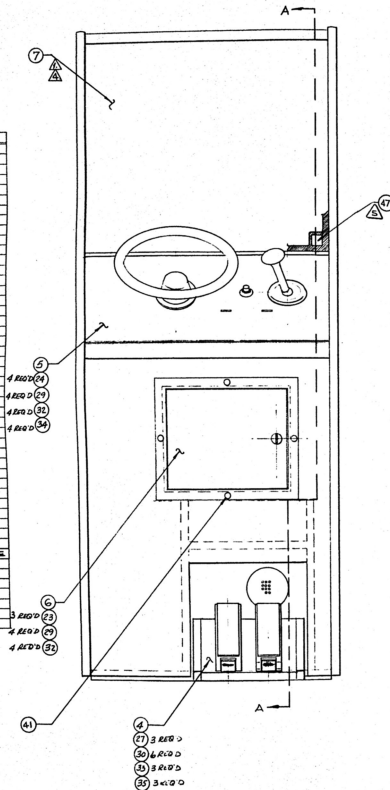


Figure 2. GT-10; Front View

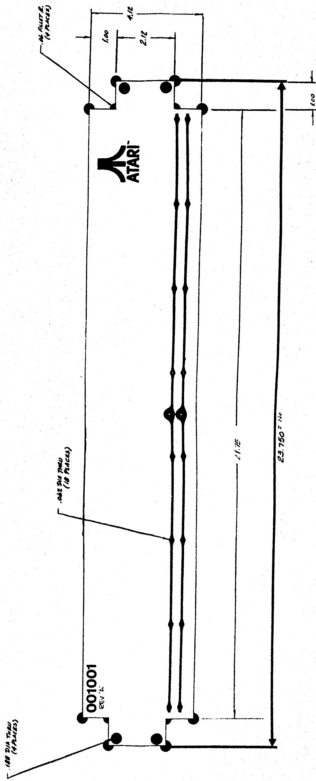
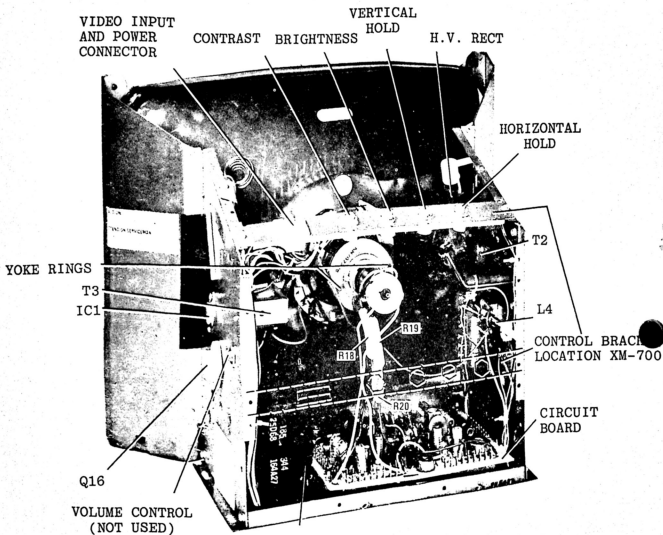
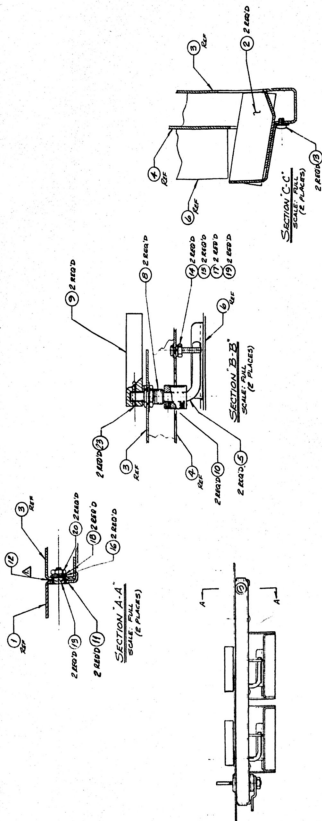


Figure 3. General Illumination Lamps



XM-700 CHASSIS REAR VIEW

Figure 4. T.V. Monitor Adjustments



LIST OF MATERIALS Figure 5. Coin Door

ITEM	QTY	DESCRIPTION
1	1	FRAME WELDMENT
2	2	CUP REJECT WELDMENT
3	1	DOOR
4	1	PANEL
5	2	LETTER REJECT
6	2	ACCEPTOR MECHANISM ASSY, 2574LS
7	2	REJECT LEVER
8	2	REJECT LEVER
9	2	REJECT LEVER
10	2	REJECT LEVER
11	2	REJECT LEVER
12	2	REJECT LEVER
13	2	REJECT LEVER
14	2	REJECT LEVER
15	2	REJECT LEVER
16	2	REJECT LEVER
17	2	REJECT LEVER
18	2	REJECT LEVER
19	2	REJECT LEVER
20	2	REJECT LEVER
21	2	REJECT LEVER
22	1	CABLE ASSEMBLY
23	2	SPRINGS, 3/16" DIA. X 1/2" DIA.

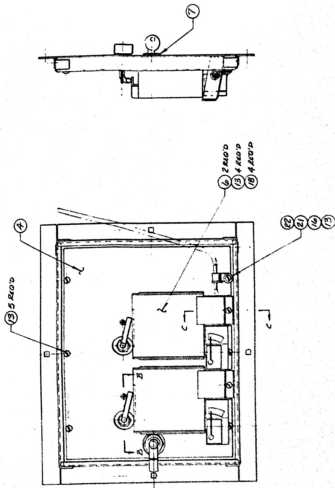


Figure 6b

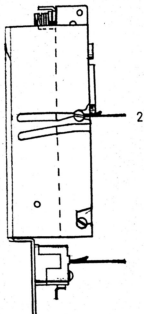


Figure 6a

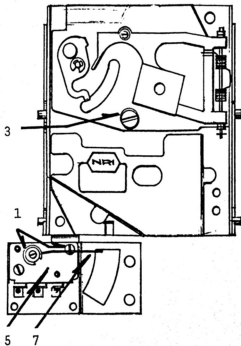
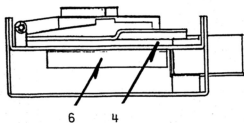
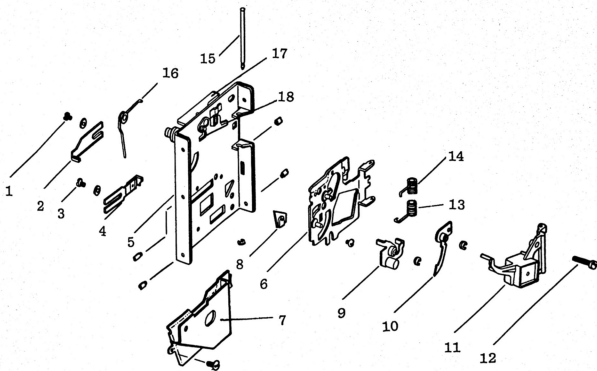


