

Pinball Troubleshooting Guide

for use with PBS-1



Includes Parts List for PBS-1

 A Warner Communications Company

Pinball Troubleshooting Guide

Includes Parts List for PBS-1

ATARI INC
1265 BORREGAS AVENUE
PO. BOX 9027
SUNNYVALE, CALIFORNIA 94086
408/745-2000 • TELEX 35-7488



ATARI[®]

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ATARI PCB INTERCHANGEABILITY

There are four printed circuit boards (PCBs) in each Atari Pin-ball game: 1) Processor PCB, A006020-XX: 2) Auxiliary PCB, A006407-01. 3) Score Drive PCB, A004924-01 or A020704-01. 4) Match/Credit PCB, A006096-01 or A030912-01. Section E of this chapter explains how to check the PCBs for interchangeability.

A. Processor PCB, A006020-XX

At the time this was printed, there were fifteen variations of the Processor PCB. Each Processor PCB is marked with a part number next to location F1. Part number A006020- is permanently etched onto the PCB. The dash number variation is added with a felt-tipped pen. The PCB serial number and the game name are also marked in felt-tipped pen somewhere between locations A12 through A20 and B12 through B20. All variations for the four games are listed as follows:

<u>Processor PCB</u>	<u>Game</u>
A006020-01	The Atarians
A006020-02	Universal
A006020-03	Time 2000
A006020-04	Airborne Avenger
A006020-05	The Atarians
A006020-06	Time 2000
A006020-07	Time 2000
A006020-08	Airborne Avenger
A006020-09	Airborne Avenger
A006020-10	Time 2000
A006020-11	Middle Earth
A006020-12	Universal
A006020-14	Middle Earth
A006020-15	Middle Earth
A006020-16	Middle Earth

Processor PCBs -01 through -05 are all physically shorter than the -06 through -16 versions. The -06 through -16 PCBs are longer so that eight chips of program memory (PROMs E1 through E8) could be replaced with two chips (ROMs E00 and E0). Therefore, you cannot use ROM program memory chips E00 and E0 in the -01 through -05 Processor PCBs.

Take a look at the lamp and solenoid outputs of the four different games. Since each game's playfield is different, each Processor PCB, made for a specific game, contains only the lamp and solenoid drivers necessary for that game. For example, the Processor PCB for The Atarians game has only thirteen solenoid driver transistors while a Processor PCB for the Time 2000 game has fourteen solenoid driver transistors. (Refer to Atari Pinball Games Illustrated Parts Catalog, Section C, Sheets 40 and 41, for differences of transistors Q1 through Q20.) Therefore, unless you add 2N6044 transistors to the proper locations, a Processor PCB for The Atarians cannot be used in a Time 2000 game. This reasoning also holds true for the lamp drivers at locations A15 through A20 and B15 through B20.

The actual game play instructions for each game are contained in the program memory. Program memory is located either in location E00 and E0 (ROM) or E1 through E8 (PROM). Therefore, to remove a Processor PCB from The Atarians game and put it into a Time 2000, Airborne Avenger, or Middle Earth game, you must replace program memory with the proper memory chips. (Refer to the Atari Pinball Games Illustrated Parts Catalog, Section C, Sheets 40 through 43, for the part numbers for the proper program memory chips for each game.)

The -02 and -12 universal Processor PCBs are made to be interchangeable in all four games. These PCBs include all solenoid and lamp drivers. The difference between the -02 and -12 universal Processor PCB is the physical length, and like the other short Processor PCBs, the -02 will not accept chips E00 and E0 ROM program memory.

B. Auxiliary PCB, A006407-01

The Auxiliary PCB is designed to function in all games. All revision levels of the PCB are of identical physical size and can mount easily into any game. See Section E of this chapter for interchangeability problems, however, since a modification to the Auxiliary PCB is necessary to be compatible with all Processor PCBs.

C. Score Drive, A004942-01 or A020704-01

There are two Score Drive PCBs referred to by Atari Customer Service as the old electronics Score Drive, A004942-01, and the discrete Score Drive, A020704-01. The discrete Score Drive is a redesign of the old electronics to eliminate problems that occurred with the score display. The two PCBs are directly interchangeable.

D. Match/Credit PCB, A006096-01 or A030912-01

There are two Match/Credit PCBs, referred to by Atari Customer Service as the old electronics Match/Credit A006096-01 and the discrete Match/Credit A030912-01. The latter is a redesign of the old electronics to eliminate problems with the Match/Credit display. The two PCBs are directly interchangeable.

E. Processor PCB and Auxiliary PCB Interchangeability

Recent revisions of both the Processor PCBs and the Auxiliary PCB incorporate a design change which was not installed on earlier revisions of these boards. This additional circuitry is known as the POWER FAIL modification. It prevents the Coin Counter and other optional counters from tripping during "power down" and also prevents the Coin Lockout coil from engaging if the display power or +5V DC fails.

It is imperative that all Processor and Auxiliary PCBs not containing this circuitry be modified as per the following instructions, if they are to be used interchangeably.

WARNING

A Processor PCB with the POWER FAIL modification will not operate when installed with an unmodified Auxiliary PCB, and vice versa. Applying power to an incompatible board set such as this could damage one or both of the PCBs.

You can determine whether or not your PCBs contain this circuitry by the presence of transistor Q21 on the Processor PCB and transistor Q12 on the Auxiliary PCB. (See the appropriate PCB assembly at the back of SECTION TWO). Any boards not containing the circuitry should be modified when you receive them in your shop, especially if you will be substituting or exchanging them for other PCBs:

F. Processor PCB Modification

Modify the Processor PCB as follows:

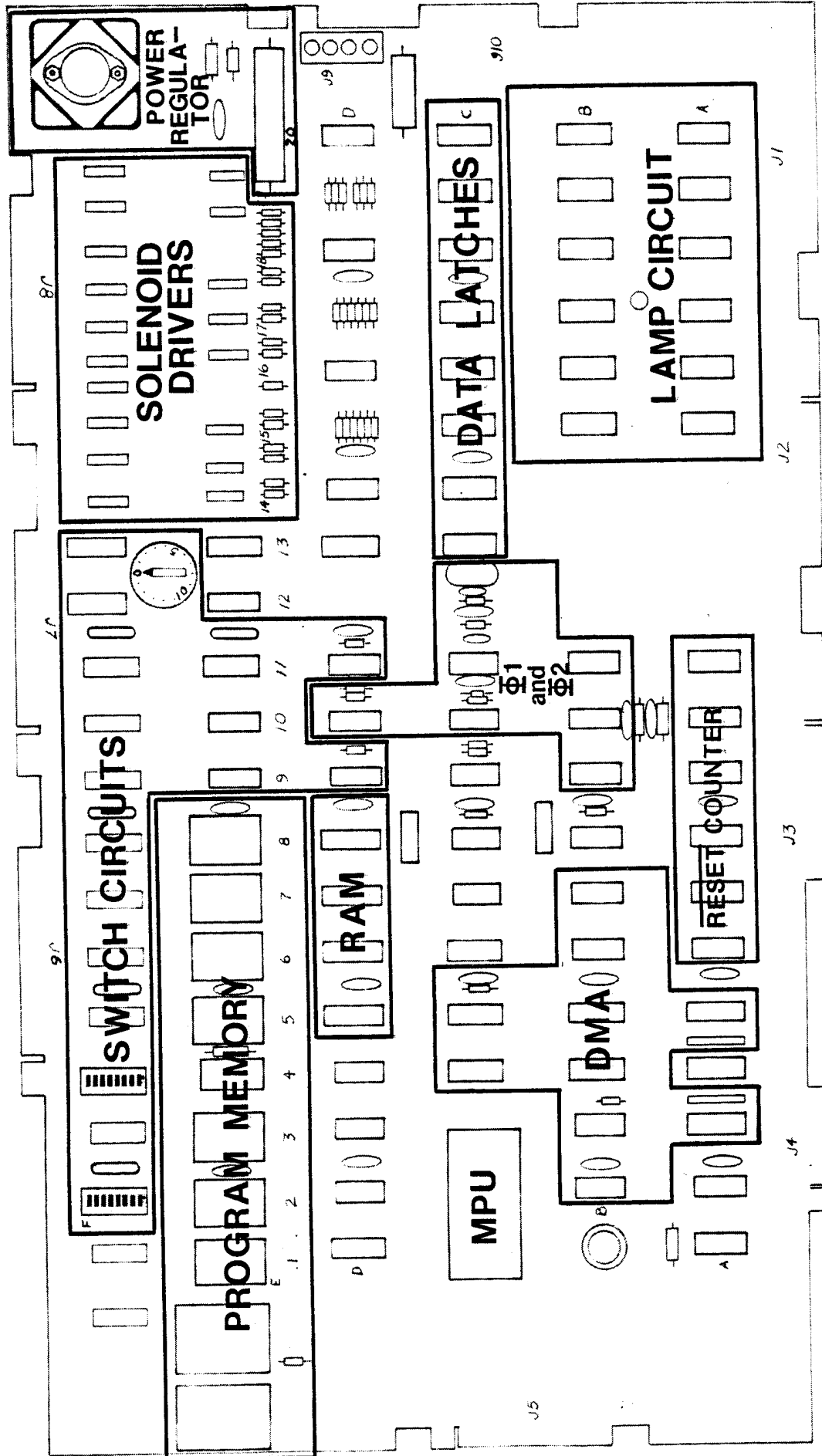
1. Cut and lift leads of Resistor R21, R23, R24, and R25 that go to +5V bus.
2. Add a 2N3643 (Q21) transistor:
Add a jumper wire from its base to edge connector J10, Pin K.
Add a jumper wire from its collector to +5V bus.
Add a jumper wire from its emitter to lifted leads of R21, R23, R24, and R25.

G. Auxiliary PCB Modification

1. Cut trace running from + side of C4 (50 μ f/150V) to cathode of CR17 (1N4005).
2. Cut trace running from cathode of CR17 to R38 (7.5K, 5W).
3. Cut trace running from cathode of CR15 (1N4005) to feed-through.
4. Add an insulated 24 GA jumper from the + side of C4 to the end of R38 that went to CR17.
5. Add a jumper from the feed-through in Modification 8 to the cathode of CR17.
6. Add a 1N4005 diode (CR22), anode to the cathode of CR17, and cathode to the jumpered end of R38.
7. Add a 200K Ω resistor (R48) between R36, 10K, 1W (the end closest to the BURN IN connector) and the ground trace going to the anode of CR19.
8. Add a 0.1 μ f capacitor (C19) in parallel with resistor R48 (added in step 7).
9. Replace resistors R21 and R22 (1.5K Ω) with 200 Ω resistors.
10. Cut trace running from resistors R21 and R22 to +5V bus (from connector J12, pin B).
11. Add a 2N3643 transistor (Q12) in the following manner:
 - a. Solder the collector to the +5V side of the trace cut in step 10.
 - b. Solder the emitter to the other end of this cut trace (going to R21 and R22).
 - c. Jumper the base of this transistor to the feedthrough above empty IC position B2.

PROCESSOR PCB CIRCUIT LAYOUT

Figure TWO-1



The Operation, Maintenance and Service Manual for each of the four games provides fairly straightforward information for the details of operation. This section expands on that information by supplying schematics that isolate the individual circuits. The isolated circuits for the Processor PCB are illustrated in Figure TWO-1.

A. Processor PCB

1. MPU Circuitry

The heart of the Processor PCB is the Microprocessor circuitry. A brief discussion of the major components and their function in the microprocessor circuitry is provided in the following paragraphs. Note that these components include:

- a) the MPU (C1) and its address and data buffers.
- b) its ROM memory (E00 through E6)
- c) its RAM memory (D5 through D8)
- d) its address decoding circuitry (C6, D1, and misc. gates)
- e) its $\phi 1$ and $\phi 2$ clock drivers (C11, B9, B10, and misc. gates)
- f) its RESET and INTERRUPT timing counters (A6 through A11 and misc. gates)
- g) its DMA circuitry (B2 through B8, B10, C4, C5, and misc. gates).

The schematics of this circuitry are shown on pages TWO-13 through TWO-15 at the end of this chapter. They have been isolated from the remainder of the circuitry and broken down as much as feasible for the sake of clarity.

MPU, ROM and RAM

The microprocessor is the "master controller" behind all action which takes place in the game circuitry. Upon initialization, the MPU addresses data permanently stored in the Program ROMs (E00 through E8). This addressed data then travels to the MPU via its 8-bit data bus (D0 through D7). The MPU decodes this data to determine what action it is to perform next, i.e. "read coin switch 1," "turn on lamp 43," etc. The MPU utilizes RAM memory (D5 through D8) in the performance of many of these instructions, using the RAM as a temporary storage space for information which it will later need to recall. The MPU is capable of writing (or putting data into) the RAM and then later reading (or pulling data out of) the RAM, via its address bus (A0 through A15) and bi-directional data bus (D0 through D7).

Address Decoding

The MPU address decoding circuitry performs the critical function of "turning on" or enabling the appropriate game circuitry (i.e. RAM, ROM, LATCHES, etc.) at the appropriate time, so that information can be transferred back and forth between this game circuitry and the MPU.

$\phi 1$ and $\phi 2$ Clock Drivers

The basic operating frequency of the microprocessor is established by the $\phi 1$ and $\phi 2$ clock inputs (on pins 3 and 37). All of the Atari Pinball PCBs run at an operating frequency of 1 MHz. Examination of the $\phi 1$ and $\phi 2$ wave forms with an oscilloscope should show two signals of opposite polarity with a period of 1 microsecond. (The period of a waveform is the time it takes to complete one full cycle). The 1MHz clock frequencies are derived from a 4 MHz crystal controlled oscillator. This 4 MHz frequency is "divided-by-four" by counter C11 and flip-flop B9 and pre-shaped by timer B10.

RESET and INTERRUPT Timing Counters

The reset and interrupt timing counters in the microprocessor control circuitry are shown on page TWO-15. They consist of 6 stages of 4-bit binary counters (A6 through A11). These counters serve a multi-purpose function, by dividing down the MPU's clock frequency into various timing signals.