Figure 6c



1. COIN SWITCH RETAINING SCREWS
2. COIN ACCEPTOR RETAINING SCREW
3. MAGNET GATE ADJUSTER
4. COIN ENTRANCE
5. COIN SWITCH
6. WIPER LEVER
7. TRIP WIRE

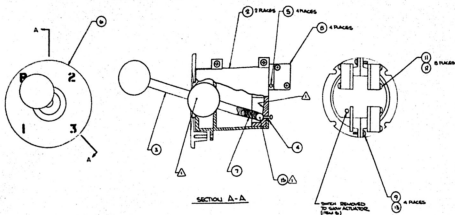
Figure 6. Coin Acceptor



ITEM DESCRIPTION

1. KICKER SCREW
2. KICKER
3. SEPARATOR SCREW
4. SEPARATOR
5. MAINPLATE ASSEMBLY
6. GATE ASSEMBLY
7. COVERPLATE ASSEMBLY
8. RAIL
9. CRADLE ASSEMBLY
10. UNDERSIZE LEVER
11. MAGNET ASSEMBLY
12. MAGNET GATE ADJUSTER
13. LOWER GATE PIVOT SPRING
14. UPPER GATE PIVOT SPRING
15. GATE PIVOT PIN
16. WIPER LEVER SPRING
17. WIPER LEVER
18. WIPER

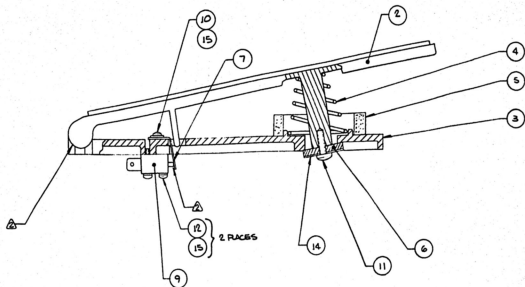
Figure 6d
COIN ACCEPTOR
(EXPLODED VIEW)



UPPER 1
 △ DIMENSIONS TO SURFACE UNLESS OTHERWISE SPECIFIED

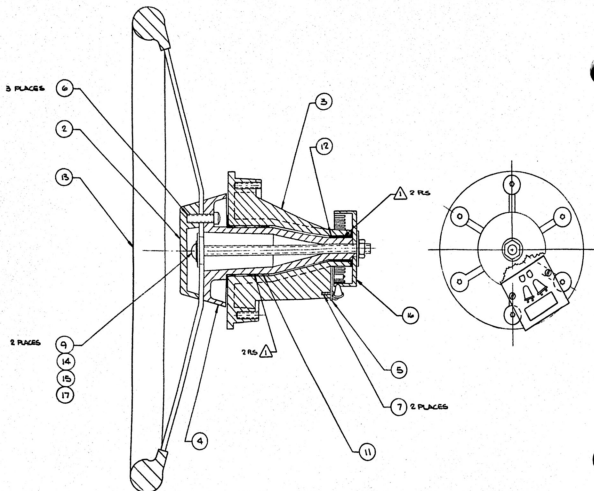
ITEM	PART NUMBER	DESCRIPTION
1.	000608	Shift Assembly
2.	000609	Shift Housing
3.	A000610	Handle Assembly
4.	000611	Shift Detent
5.	000628	Shift Rivet
6.	000612	Shift Bezel
7.	83241	Spring
8.	60004	Cherry Switch
9.	75129	Washer, Flat, #6
10.		
11.	75163	Washer, Flat, #4
12.	75800	Screw, #4-40 x 3/4
13.	75801	Screw, #6-32 x 1/2
14.		
15.	75407	Ball, Steel, 3/8

Figure 7. Gear Shifter



ITEM	PART NUMBER	DESCRIPTION
1.	A000589	Foot Pedal Assembly
2.	000590	Foot Pedal
3.	000591	Pedal Foot
4.	000592	Spring
5.	000593	Bumper
6.	000594	Stop Washer
7.	000596	Actuator
8.	000597	Bearing Block
9.	60004	Cherry Switch
10.	75166	Screw, #4-40 x 1/4
11.	75199	Screw, #4-20 x 1/2
12.	75800	Screw, #4-40 x 3/4
13.		
14.	75425	Washer, Fender 1/4
15.	75163	Washer, Flat, #4

Figure 8. Pedal Assembly



NOTES:
 ▲ APPLY LIGHT FILM OF SILICONE GREASE #5 COMPOUND (OR EQUIV.) ON AREAS INDICATED. (ITEM 18)

▲ VENDOR PART NO. 5201-3805

Figure 9. Steering Wheel Assembly

ITEM	PART NUMBER	DESCRIPTION
1.	000598	Steering Wheel Assembly
2.	000599	Cover
3.	000605	Housing
4.	000606	Shaft
5.	000607	PCB Assembly
6.	75804	Screw, #4-20 x 3/4
7.	75424	Screw, #2 x 1/4
8.		
9.	75409	Washer, Fender, 1/4
10.		
11.	83236	Bearing
12.	83242	Bearing
13.	83243	Steering Wheel
14.	75221	Nut, #4-20, Nylon Lock
15.	75198	Screw, #4-20 x 5
16.	000616	Light Hub
17.	75189	Washer, 1/4, Starlock
18.	83268	Silicone Grease, #5

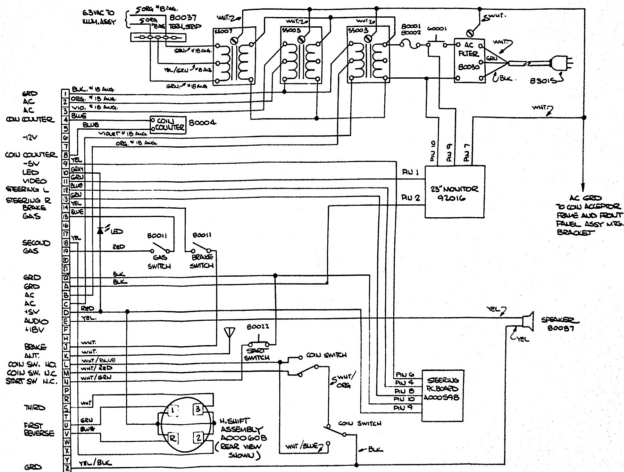


Figure 10. Wiring Diagram

ITEM	PART NUMBER	DESCRIPTION
1.	A000521	Electronics Tray Assembly
2.	000548	Tray, Electronics
3.	000622	Cover, Transformer
4.		
5.	A000872E	PCB Computer, Rev. E
6.		
7.		
8.	55003*	Transformer
9.	55007*	Transformer
10.	60001	Interlock Switch
11.	75200	Screw, #6 x 1/2
12.	75211	Screw, #6 x 1-1/4
13.	75102	Washer, Flat, #6
14.	80001	Fuse Holder
15.	80002	Fuse, 1 Amp., Slo-Blo
16.	80004	Game Counter
17.	80030	AC Filter
18.	80037	Terminal Strip
19.	83011	Cable Clamp
20.	83013	Spacer, 1/2, #6
21.	83015	Power Cord, 8'
22.	83097	Switch Bracket
23.	77035	Wire, 18 gauge, Orange
24.	77037	Wire, 18 gauge, Red
25.	80054	Terminal, Push-on, 3/16
26.	75-7812	Screw, #8 x 3/4
27.	001141	Form, Disc
28.	000871	Label