The first stage of the counter chain, A6, is clocked at a rate of 1 MHz (by $\phi 1$). This stage's Q_A output (DMA CLK) is used as the basic timing frequency for the DMA circuit, and runs at 500 KHZ (period = 2 microseconds).

The Q_C output of A6 (AUDIO CLK) is used as the basic timing frequency for the audio control circuitry, and runs at 125 KHZ (period = 8 microseconds).

The Q_D output of A7 and the Q_A output of A8 are "and-ed" together to form the DMA INT signal, which occurs at a frequency of 2 KHZ, or approximately every 500 microseconds. This interrupt function is used to signal the start of a cycle of DMA (explained in DMA section).

The Q_D output of A8 (NMI) is used to generate a "non-maskable interrupt" to the MPU. It occurs at a frequency of 250 HZ, or about every 4 milliseconds, and signals the MPU to temporarily leave its normal instruction sequence, and perform the set of instructions contained in its interrupt routine. Once it has done this, the MPU will return to its normal instruction sequence from where it left off. (It should be noted that the most recent version of MIDDLE EARTH PCBs does not utilize this NMI sequence. On all such boards, the NMI input to the MPU has been disconnected, and instead, connected to a pull-up. This change should

only be done to MIDDLE EARTH PCBs, as previous game PCBs will not function if this mod. is performed. Operators should be aware of this mod. when swapping universal boards from game to game, since the mod. is recommended for MIDDLE EARTHS only, and should not be done to PCBs used in THE ATARIANS, TIME 2000, or AIRBORNE AVENGER.)

The NMI signal is also used to clock counter A11. The Q_B output of this counter occurs at a frequency of approximately 60 HZ, or about every 16 milliseconds. This output is gated onto the MPU data bus line D6, by the SWITCH READ address decode. The MPU program uses this information during its switch reading routine, to time out or "debounce" any switch closures which it has recognized.

The final function of these counter stages is the RESET signal to the MPU. This signal hopefully occurs at a frequency of 0, or in other words, never. Counters A9 and A10 count how many times the Q_D output of counter A8 changes states. Meanwhile, the WAKE-UP RESET signal, generated at various points during the MPU's normal instruction sequence, is resetting these same counters (A9 and A10) back to a count of zero. If for some reason the MPU program has strayed from its normal instruction sequence, and WAKE-UP RESET does not occur before these counters count up to the point where the Q_B output of A10 goes high, a RESET signal is generated to the MPU, causing it to restart its instruction sequence from the beginning.

NOTE: If trouble-shooting the MPU circuitry, it is normally recommended to disable this reset generating circuitry until any other problems have been fixed. This disabling is easiest done by cutting and lifting pin 6 of F1.

DMA (Direct Memory Access)

Direct Memory Access is a term used in Atari Pinball electronics to refer to the situation where the circuitry peripheral to the MPU temporarily takes over the MPU's address and data bus to gain direct access to some portion of the MPU's RAM memory. As you already know, the microprocessor controls the game operation. It flashes lamps during the ATTRACT mode, recognizes coin inputs, senses playfield switch closures, operates game lamps and solenoids and does the "bookkeeping" for player score information. The MPU, in performing these tasks, directly "reads" all switch inputs and directly "writes" on/off information to all audio, coil, and solenoid output latches. The MPU, however, does not transfer lamp and score information to the respective lamp and score latches. Instead, the MPU stores the lamp on/off and player score information in selected locations in its RAM memory. Then at regular intervals (every 512 microseconds) the game circuitry halts the MPU and inserts lamp and score addressing information onto the MPU address bus. This addressing information is configured so that it accesses the selected RAM cells where lamp and score

information has been stored by the MPU. The RAM output data is then used to update the Lamp data latches and lamp strobes, the four score displays, and the Match/Credit display. The following paragraphs go into the details of the timing of the game circuitry's access to the MPU RAM memory, and how it uses the information that the MPU has stored in that memory.

Refer to schematic on page TWO-15 as you go through this circuit description. Every 512 microseconds a DMA INT signal is generated by the reset and interrupt timing counters. This initiates the DMA interrupt routine. One DMA CLK pulse after the DMA INT goes low, the \bar{Q} output of the Halt flip-flop (B6, pin 8) generates a HALT signal to the MPU. The MPU responds by finishing its current instruction cycle, and then signaling that it has stopped and relinquished control of its address and data bus, by a high on its BA (Bus Available) output line. BA going high (and \bar{BA} going low) then generates the LD, \bar{LD} , ANODE BLANK, and CATHODE BLANK signals and also turns on the tri-state address bus drivers C4 and C5. The access to the MPU RAM is now ready to take place, via address lines A0 through A5 and A12 through A14.

For the next several microseconds, these address lines are controlled by the outputs of counters B3 and B4, as they address the respective calls in RAM memory which contain the lamp and display update information. Counters B3 and B4 are both clocked by the basic DMA timing frequency, DMA CLK, at a frequency of 500 KHZ. The Q_A output of B3 (clocked by the CP_A input on pin 14) runs at half of this frequency. This divide-by-two effect inhibits counter B4 from counting on every other (or alternate) DMA CLK pulse, and also triggers the LOAD DISPLAY one-shot timer (B10) for every other DMA CLK pulse. This alternate cycle loading of display information via one-shot B10 is done so that display update data (from the MPU RAM which is being addressed by counters B3 and B4) has time to stabilize before it is actually loaded into the displays. The CP_B clock input of counter B3 (pin 1) is clocked once per each DMA interrupt cycle (by the falling edge of \bar{LD}). The Q_B , Q_C , and Q_D outputs of B3 indicate to the RAM, as well as to the display and lamp drivers, which of the 7 display digits (via DISPLAY ADDRESS 0, 1, and 2) or which of the 4 lamp strobes (via LAMP BIT 0 and 1) is currently being updated.

One of the 7 display digits and one of the four lamp strobes is therefore updated each DMA interrupt cycle. Counter B3 determines which of these is updated. Counter B4 determines what information this display digit or lamp strobe is updated with. Counter B4 counts from a count of 0 (all outputs low) at the beginning of each DMA interrupt, to a count of 15 (all outputs high), which signals the end of the interrupt. The 16 possible combinations on the Q outputs of B4 are used to address 16 locations in RAM (via A2, A3, A4, and A5). The information contained in these RAM locations is used as follows: 1) 4 locations contain lamp update information (when B4, Q_A and Q_B outputs are both high); 2) 4 locations contain the 4 players' score information (when Q_A and Q_B outputs are both low); 3) 4 locations contain Match/Credit update information (when Q_A output is low and Q_B output is high); 4) and 4 locations are not used.

When Counter B4 has counted through all 16 locations and all appropriate lamps and display digits for that DMA interrupt cycle have been updated, a "terminal count" pulse is generated at B4 pin 15. This pulse causes the HALT flip-flop (B6) to toggle, causing HALT to go high. The MPU now recognizes that the DMA cycle has finished, responds by outputting a low on its BA (bus available) line, and then continues on in its normal instruction sequence from where it left off before the DMA interrupt began. Approximately 500 microseconds from this time, the MPU will receive its next DMA interrupt, and will repeat the identical procedure, except that it will be updating a different display digit and lamp strobe from the previous interrupt cycle. (Remember, the Q_B , Q_C , and Q_D outputs of B3 are only clocked once per interrupt cycle, therefore every succeeding cycle will update the next sequential display digit or lamp strobe.)

Since there are four lamp strobes, and one is updated each interrupt cycle, each strobe is updated every fourth cycle, or every 2 milliseconds (4×500 microseconds = 2 milliseconds). In contrast, there are 7 display digits. Each of these digits is updated every eighth interrupt cycle, or every 4 milliseconds (8×500 microseconds = 4 milliseconds). Though the DMA interrupt cycle, when viewed as a complete routine, is a seemingly complicated process, it is in actuality a large number of very simple operations happening in a very short amount of time.

2. Switch Reading Circuitry - See schematic on page TWO-16

The MPU's switch reading circuitry is relatively simple and straightforward. One side of all playfield and game PCB switches is bussed together into a single SWITCH COMMON line, which goes to the MPU data bus line D7, via edge connector J7, pins 5 and 6. The other side of each of these normally-open, single-pole, single-throw switches is connected to its own unique output of an open-collector one-of-eight decoder (F3 through F13), via edge connectors J6 and J7.

To determine if any given switch is being actuated, the MPU puts out the unique address, which has been assigned to that switch, on its address lines. (Note that the MPU hexadecimal address of each switch is listed on the right hand side of the schematic.) This MPU address is decoded by one-of-ten decoder E11 and one-of-eight decoders F3 through F13 to provide a low pulse to the appropriate switch. Simultaneous to outputting this address, the MPU also "reads" data bus line D7, via the SWITCH READ enabling signal to tri-state buffer, C5. If a switch is actuated (or closed), the low pulse caused by the one-of-eight decoder will be seen by data line D7 via the SWITCH COMMON line.

NOTE: When trouble-shooting the switch-reading circuitry, it is recommended you begin by trouble-shooting the SWITCH COMMON line. With all switches open (including the on-board option switches, F2 and F4) the SWITCH COMMON line should be a constant high. If not, first check to see if you have any shorted playfield or PCB switches.

3. Lamp Output Circuitry - See schematic on page TWO-17

All MPU-controlled lamps are powered by one of four lamp strobes. Each of these 4 lamp strobes is connected to a string of several lamps. (See each game's individual wiring diagram to determine which lamps are connected to which strobes.) The actual lamp strobes are generated by the Auxiliary PCB, but are controlled by the Processor PCB via LAMP BIT 0 and LAMP BIT 1. The two bits of data indicate to the Auxiliary PCB which of the 4 lamps strobes to turn on. (Note that these two lamp bits are a function of counter B3, as previously discussed under DMA. These two bits count up in a binary sequence with each DMA interrupt (every 500 microseconds.) Each "set" of lamps has power applied to one "side" of each individual lamp every 2 milliseconds for a duration of approximately 500 microseconds. The other "side" of each individual lamp is connected to its own unique lamp driver (A15 through A20 and B15 through B20) on the Processor PCB via edge connector J1 and J2. These 2003 A lamp drivers merely provide a current path to ground for any lamp which is to be turned on. The lamp driver's on/off status is controlled by the outputs of data latches C13 through C20. These data latches are updated with the proper lamp information every 500 microseconds by the DMA interrupt sequence previously discussed.

NOTE: The 9 data latches (C13 through C20) are used for storing control information for both the lamp driver and solenoid driver circuitry. For this reason, the data latches are schematically shown on both pages TWO-17 and TWO-18. It should be noted, however, that only latch outputs Q4, Q5, Q6, and Q7 are used for controlling lamp drivers, while latch outputs Q0, Q1, Q2, and Q3 are used to control solenoid drivers.

4. Solenoid Output Circuitry - See schematic on page TWO-18

The solenoid output circuitry is very straightforward. To turn a solenoid on at the appropriate time, the MPU writes directly to data latches C13 through C20. The output of these data latches is used to turn on or off the appropriate solenoid drivers, Q1 through Q20. Similar to the lamp driver circuits, the solenoid drivers merely provide a current path to ground. One side of each solenoid is connected to the Solenoid Supply (generated directly from the power supply). The other side of each solenoid is connected directly to its individual driver on the Processor PCB, through edge connector J8.

B. Auxiliary PCB

The Auxiliary PCB is in effect an extension of the Processor PCB circuitry. It contains various power-consuming portions of the lamp driver circuitry, the solenoid driver circuitry, and the audio generating circuitry, as well as the audio and display supply voltages. See schematic on page TWO-19.

Display Supply

The Display supply is generated from the 170 VAC center-tapped voltage from the game power supply. It is rectified on the Auxiliary PCB to form the +90 V and -90 V DC voltages necessary to power the Score and Match/Credit Displays. Note that this circuitry also includes transistor Q12 as part of the POWER FAIL protection. This circuitry is included in all recent versions of Auxiliary PCBs. Any older version PCBs which do not have this circuitry incorporated should be updated immediately. See Chapter 1 for modification instructions and interchangeability problems.

Miscellaneous Drivers

Drivers for the coin door lockout coil and coin counter coil are also included on this PCB. These two drivers are controlled by latched signals generated on the Processor PCB. Each driver is capable of "energizing" its respective coil by providing a current path through the coil to Auxiliary PCB ground.

Lamp Strobes

The Auxiliary PCB also generates 4 mutually exclusive lamp strobe outputs. These strobes are controlled by the LAMP BIT 0 and LAMP BIT 1 control bits from the Processor PCB. The 4 lamp strobes should each consistently pulse at a rate of every 2 milliseconds and each pulse should last for a duration of about 500 microseconds. These strobes serve as the "supply voltage" for all MPU controlled lamps. Since each strobe has an "on" duty cycle of only 25%, even lamps which appear to be on all the time are really only being supplied with power about one-fourth of the time. Since this 25% duty cycle at this frequency is not perceptible to the human eye, this is an efficient way to reduce power consumption as well as prolong lamp life. As a point of general interest, the Atari "keep-alive" routine might also be mentioned at this time. If one would observe carefully any lamps which are supposedly in their "off" condition, you could observe a faint pulsing of the lamp filament. This is because these lamps are being turned on and off very quickly at a very low frequency. The effect of this procedure is to prolong lamp life, since it prevents sudden current surges through the lamp filament.

Audio Circuit

The game's audio amplifier (D1) is also located on the Auxiliary PCB. The actual audio control circuitry is located on the Processor PCB, where a three-stage MPU-controlled counter (consisting of D13, E12, and E13) is used to address audio PROM D12. The output of this audio PROM (Audio 0 through Audio 3) is then sent to the Auxiliary PCB. A D/A (digital to analog) conversion is then performed on these 4 audio bits, using open-collector gate C2 (7407) and resistors R16 through R19. This analog waveform is then buffered and amplitude modulated by OP-AMP C1. The output of OP AMP C1 is then sent to the audio amplifier through a 5K Ohm VOLUME adjustment potentiometer. The necessary voltages to power the audio circuitry (+20V, +16V, +13.6V, and +6.8V) are also generated on the Auxiliary PCB.