* Optional transformer replaces items 8 and 9.

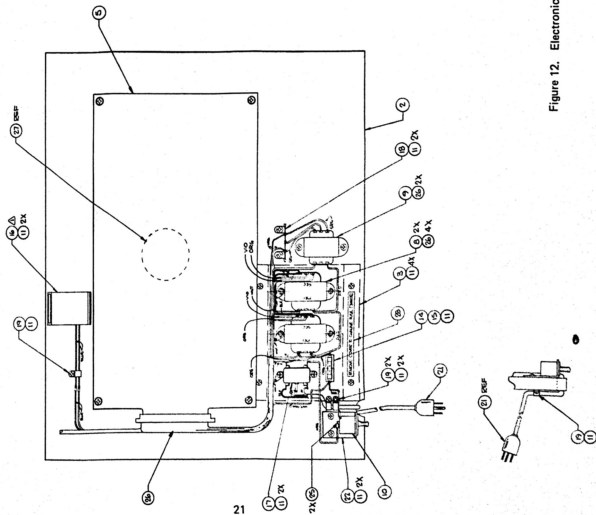
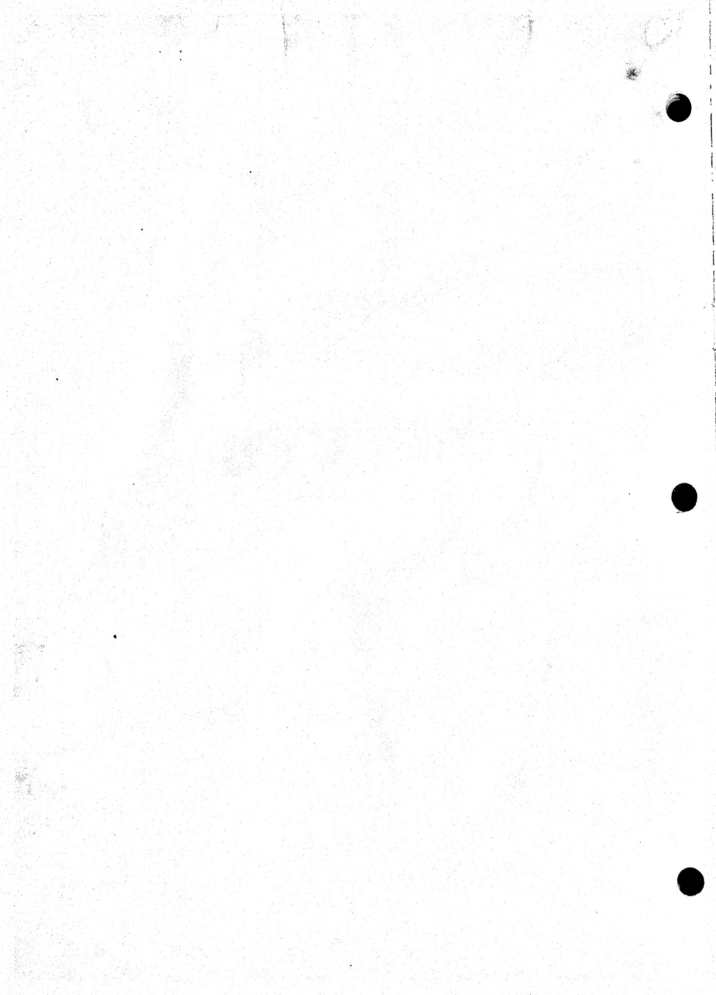
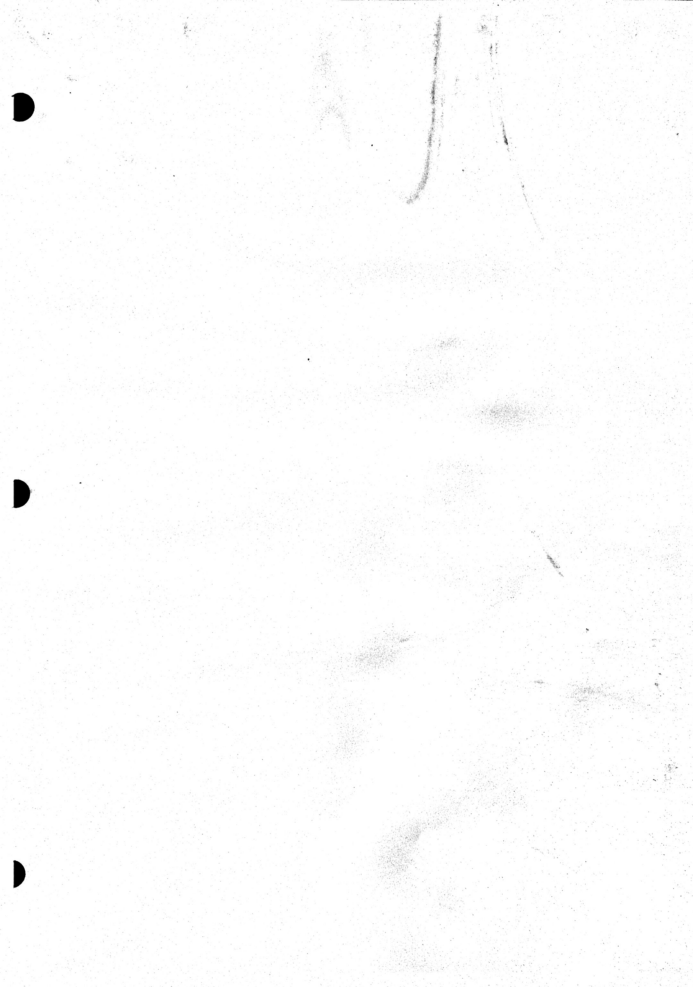


Figure 12. Electronics Tray Assembly

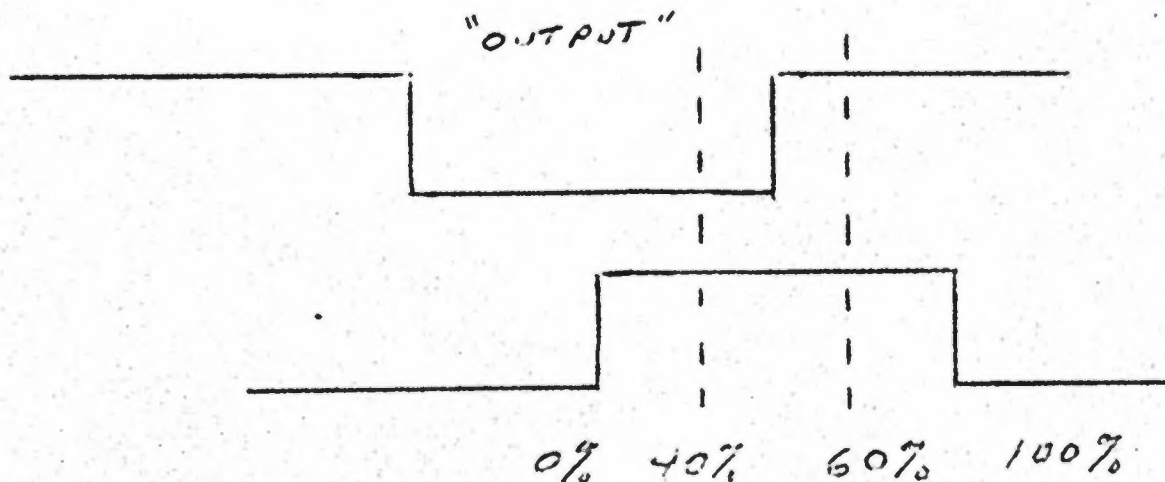




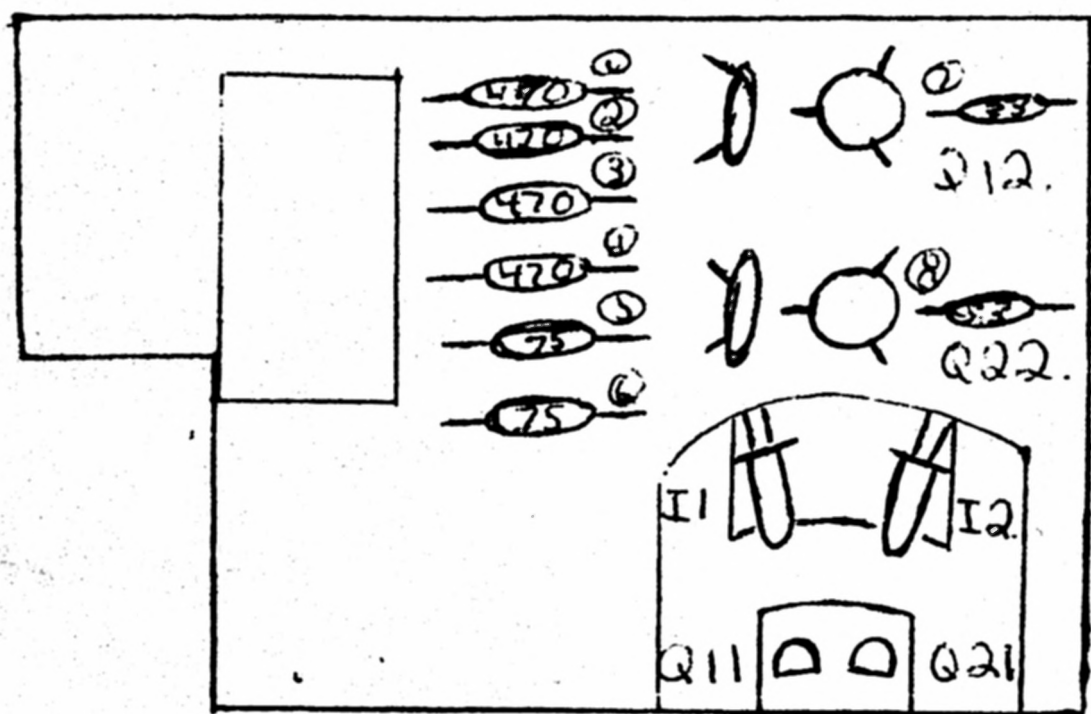
GRAN TRACK 10

STEERING UNIT ALIGNMENT PROCEDURES

1. Adjust the scope for 2 V/DIV and 5 ms/DIV. Connect the steering checker box to scope. The A output goes to Ch. 1 input of scope and B output to Ch. 2 input of scope. Sync scope on Ch. 1 and use "chopped" mode.
2. Plug steering unit to be aligned into the steering checker box. Place hub into rotator and turn motor on.
3. Check the "Input" (switch on box at "Input" position) and make sure both photo-transistors are saturated (+4 volts) and duty cycle is between 40 and 60%.
4. If either one of the photo-transistors is not saturated, adjust the LED of the one which is not saturated until it is saturated to 4 volts and has a nominal 50% duty cycle.
5. Switch to "Output." The signals should have a 40 to 60% duty cycle and have std TTL voltage swings.
6. The two signals must be in quadrature as shown in Figure 1. If the transitions are not in the 40% to 60% zone as shown, adjust one or both of the LED's until the correct signal is obtained.
7. Recheck the "Input" to ensure that the phototransistors are fully saturated. Repeat steps 4 - 6 as necessary until correct alignment is obtained.



STEERING BOARD CHECK SHEET FOR SERVICING.



1. 0V
2. 1.7V
3. 1.7V
4. 0V
5. 1.3V
6. 1.3V
7. 0.8V
8. 0.8V

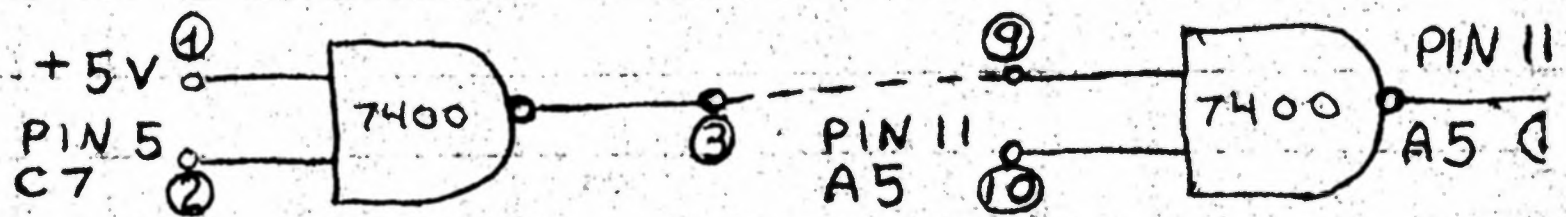
- | | |
|---------|---------------|
| 1. 5V | Q12 (C) |
| 2. 5V | Q11 (C) |
| 3. 5V | Q21 (E) |
| 4. 5V | Q22 (C) |
| 5. 1.3V | IFR |
| 6. 1.3V | IFR. |
| 7. 0V | Q12(B) Q11(E) |
| 8. 0V | Q22(B) Q21(E) |

IFR ON

IFR OFF.