C. Score Display PCB

See schematics on page TWO-20 and TWO-21. Note that there are two separate schematics shown for the two different revisions of the Score Display PCB. The first schematic refers to the "Old Score Display." This PCB has since been replaced with the "Discrete Score Display PCB." The newer PCB design has incorporated discrete anode and segment drivers. These discrete drivers are proven to be more reliable under severe operating conditions than the integrated drivers used on the Old Score Display. If an older Score PCB needs to be replaced, either because of damage or intermittent failures, it is recommended that it be replaced with the Discrete Score Display PCB.

The Score Display PCB receives score update information from the Processor PCB. This information includes 7 bits of Display Address information (Display Address 0 through 6), four bits of Display Data (Display Data 0 through 3), a LOAD DISPLAY signal, a CATHODE BLANK signal, and an ANODE BLANK signal. LOAD DISPLAY is a synchronizing pulse generated by the Processor DMA timing circuit which indicates the timing of the actual updating of Display information from the MPU RAM. If DISPLAY ADDRESS 5 and 6 are both low, this indicates to the Score PCB that the information contained by DISPLAY DATA 0 through 3 is intended for updating the Score Display (as opposed to the Match/Credit Display). DISPLAY ADDRESS 3 and 4 are decoded to determine which player's score is being updated. DISPLAY ADDRESS 0, 1, and 2 are decoded to determine which of the 7 digits of a player's score is being updated. DISPLAY DATA 0 through 3 contain the actual information for updating the appropriate digit of the appropriate player's score. ANODE BLANK and CATHODE BLANK inhibit, or blank, the displays during the time when they are actually being updated by the Processor PCB.

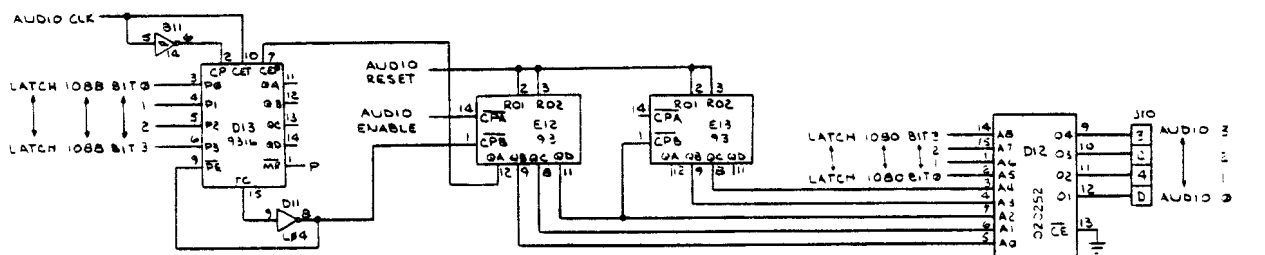
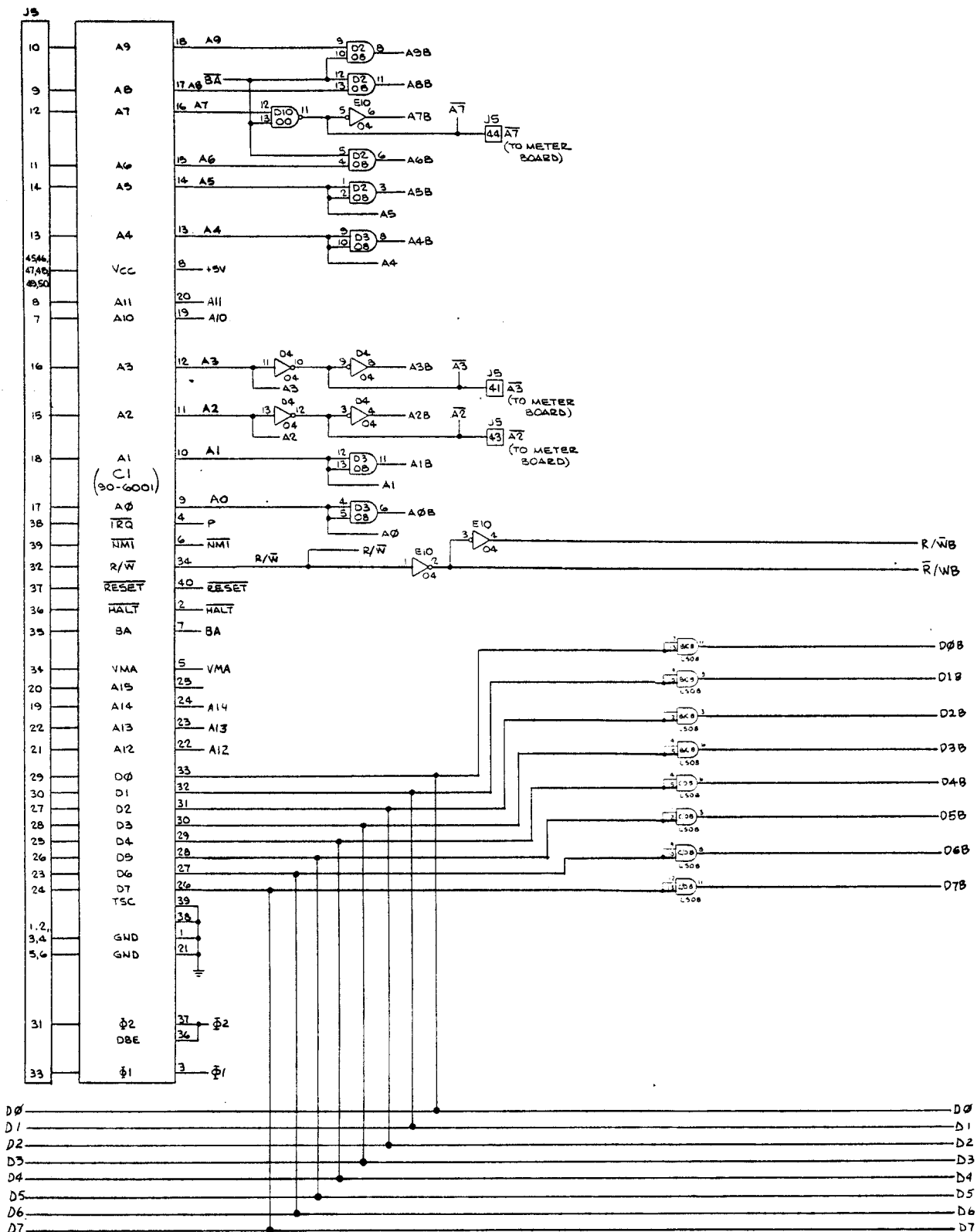
D. Match/Credit PCB

See schematics on pages TWO-22 and TWO-23. As in the case of the Score Display PCB, the original design, or "Old Match/Credit PCB" has been replaced with the more recently designed "Discrete Match/Credit PCB." If replacing a Match/Credit PCB, it is recommended that a "discrete" board always be used as the substituted PCB.

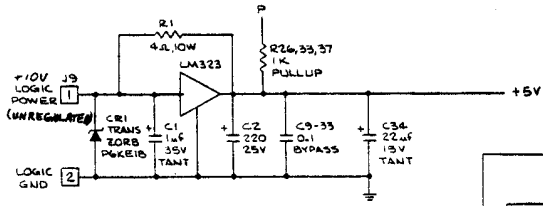
The Match/Credit PCB also receives its update information from Processor PCB. LOAD DISPLAY reflects the timing of the MPU's DMA routine, and indicates when the actual loading of Match/Credit display information should take place. If DISPLAY ADDRESS 5 is high and DISPLAY ADDRESS 6 is low, this indicates to the Match/Credit PCB that the display information contained on DISPLAY DATA 0 through 3 is intended for updating the Match/Credit display. DISPLAY ADDRESS 0, 1, and 2 are decoded to determine which of the four digits on the Match/Credit display is being updated. DISPLAY DATA 0 through 3 contain the actual MPU RAM information with which the appropriate digit is updated. CATHODE BLANK and ANODE BLANK inhibit, or blank, the Match/Credit display while it is being updated.