"SOUND MODIFICATION" FOR
 TRACK CHANGE MODIFIED
 GAMES. ELIMINATES CRASH
 SOUND DUE TO CHANGING TRACK.

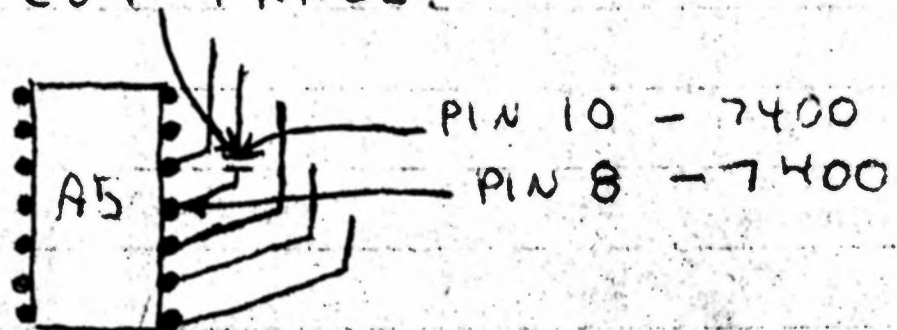
- PROCEDURE :
1. MOUNT A SN7400 IC PIGGY
 BACK STYLE ON A5.
 2. MAKE THE FOLLOWING
 CONNECTIONS AS SHOW BELOW.



3. IN REFERENCE TO PIN 11 - A5
 CUT THE TRACE LEADING TO
 THE PIN. JUMPER PIN 8 OF
 THE 7400 DIRECTLY TO
 PIN 11 - A5. JUMPER PIN 10 OF
 THE 7400 TO THE OTHER
 SIDE OF THE CUT TRACE
 HEADING TO PIN 11 - A5.

EXAMPLE

CUT TRACE.



GRAN TRACK 10

#3



Job Title GRANTRAK 10 PCB ASSEMBLY	Dwg. P/L 000872
------------------------------------	-----------------

Parts List Specification sheet 1 of 3

Drawn Denise Tiffin		Rev. K
Checked <i>[Signature]</i>	Mech. Eng.	
Proj. Eng. <i>[Signature]</i>	Elec. Eng. <i>[Signature]</i> 4/2/74	

Rev.	Description	Apprv.	Rev.	Description	Apprv.
F	Release for Production	<i>[Signature]</i>			
G	Rev per ECN 228	4-4-74			
H	Rev per ECN 245	4-16-74			
J	Rev per ECN 292	4-22-74			
K	Rev per ECN 574	5-15-74			

Item	Part. No.	Qty.	Description			
1	000872	Ref	P.C	Board	Assembly	
2	000873	Ref	Schematic			
3	10101	8	Resistor,	100 ohm,	10%,	1/4 Watt
4	10102	11	"	1K ohm,	"	"
5	10103	6	"	10K ohm,	"	"
6	10104	1	"	100K ohm,	"	"
7	10151	2	"	150 ohm,	"	"
8	10221	3	"	220 ohm,	"	"
9	10222	3	"	2.2K ohm,	"	"
10	10224	1	"	220K ohm,	"	"
11	10331	9	"	330 ohm,	"	"
12	10332	1	"	3.3K ohm,	"	"
13	10471	2	"	470 ohm,	"	"
14	10473	7	"	47K ohm,	"	"
15	10681	1	"	680 ohm,	"	"
16	10682	9	"	6.8K ohm,	"	"
17	10683	1	"	68K ohm,	"	"
18	11102	1	"	1K ohm,	5%,	"
19	11104	1	"	100K ohm,	"	"
20	11105	3	"	1M ohm,	"	"
21	11153	1	"	15K ohm,	"	"
22	11270	1	"	2.7 ohm,	10%,	"
23	11471	1	"	470 ohm,	5%,	"
24	11472	1	"	4.7K ohm,	"	"
25	11561	1	"	560 ohm,	"	"
26	11564	1	"	560K ohm,	"	"
27	11820	1	"	820 ohm,	"	"
28	12102	1	"	180 ohm,	10%,	1/2
29	19100	1	"	4 ohm,	10 Watt	
30	19109	1	"	50 ohm,	5 Watt,	20%, Wire Wound
31	22105	1	1M ohm	Trim Pot		
32	22107	2	250K ohm	Trim Pot		
33	22502	3	5K ohm	Trim Pot		
34	22503	1	50K ohm	Trim Pot		
35	30100	2	Capacitor,	100pfd mica @ 100V		
36	30331	1	"	330pfd mica @ 100V,	20%	
37	32471	2	"	.47mfd Mylar		
38	32221	1	"	.22mfd Mylar,	10%	
39	32502	1	"	.0047mfd Mylar		