MICROPROCESSOR and BUFFERS

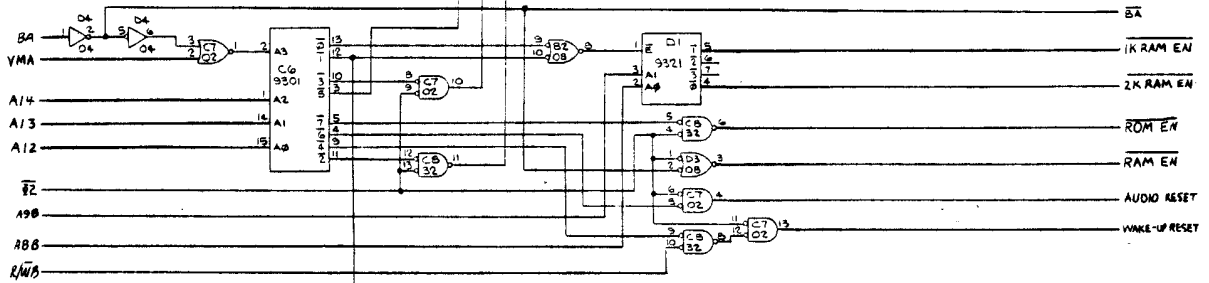
AUDIO CONTROL CIRCUITRY



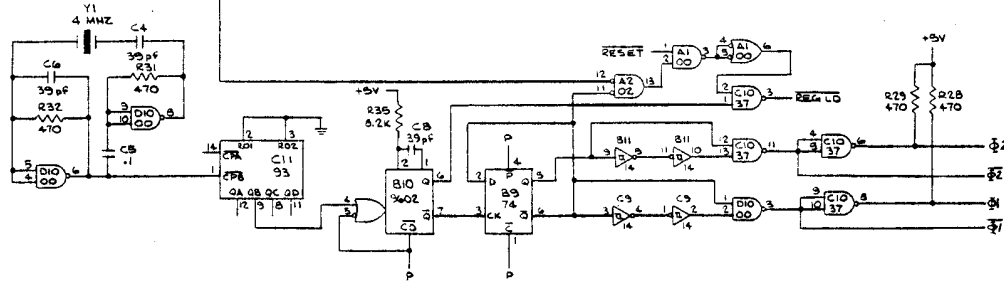
+5VDC REGULATOR



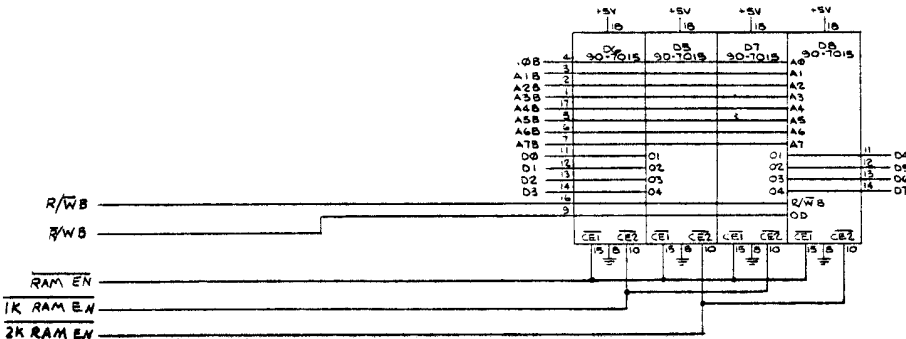
ADDRESS DECODING



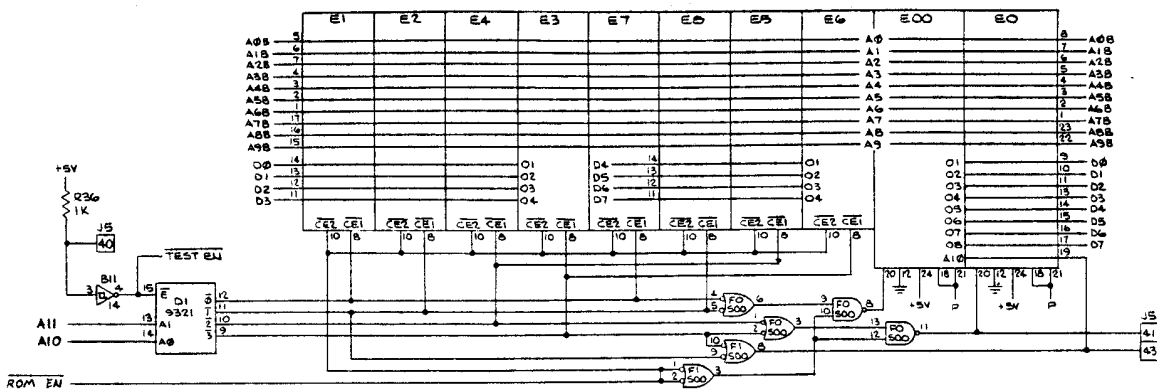
Φ1 AND Φ2 CIRCUIT



RAM



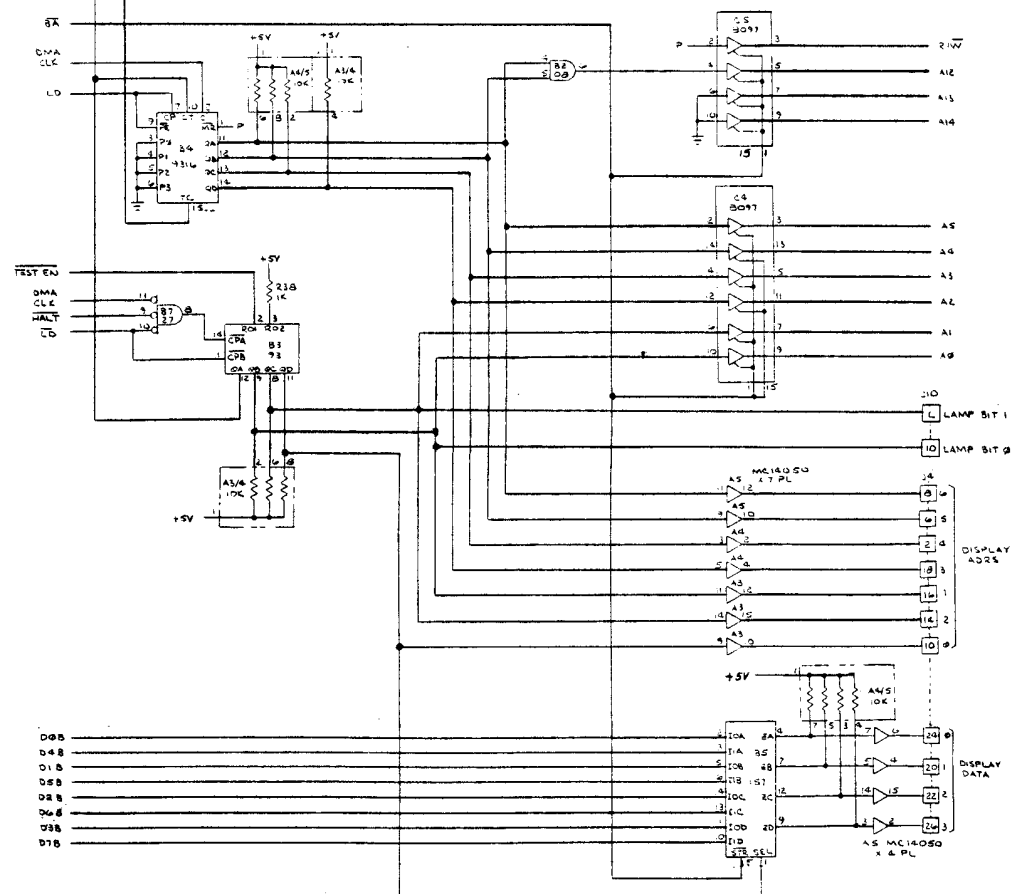
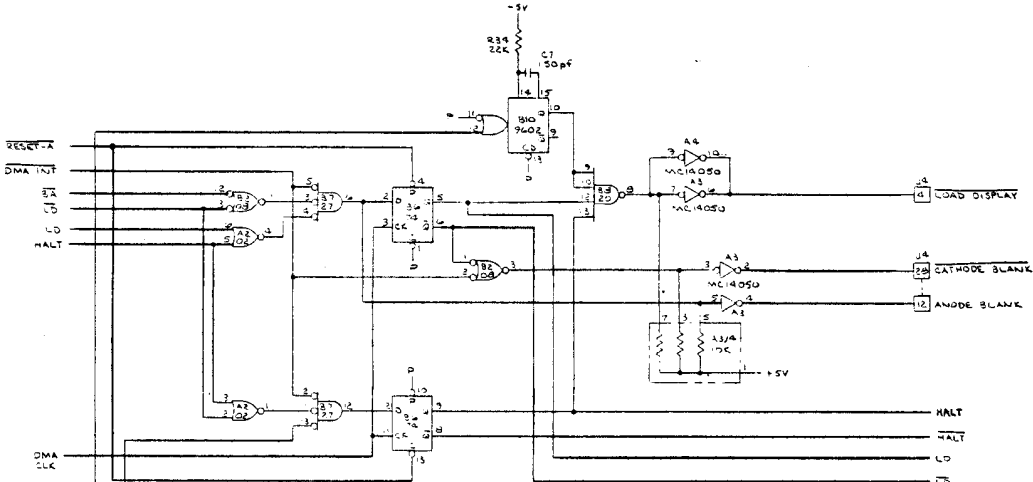
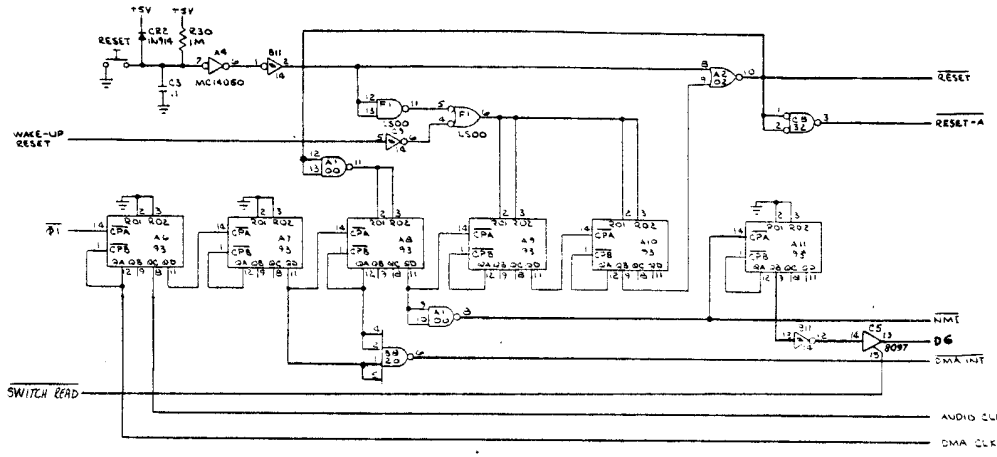
ROM



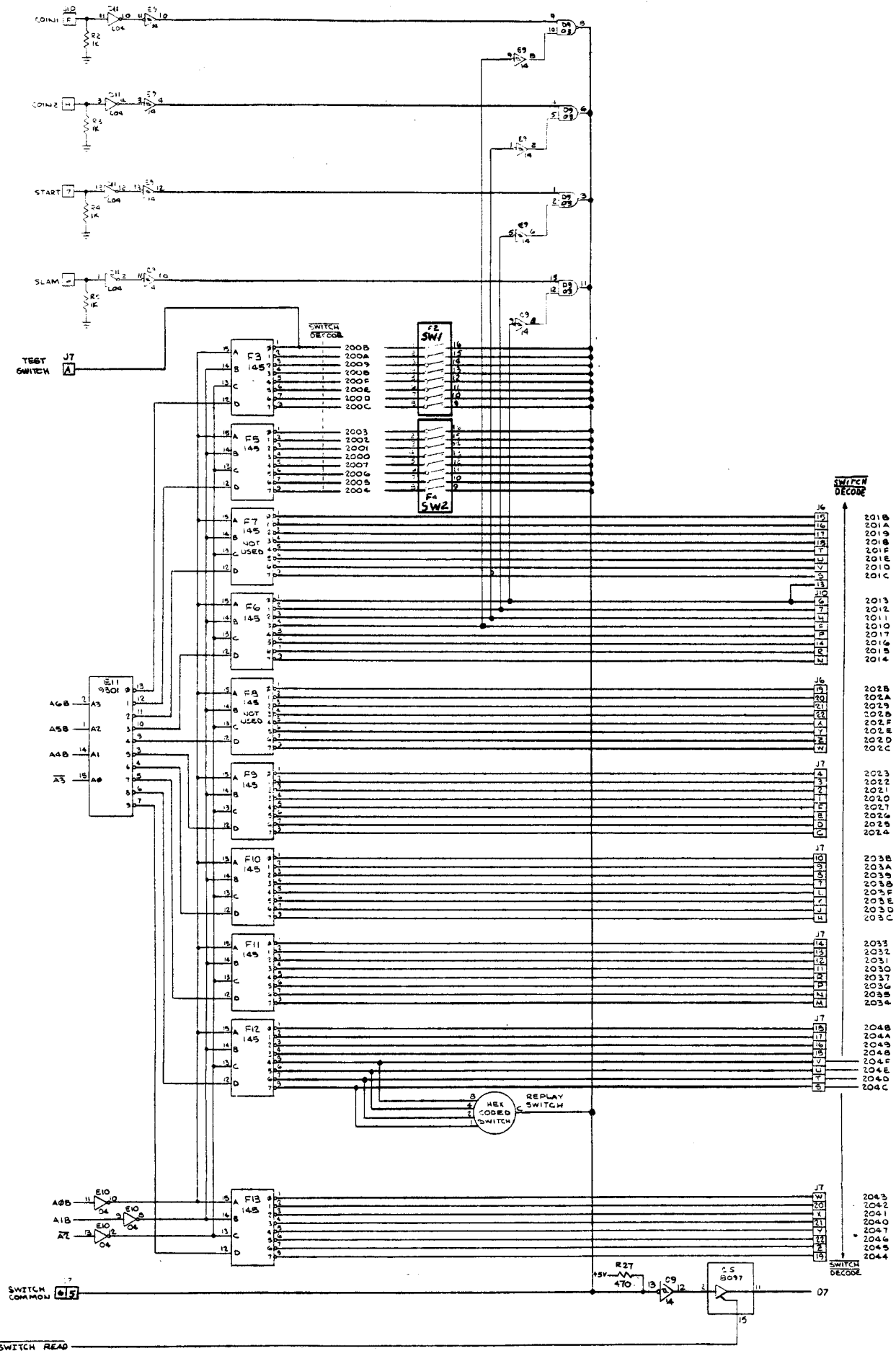
RESET and DMA INTERRUPT COUNTERS

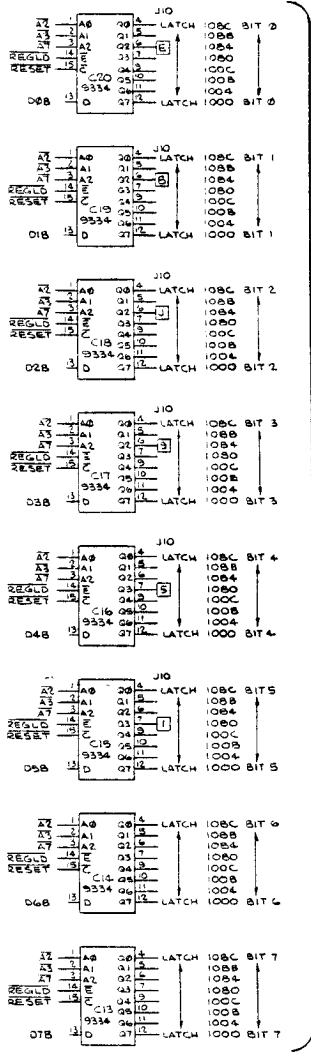
DMA TIMING CONTROL

DIRECT MEMORY ADDRESS



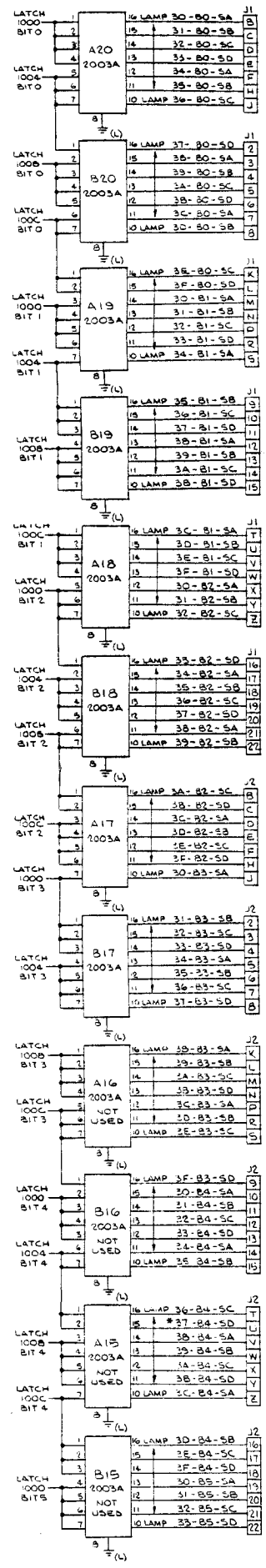
SWITCH READING CIRCUITRY





ALL DATA LATCHES ARE REPEATED ON SOLENOID DRIVER PAGE

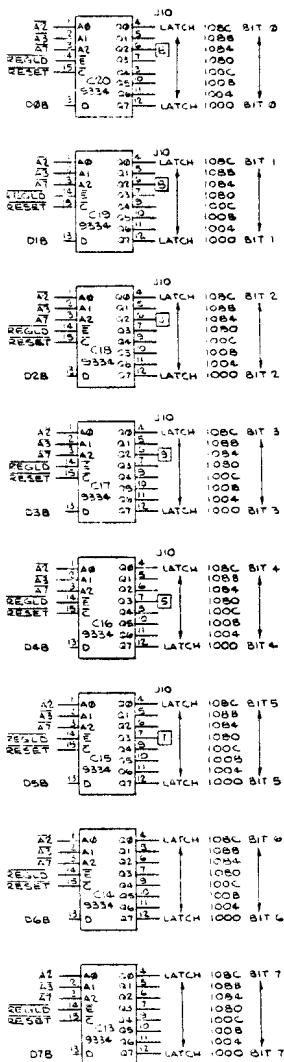
RAM LOC	BIT NO.	STRB
37	84	5D



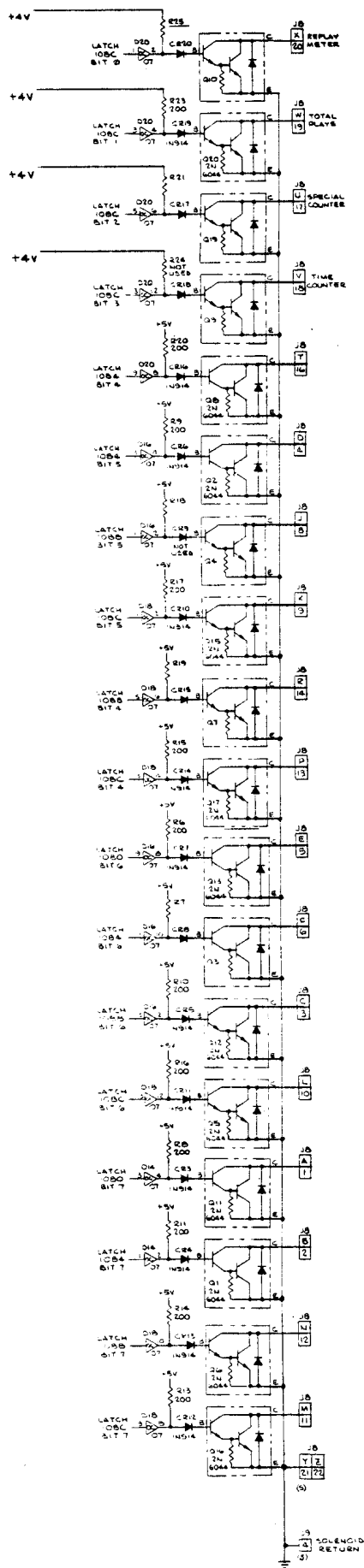
LAMP OUTPUTS



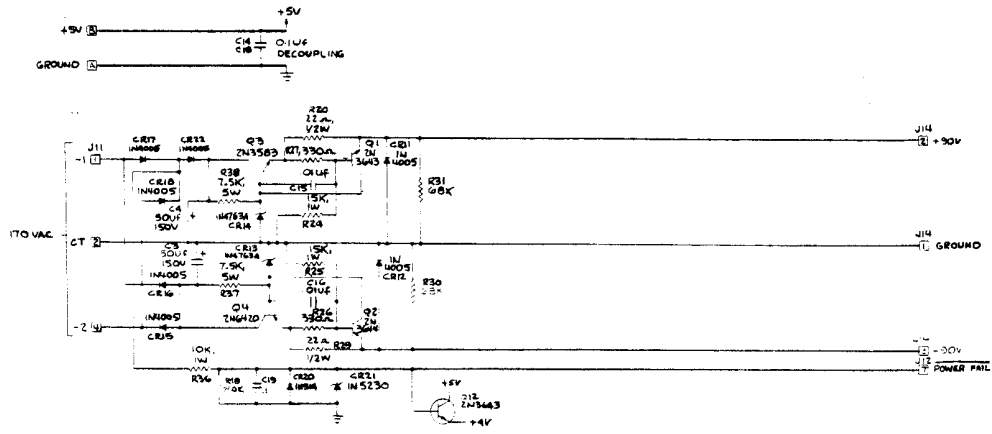
SOLENOID OUTPUTS



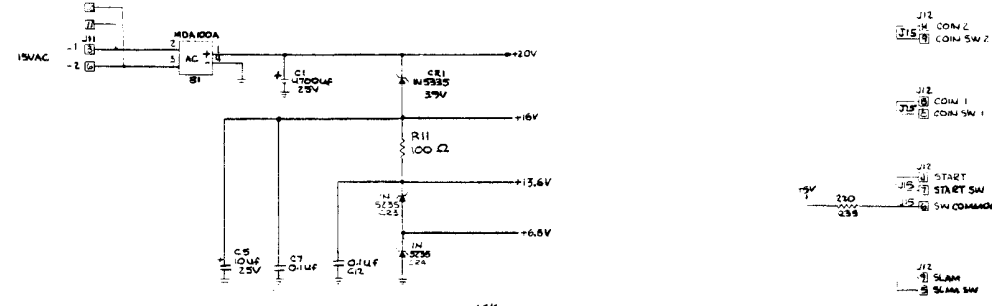
ALL DATA LATCHES ARE RE-
PEATED ON SOLENOID DRIVER PAGE



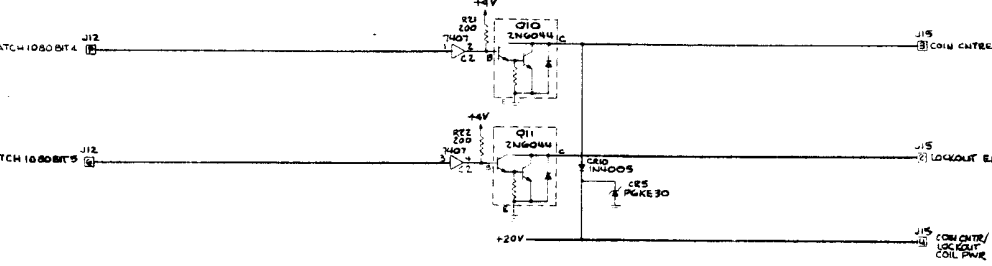
SCORE AND WATCH/CREDIT
POWER



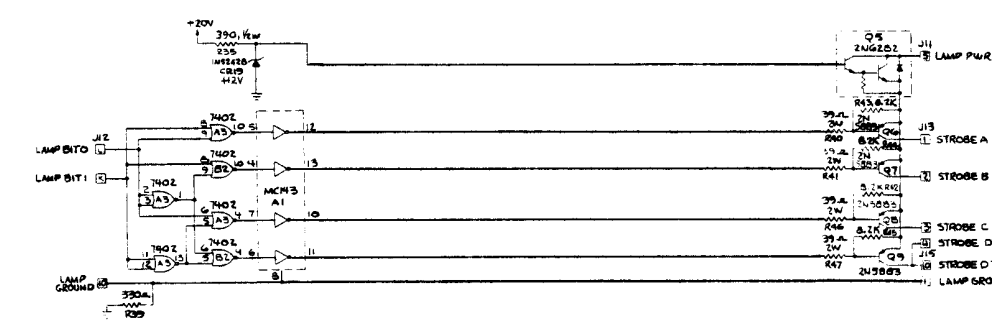
AUXILIARY POWER



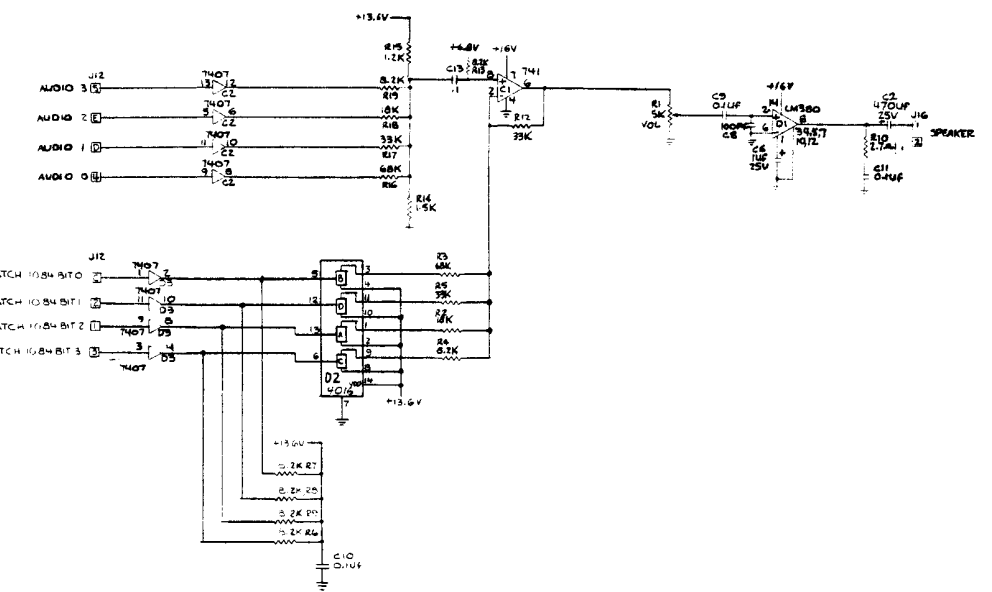
COIN DOOR
SOLENOID DRIVERS



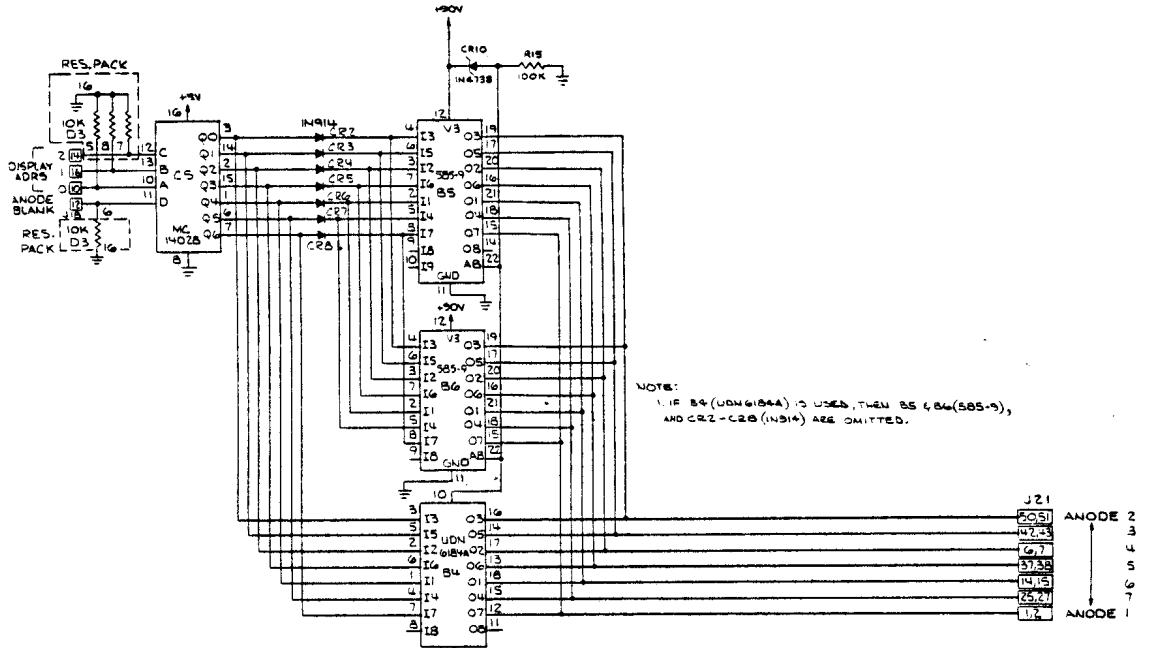
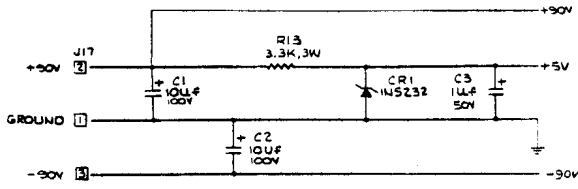
STROBES A 'THRU D