PARTS LIST SPECIFICATION

Dwg. P/L 000872

Title GRANTRAK 10 PCB ASSEMBLY

sheet 2 of 3

Rev. K

Item	Part No.	Qty.	Description
40	32101	5	Capacitor, 0.1 mfd, Mylar
41	34101	20	" .1 mfd, Ceramic Bypass
42	34102	4	" .001 mfd, Ceramic Disc
43	35508	1	" 1.0 mfd @25V Electrolytic, 10%
44	35103	3	" 10 mfd @ 6V Electrolytic
45	35222	1	" 2.2 mfd @ 10V Electrolytic
46	35254	1	" 250 mfd @ 6V Electrolytic
47	35472	1	" 4.7 mfd @ 6V Electrolytic, 20%
48	35473	1	" 47 mfd @ 6V Electrolytic
49	35503	1	" 50 mfd @ 10V Electrolytic, 20%
50	35504	1	" 500 mfd @ 20V Electrolytic
51	37000	1	" 8000 mfd @ 16V Electrolytic
52	37102	1	" 220 mfd @ 25V DC Electrolytic
53	37103	1	" 100 mfd @ 20V Electrolytic
54	37104	1	" 2000 mfd @ 25V Electrolytic
55	39100	1	" 100 mfd, Tantalum, 20%
56	60000	1	DPDT Slide Switch
57	70000	3	2N 3643 Transistor
58	70001	4	2N 3644 Transistor
59	70004	1	2N 5193 Transistor
60	71000	10	1N 914 Diode
61	71001	4	1N 4001 Diode
62	71003	1	1N 100 Diode
63	71006	2	Diode, 2.5A
64	71009	1	SCR MCR106-1
65	71010	1	1N 5241 Zener Diode
66	72000	5	Integrated Circuit, 7400
67	72001	5	" " 7402
68	72002	5	" " 7404
69	72003	2	" " 7410
70	72010	1	" " 7474
71	72012	1	" " 7486
72	72013	1	" " 7490
73	72014	3	" " 7493
74	72015	3	" " 74107
75	72016	4	" " 74153
76	72017	7	" " 9316
77	72018	1	" " 555
78	72019	1	LM 309 K
79	72021	3	Integrated Circuit, 566
80	72025	1	" " 9322
81	72027	3	" " 7408
82	72029	1	8099 Hybrid
83	72030	1	8098 Hybrid
84	72031	2	Integrated Circuit, 9321
85	72032	2	" " 74192
86	72033	3	" " 74165
87	72035	2	" " 74193
88	72036	4	" " 9314
89	72042	1	" " MFC 6040
90	72046	1	3103 Hybrid
91	72048	1	Integrated Circuit, LM 380
92	72049	1	" " 74S04

PARTS LIST SPECIFICATION

Dwg. P/L 000877

#3

Title GRANTRAK 10 PCB ASSEMBLY

sheet 3 of 3

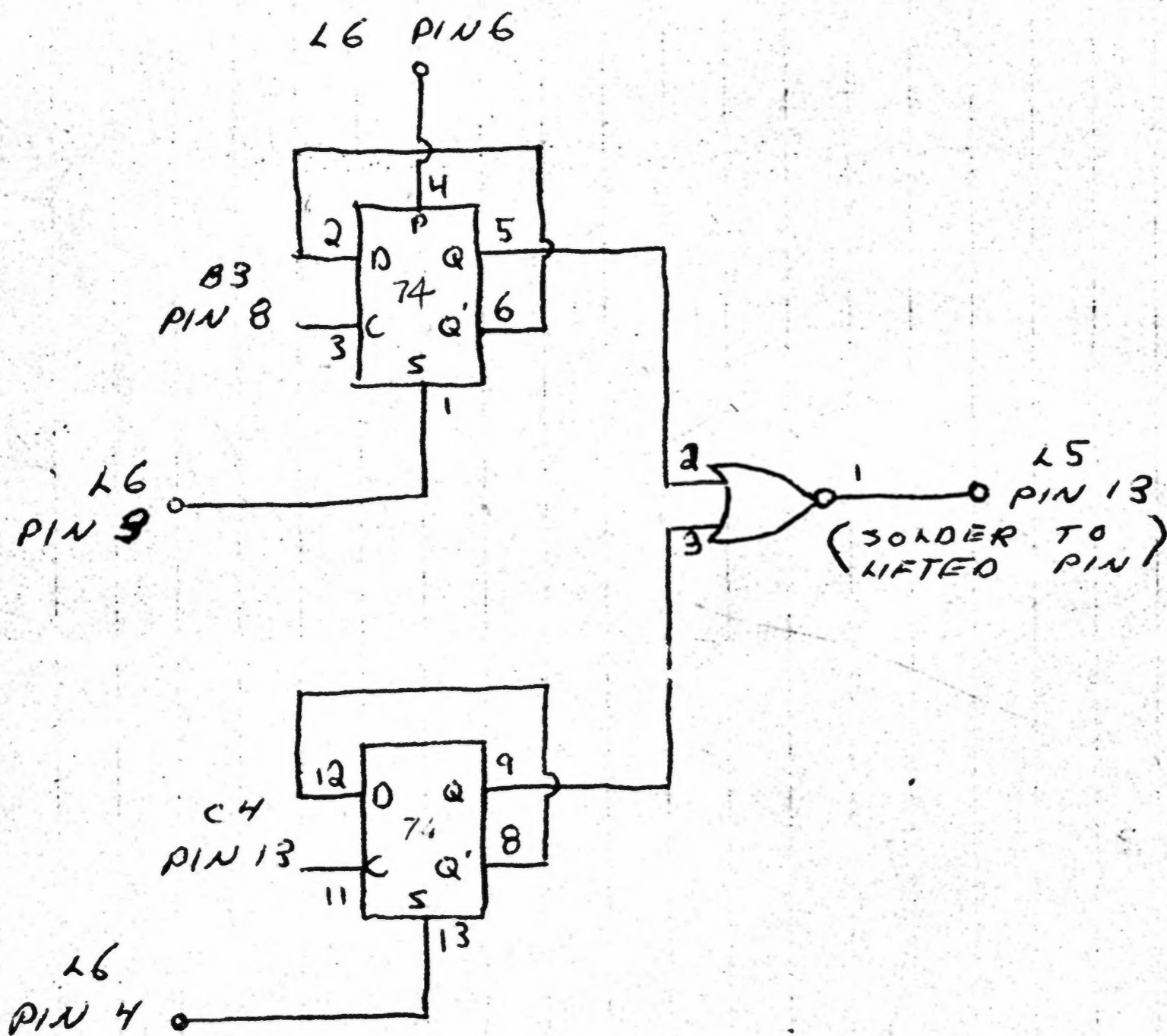
Rev. K

Item	Part No.	Qty.	Description
93	72050	1	Integrated Circuit, 7413
94	72052	1	" " RC4136 D
95	74186	1	" " ROM
96	75100	2	Screw, 6-32 X 5/8, Pan Head, S.S.
97	75101	4	Washer, #6 Internal Star Lock Washer
98	75102	2	Washer, #6 Flat
99	75103	2	Nut, 6-32, Hex
100	80009	2	Light Emitting Diode
101	80036	3	24 Pin I.C. Socket
102	81001	1	Crystal
103	83104	1	Wakefield Heatsink
104	000854	1	P.C.B. Revision E
105	001091	Ref	Modification Drawing, RT Assembly
106	10474	1	Resistor, 470K, 10%, 1/4 watt
107	10472	1	Resistor, 4.7K, 10%, 1/4 watt
108	35506	1	Capacitor, 10 mfd, @ 25V Electrolytic

TRACK CHANGE MOD FOR 1715115 FIXS / VLE-1111 DRIVING GAMES.

PROCEDURE:

- ① CUT AND LIFT PIN 13 IC 25.
- ② RUN WIRE FROM E4 PIN 2 TO L6 PIN 5.
- ③ RUN WIRE FROM C7 PIN 6 TO L6 PIN 3.
- ④ FOLLOW DIAGRAM BELOW.