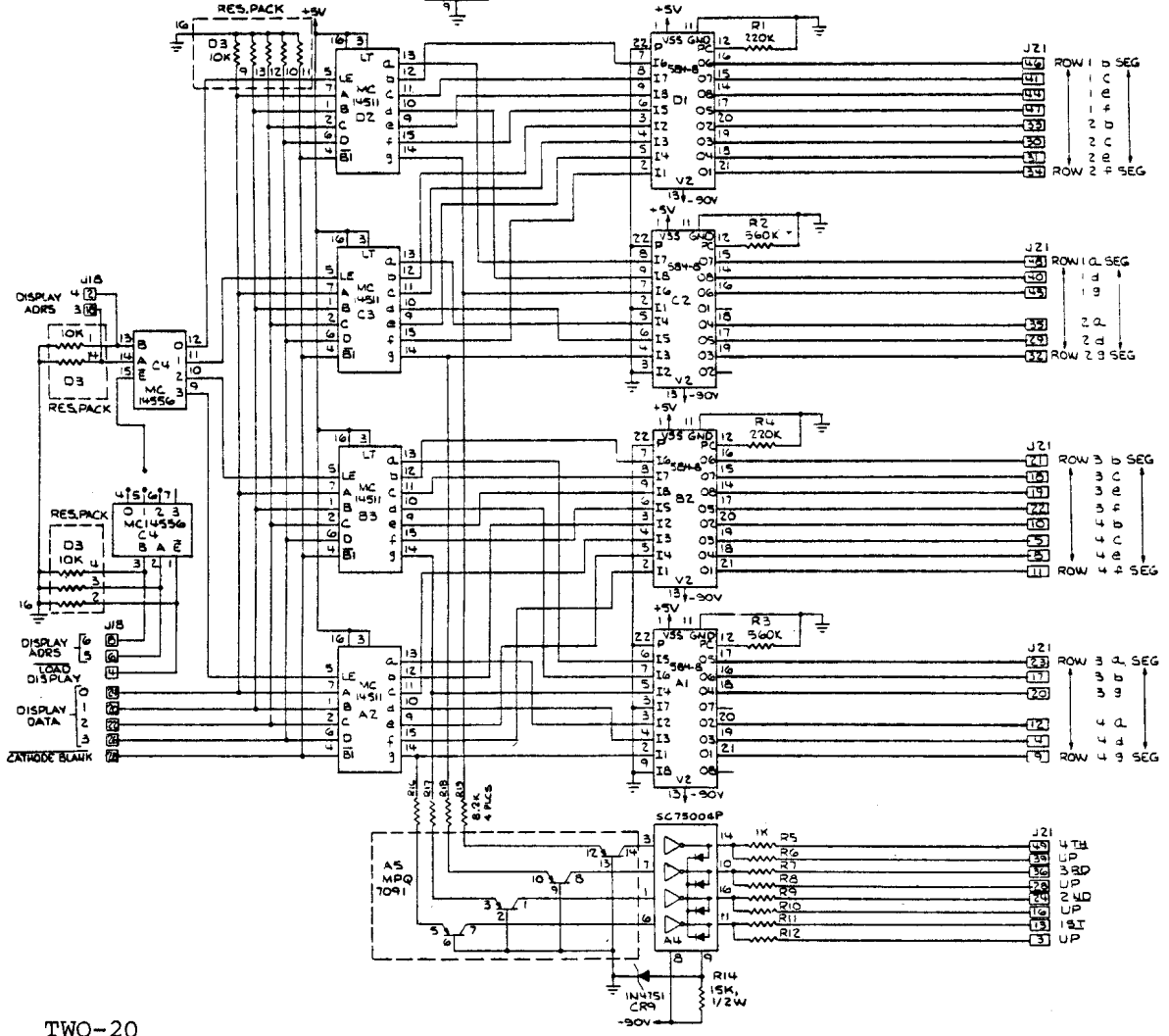
AUDIO CIRCUIT

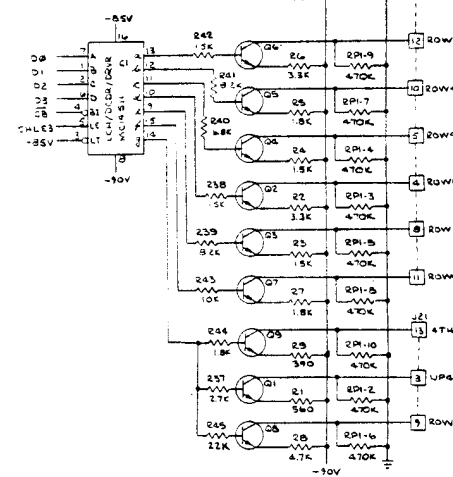
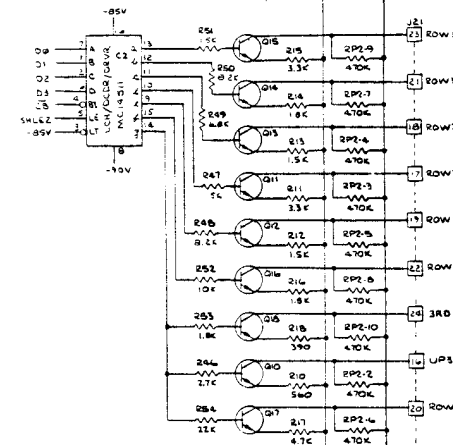
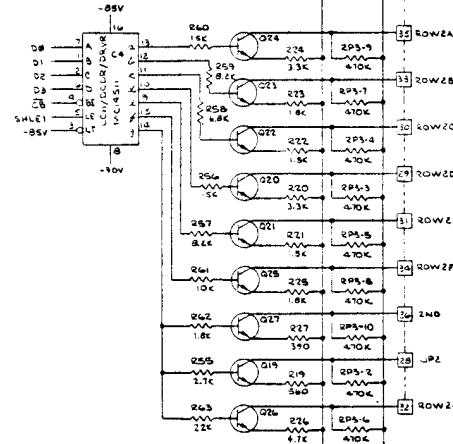
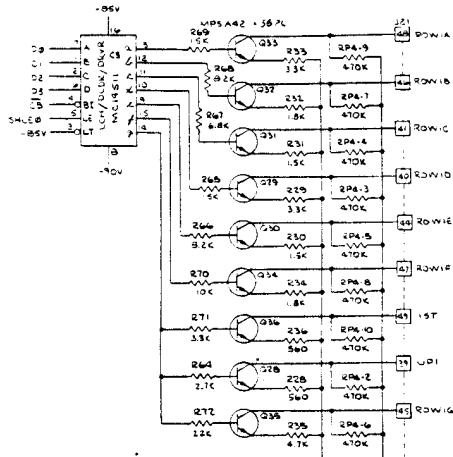
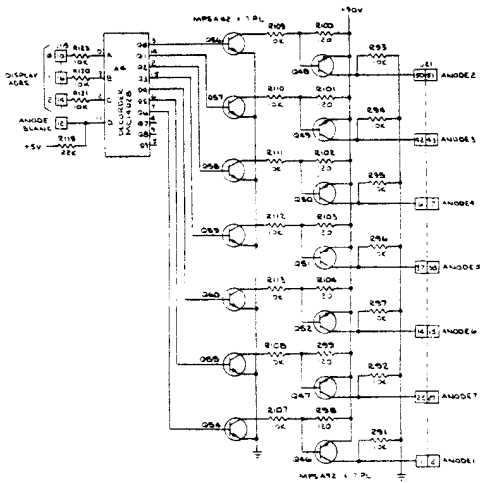


OLD SCORE DISPLAY

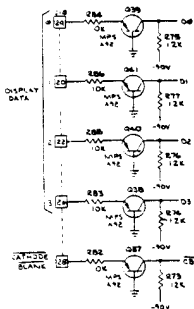
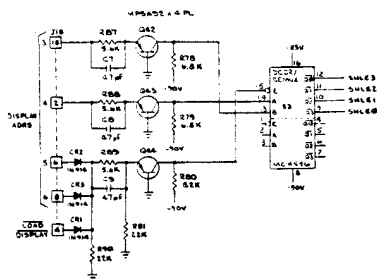
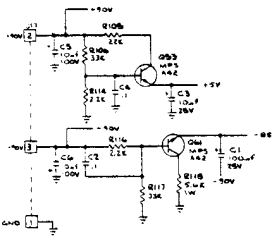


NOTE:
IF 84 (UNCG184A) IS USED, THEN 85 (846(S85-9)),
AND CR2-C28 (1N514) ARE OMITTED.

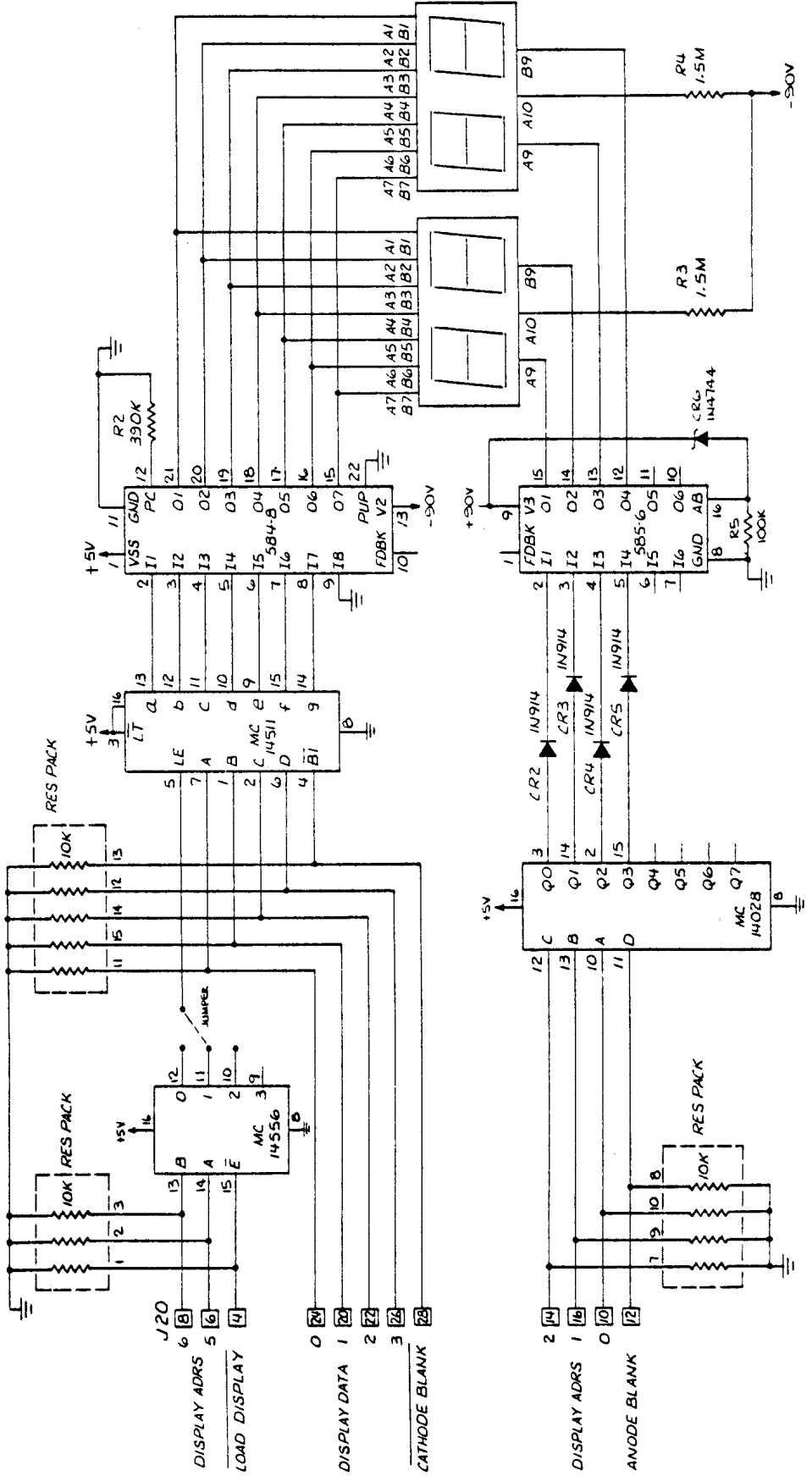
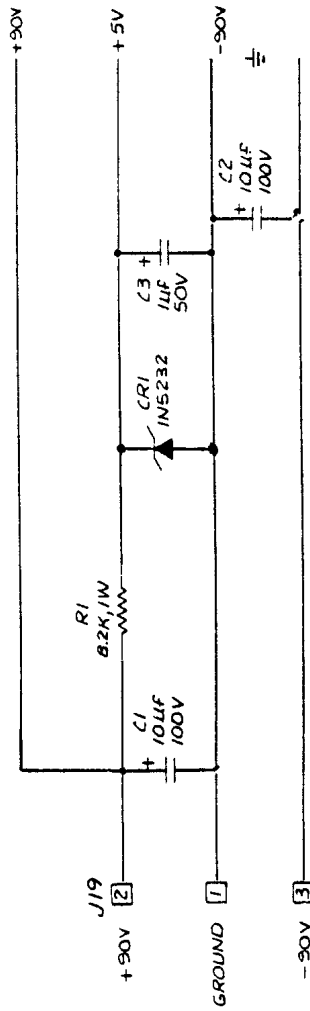


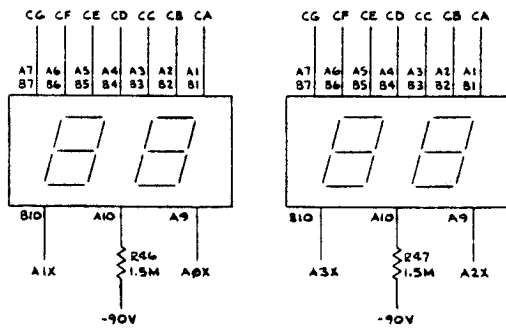
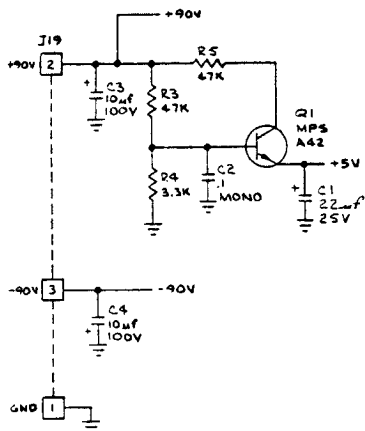
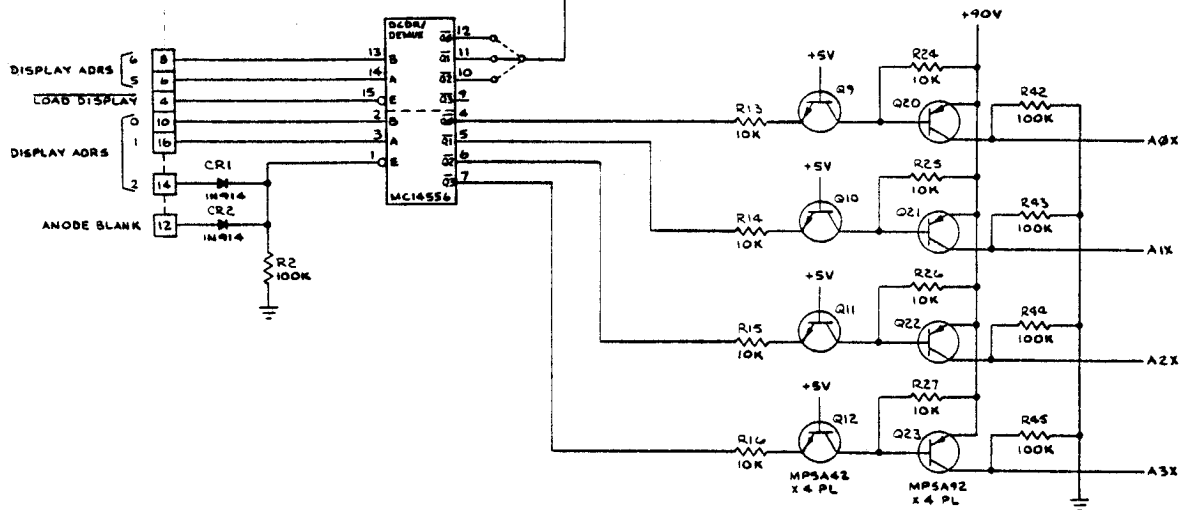
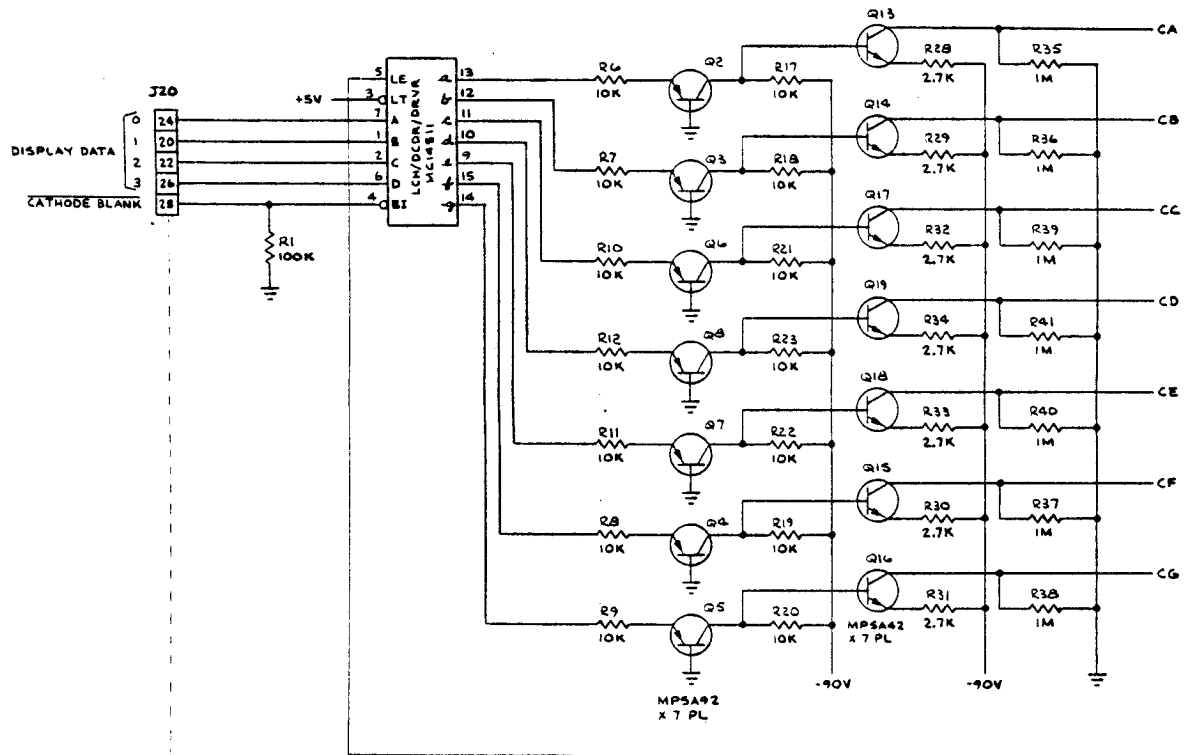