PARTS REQUIRED

- 1 - 7474 (D-TYPE FLIP FLOPS)
- 1 - 7402 (NOR GATES)

FREE PLAY MODIFICATION
 (FORMULA "K" AND GRAN TRACK "10")

- ① PUT SWITCH ON 2P. INSTEAD OF 1P.
- ② PUT A 7410 IC IN POSITION A1.
- ③ MAKE THE FOLLOWING CONNECTIONS:

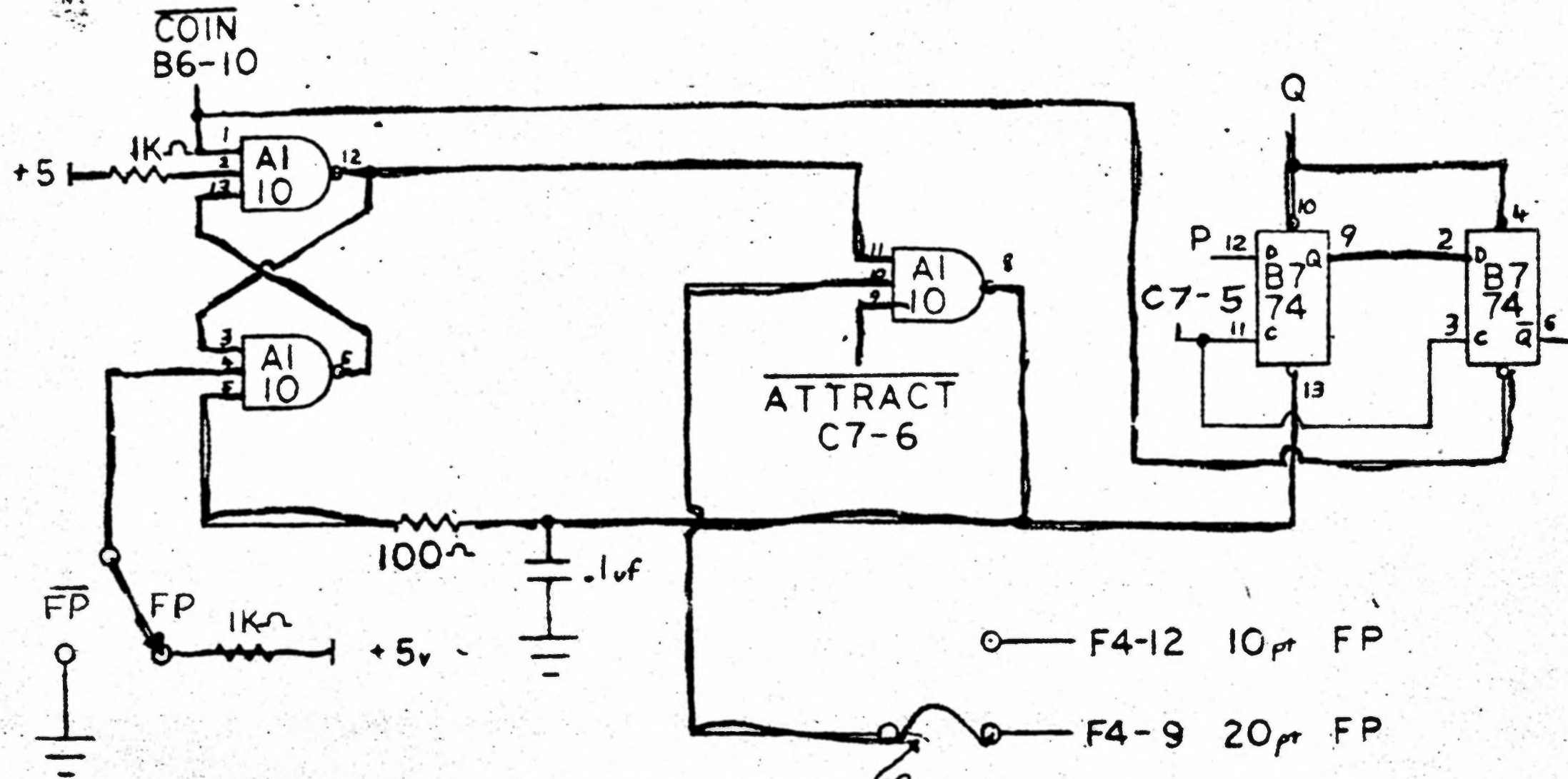
FROM	TO
A1 PIN 1	B6 PIN 10
A1 PIN 13	A1 PIN 6
A1 PIN 12	A1 PIN 3
A1 PIN 4	CENTRE POSITION OF IP - 2P SWITCH. CUT TRACE FROM THE CENTRE POSITION THAT GOES TO B7 PIN 10.
A1 PIN 12	A1 PIN 11
A1 PIN 9	C7 PIN 6
A1 PIN 8	B7 PIN 13 - LIFT PIN AND SOLDER WIRE TO PIN
B7 PIN 10	B7 PIN 4

- ④ ADD THE FOLLOWING PARTS TO A1 IC 7410:

FROM	TO
A1 PIN 5	A1 PIN 8 - 100 Ω RESISTOR
A1 PIN 5	GROUND - 0.1 μ F CAP.
A1 PIN 2	+5V - 1K RESISTOR

- ⑤ PUT A JUMPER WIRE:

FROM	TO
A1 PIN 10	F4 PIN 12 - 10 PTS. F.C.
A1 PIN 10	F4 PIN 9 - 20 PTS. F.C.
A1 PIN 10	F4 PIN 8 - 40 PTS. F.C.

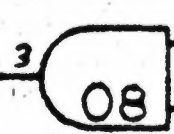


USE JUMPER WIRE HERE TO
SELECT FREE PLAY POINTS

○ — F4-12 10 pt FP

○ — F4-9 20 pt FP

○ — F4-8 40 pt FP

○ —  } 30 pt. FP
 1 — F4-12
 2 — F4-9

REVISIONS			RT FREE PLAY MOD.		
NO.	DATE	BY			
1					
2					
3			DRAWN BY	SCALE ?	MATERIAL
4			CHK'D	DATE	DRAWING NO.
5			TRACED	APP'D	

INFORMATION SHEET

Your Trak 10 has a new type of monitor manufactured by Ball Brothers. This is different because Atari used in the past monitors manufactured by Motorola. The Ball Brothers' TG Series of monitors incorporates a video amplifier which operates from a very stable 55 volt power supply. The use of this regulated and relatively low voltage for the video amplifier results in very reliable operation (power dissipation is very low) and long term amplifier stability. Since the TG Series of monitors are normally driven from a digital logic sub-system, the displayed image should remain as initially set for long periods of time with no need to readjust the contrast control. The difficulty of low voltage operation of the video amplifier is a limitation on video drive, requiring rather precise initial adjustment of the contrast control to avoid smearing of white video information while obtaining maximum useable monitor contrast. Because of the critical nature of this adjustment, we have limited your accessibility to the controls needed to make this adjustment.