DISCRETE SCORE DISPLAY

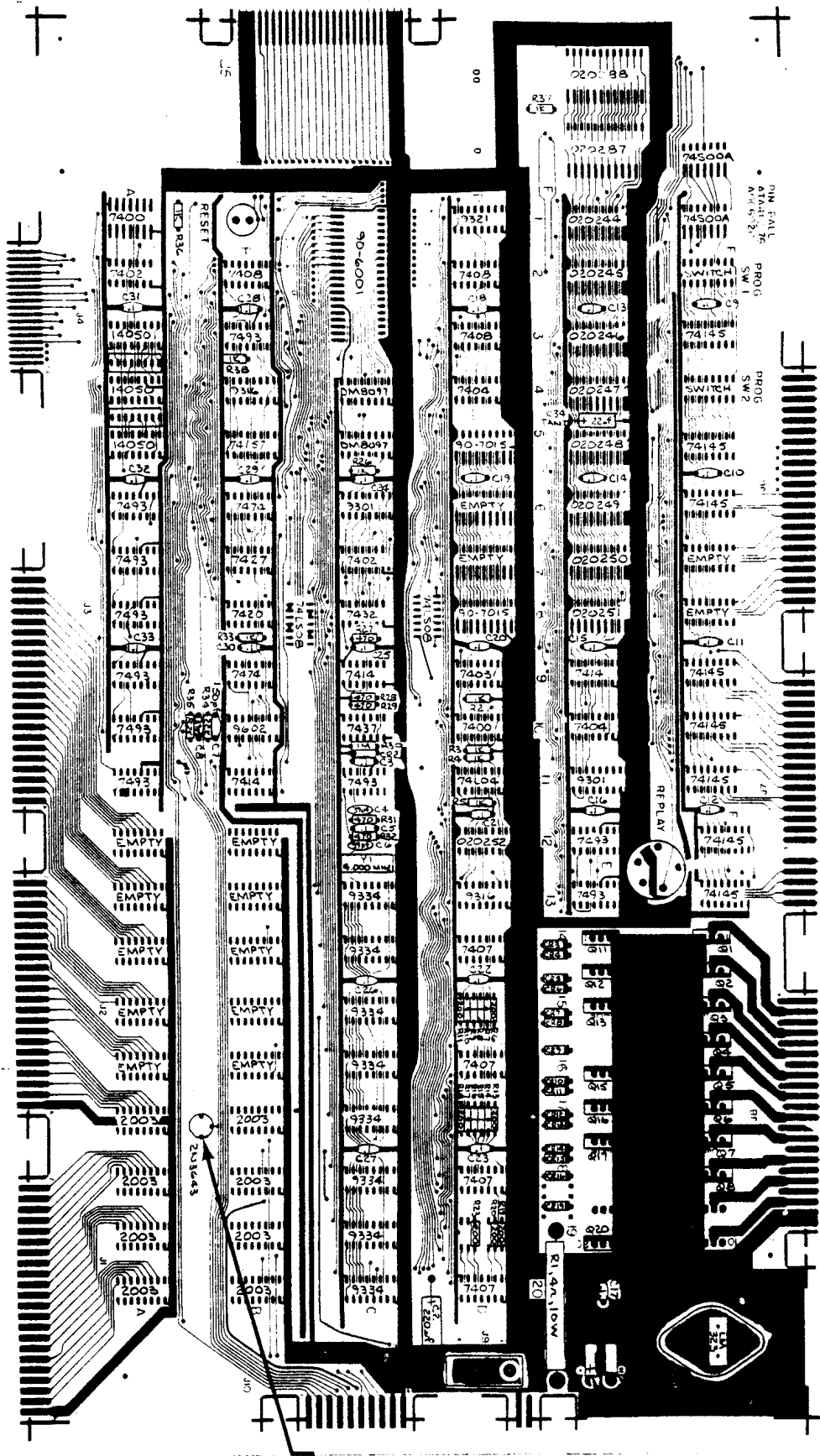


OLD MATCH/CREDIT PCB





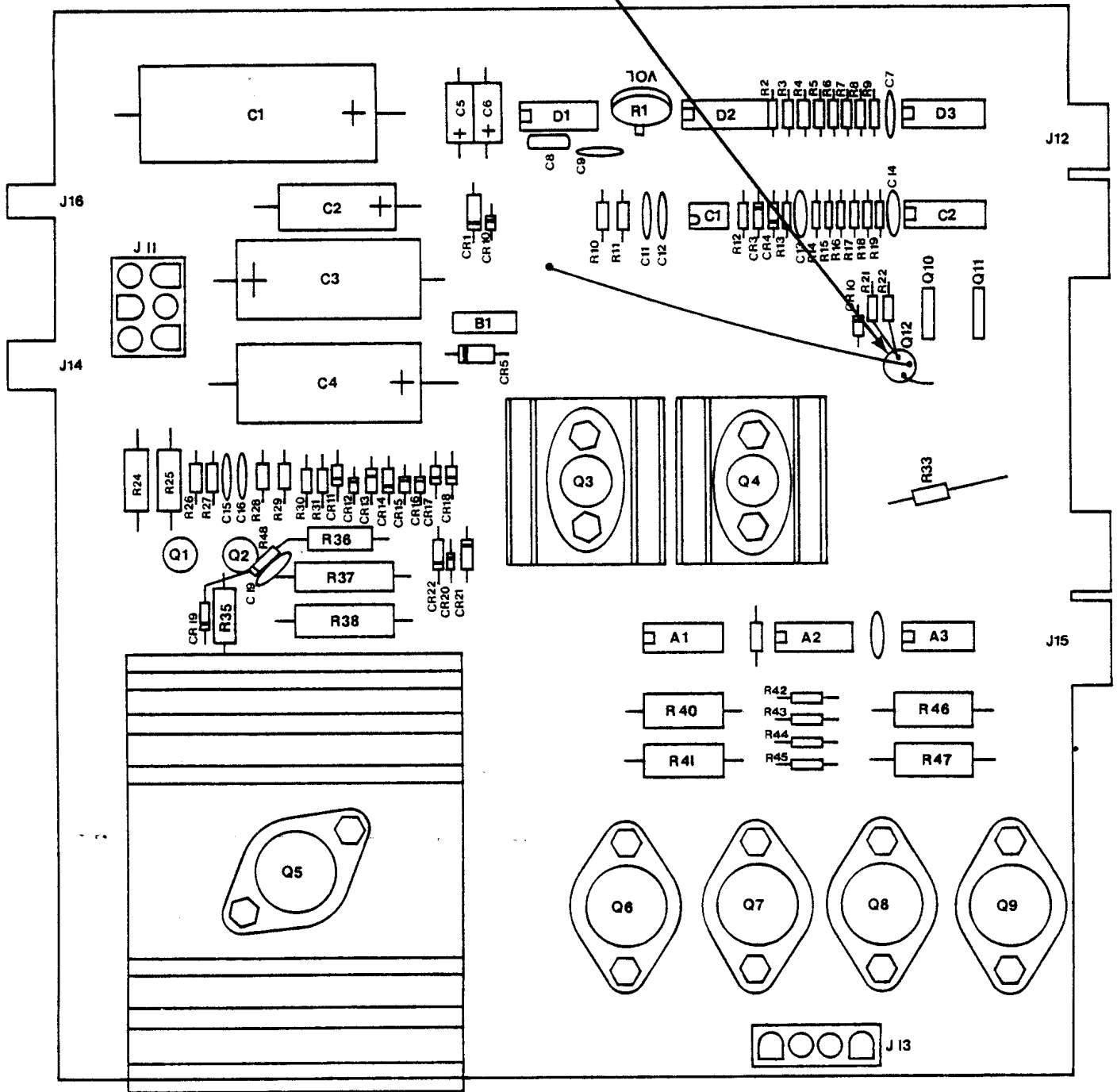
DISCRETE MATCH/CREDIT PCB



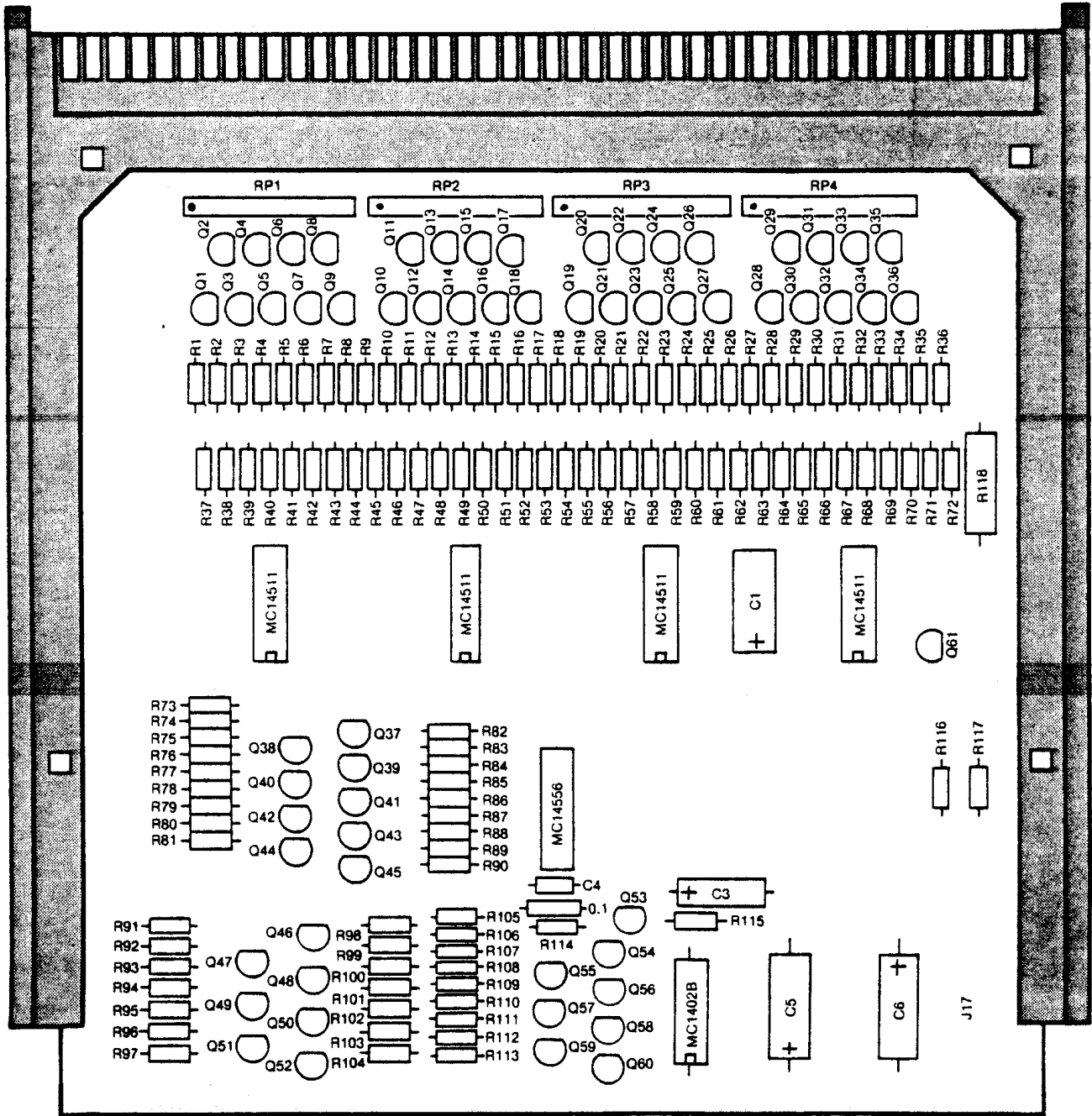
LOCATION OF POWER FAIL
MODIFICATION TRANSISTOR Q21