Contrast is factory adjusted for optimum performance. Do not readjust unless required because of component replacement. If you find it necessary to make the adjustment, we have outlined the procedures below but would suggest you review them with your distributor to insure that they are properly performed.

With monitor operating and picture stable:

1. Turn contrast control fully CCW.
2. Turn brightness control fully CCW.
3. Turn brightness control CW until background is visible.
4. Turn brightness control CCW just to the point where background is extinguished.
5. Turn contrast control CW until white video information begins to smear.
6. Turn contrast control CCW until smearing of white video information is eliminated. This is the optimum contrast control setting.
7. Adjust brightness control (only) as desired.

(continued)

Tricks of the Trade

Richard Sukinik

In a continuing effort to present the highest level of technical assistance, RePlay Magazine is pleased to announce the addition of this monthly column, "Tricks of the Trade." Here, and in the months to come, this feature will provide technical tips that are not readily available from factories and distributors. The main function will be to explain a continuing problem and its remedy, including basic conversions to increase player appeal and reliability.

RAMTEK BASEBALL MIDWAY BALL PARK

With these games, there have been some design flaws that have hindered the success of both pieces. The best laid plans of mice and men, so the saying goes, sometime go awry. The 'Baseball' game suffered some ills. For starters, the power supply was a problem. It couldn't handle the current load and therefore, often popped its filter capacitor. The regulators either just came up to enough voltage or else far exceeded the proper operating voltage. For this there is no easy cure. Adjust the regulator for five volts, measured at the board. Replace the filter cap for about 14,000 MFD. Now let's move into the next phase - the edge connectors.

If the factory had gold plated the edge connector on the board, our edge connector problems would have been greatly reduced. Because of this, they need constant attention. Another idea is to seal the card cage with a piece of wood across the back of the boards by applying pressure to the back of the board making for a tighter fit (Ramtek 'Baseball's' early model had a card cage that would not allow this. In this case, wedge a wood lock to securely hold the board).

Because of the current draw, it is advisable to run your supply voltages directly from the regulator to each circuit board, thereby eliminating the edge connector supply loss. These basic improvements will greatly increase the reliability of the game.

MIDWAY GUN FIGHT & SEA WOLF

The first successful microprocessor games have helped lead us into a new era. Unfortunately, there have been some small trivial things that have reduced the dependability of these games. Resistor packs, which are the current-limiting devices used to drive the opto-isolators on the game board of the 'Gun Fight' have been plagued with burn-outs. When they burn out, you can no longer control the movement of the men or the arms. When replacing the resistor pack, use 1,000 ohm 1/2 watt resistors and stand them vertically across the board, tying the top of each resistor to the common bus. The next question is "why do they burn out?" While more than like-

ly, they probably have a few burnt out 1895 lamps. These lamps illuminate the name "Gun Fight". When the bulbs burn out, there is less load, therefore the voltage increases, thus helping to destroy the resistors.

On 'Sea Wolf', it is not uncommon to have a few lamp driver transistors burn out. The original transistors were 2N4401 and 2N4403. You'll find that replacing them with a 2N3643 and 2N3644 respectively, you'll probably see the last of a bad lamp driver transistor.

A major problem is a system stoppage. That is where scrambled data and hash appear on the screen. The game is dead until you hit the slam switch. This only has to happen once for the game to be out of order for the night. To correct this problem, run a jumper wire from IC G3 pin 7 to IC F3 pin 7. This completes the ground bus. Also add a .1 MF capacitor across pin 14 and pin 7 of G3 and H3. Please use ceramic type. This will eliminate the transients and oscillation that screws up the address buffer. Also add a .1 MF capacitor at the edge connector of the mother board, pin 10. Tie the other end of the cap. to ground. This will eliminate the outside noise from triggering the reset line. These two basic cures will eliminate erratic behavior.

ATARI GRAN TRAK 10 & 20 FORMULA K & TWIN RACER

Many people have complained of poor steering in these games. This can be greatly improved by a simple modification that Atari advises. When completed, the car will steer like in an Indy:

A) Trak 10 and Formula K. Clip and lift A4 pin 11. Clip and lift A4 pin 12. Clip and lift A4 pin 13. Run a jumper from A4 pin 11 to J8 pin 6. Run a wire from A4 pin 12 to the pull-up side of the 1K resistor located above A4. Jump A4 pin 13 to H1 pin 8.

B) Trak 20 and Twin Racer digital board: Clip and lift C10 pin 12. Clip and lift C10 pin 11. Clip and lift D10 pin 2. Clip and lift D10 pin 3. Clip and lift C10 pin 13. Clip and lift D10 pin 1. Tie C10 pin 12 and D10 pin 2 to a 1k pull-up resistor. Jumper C10 pin 11 to trace going to C10 pin 12, D10 pin 3 to trace going to D10 pin 2. Jump C10 pin 13 and D10 pin 1 to L7 pin 8.

O.B.A. Expands Product Lineup

In addition to its new line of chemicals, O.B.A. said it has developed a customizing kit for 'Gran Traks' and Trak 10's. The electrical conversion kit developed by O.B.A. allows the addition of five different tracks to the games.

It was explained by O.B.A. that the track changes each time the car passes the starting position. In addition, an attract mode causes the tracks to change on the screen while the game is not being played.

An extended time feature is also provided which allows the player to gain extra time if he achieves a certain score. And the steering, says O.B.A., makes the car sensitive in relation to the steering wheel action. The conversion Package is contained in a "piggy-back" board which plugs into the 'Gran Trak' and Trak 10' PC boards.

Mirco Cites Superb Reliability Factor

Mirco Games of Phoenix has released "reliability statistics" relating to the company's electronic video games presently in the field.

According to the company, a typical video game, under average conditions (conservatively estimated to be six hours of operation per day) will operate approximately 13,000 hours before experiencing a failure. This mean time between failure (MTBF) figure represents the equivalent of only one failure for every six years of operation.

R.E. Pepper, Mirco's manager of quality control, explained that the MTBF figure was determined by documenting all field returns on Mirco video units shipped over the past few years, calculating the total hours of operation per year for all games shipped and dividing total hours by the average number of field failures per year.

Pepper further stated that the good field performance of Mirco's games resulted from four interrelated factors: (1) Careful initial design with emphasis on enhancing reliability; (2) Stringent inspection of incoming components and subassemblies; (3) A number of in-process quality control checks throughout the manufacturing cycle; (4) Rigid prototype testing in the field of new video game products.

These practices have had the effect of keeping Mirco's quality cost figures to less than 2% of sales compared to typical industrial figures averaging between four and five percent.

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