Processor PCB A006020
Figure TWO-2

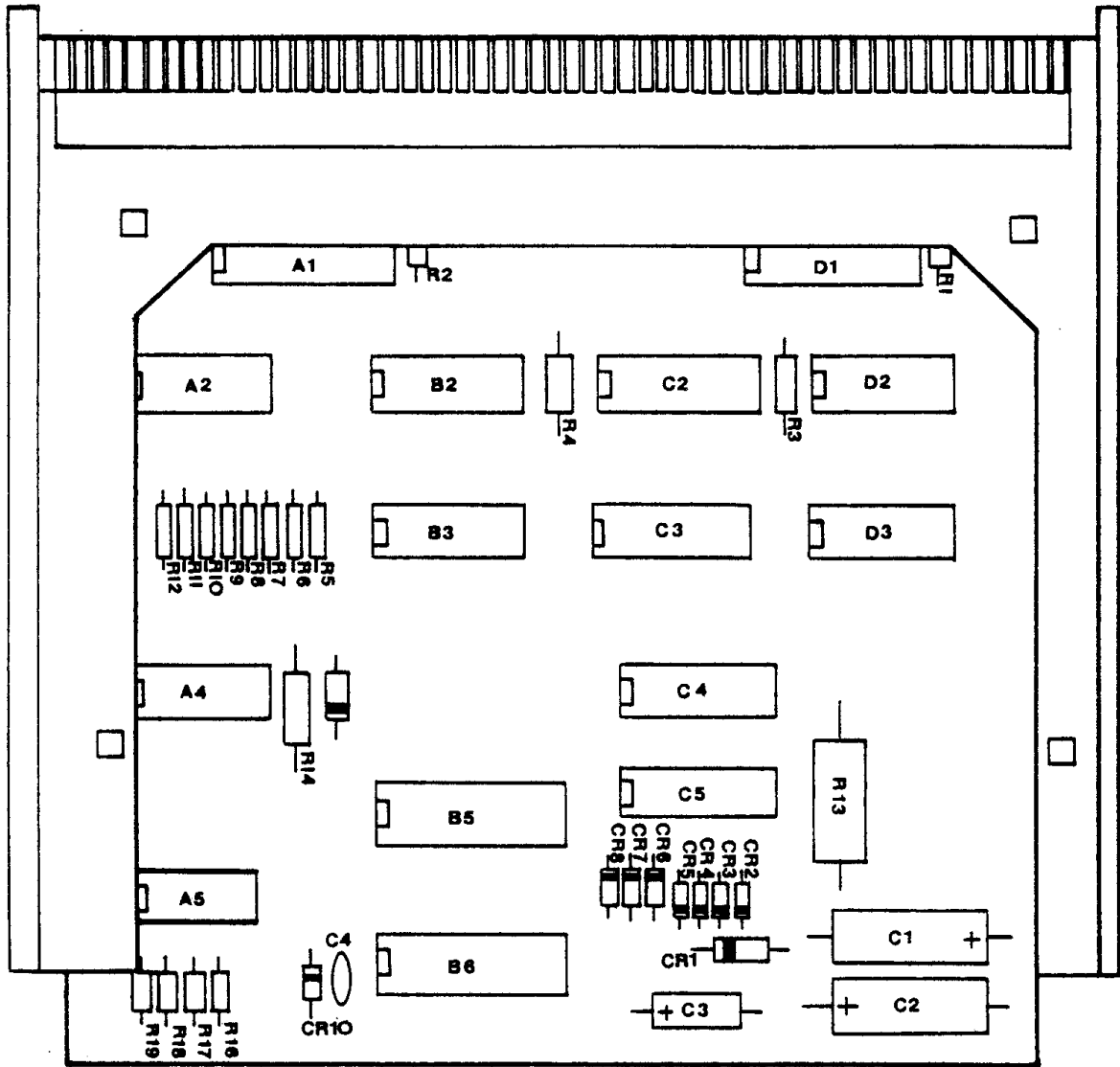
LOCATION OF POWER FAIL
MODIFICATION TRANSISTOR Q12



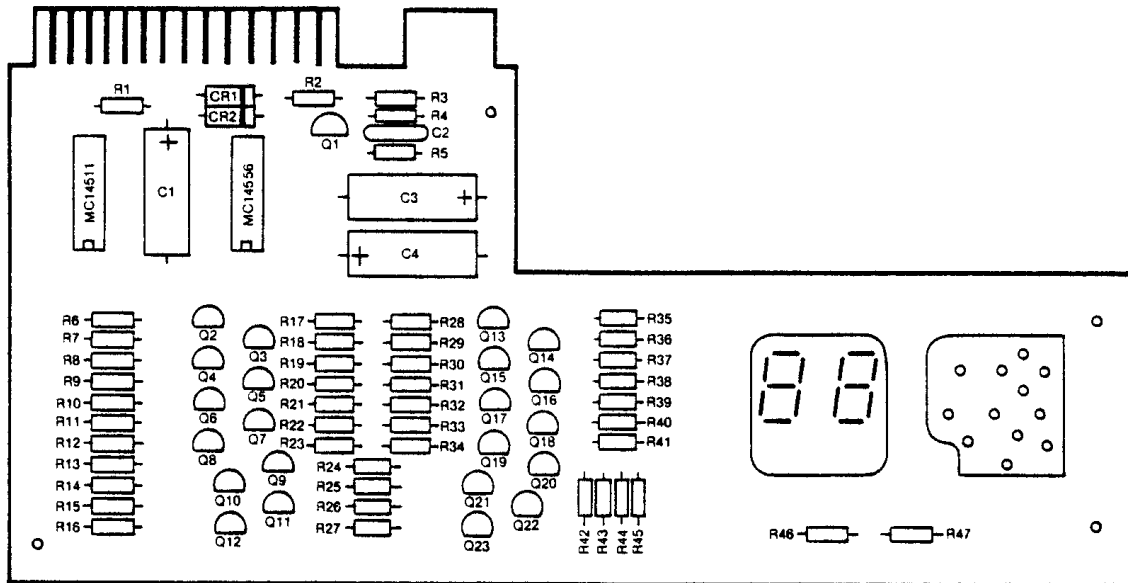
Auxiliary PCB A006407
Figure TWC-3



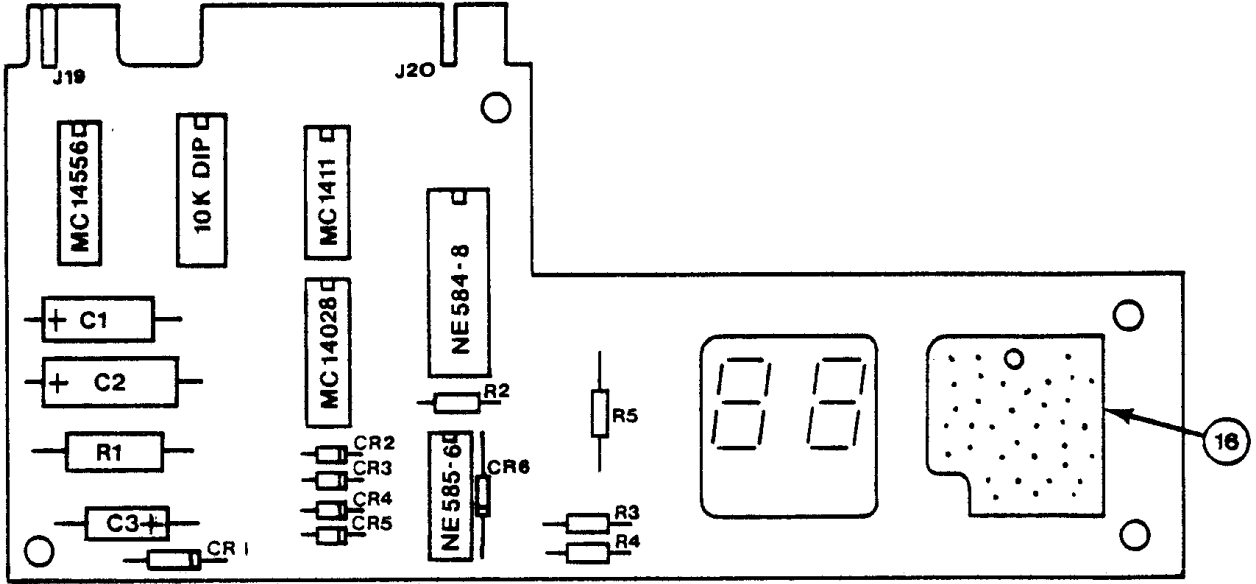
Discrete Score Display A020704
Figure TWO-4



"Old" Score Display PCB A004924
Figure TWO-5

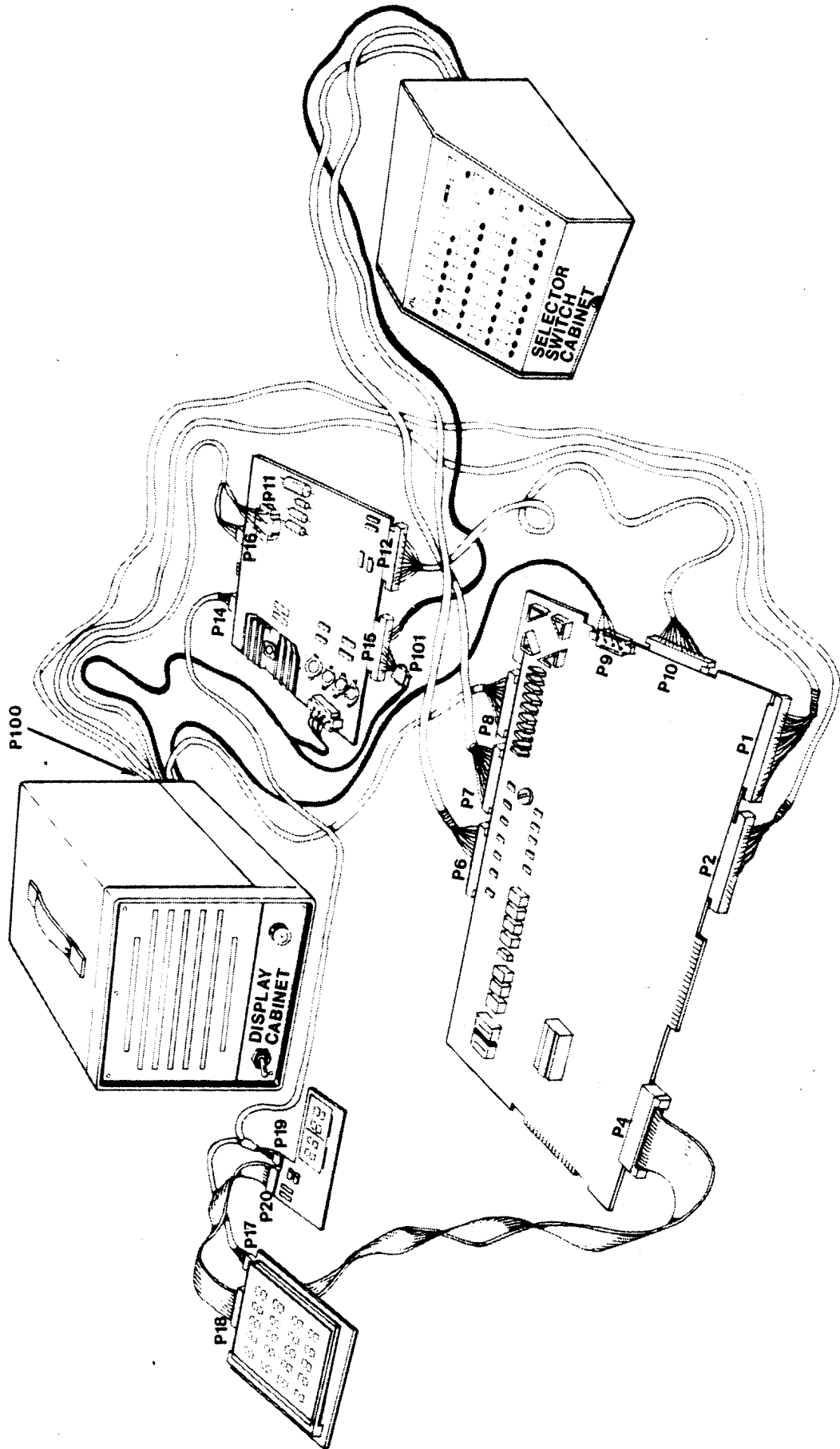


Discrete Match/Credit PCB A030912
Figure TWO-6



"Old" Match/Credit Display PCB A006096
Figure TWO-7

Connecting PBS-1
Figure THREE-1



A. What is PBS-1?

Atari's PBS-1 is a complete Pinball playfield simulator contained in two packages: 1) Display Cabinet, and 2) Selector Switch Cabinet.

The Display Cabinet is the big black box with the handle on its top. Inside this cabinet is a power supply that provides all voltages equivalent to the power supply of a Pinball game cabinet. There is also a 100-watt light bulb that closely simulates the load of a Playfield or Coin Door solenoid.

B. How to Use PBS-1

Use of Atari's PBS-1 is based on a complete test set. A set of "known to be good" Atari Pinball PCBs are connected to PBS-1. The Pinball PCBs are supplied by you. The Processor and Auxiliary PCBs should both be updated to include the POWER FAIL modifications (see Section 1).

To test a PCB with a suspected failure, just substitute the suspect PCB into the system and perform the Test procedure, contained later in this section. If a failure is found, troubleshoot with the appropriate troubleshooting procedure as referenced in the test procedure.

Since the playfield solenoids and switches are different on each game, a set of two cardboard overlays are provided for each game. The overlays for the Display Cabinet define the function of each LED and the two game toggle switches. The overlays for the Selector Switch Cabinet define the function of each pushbutton switch and the two game toggle switches.

Look at the overlays. All the information that you would normally find on a wiring diagram is contained on overlays. The overlays for the Display Cabinet have eight rows of boxes. The first six rows define the J1 and J2 Lamp Outputs of the Processor PCB. These are identified by the brackets, on the right side of the overlays, marked P1 and P2. In the fourth, fifth, and sixth rows, the far left boxes are double-lined boxes. These LEDs are the J15 lamp outputs of the Auxiliary PCB. These are identified by the double box labeled P15, located directly below the LEDs. The last two rows of LEDs are from the J8 Solenoid Output of the Processor PCB. These are identified by the bracket, on the right side of the overlay, marked P8. The two arrows, on the left side at rows two and three, identify the switch positions for the different games.

The overlays for the Selector Switch Cabinet have four rows of boxes. The boxes are light-lined, heavy-lined, and double-lined. The light-lined boxes define the J7 Switch Outputs from the Processor PCB. These are identified by the light-lined box labeled P7, at the top right of the overlay. The heavy-lined boxes define the J6 Switch Outputs from the Processor PCB. These are identified by the heavy-lined box labeled P6, at the top right of the overlay. The double-lined boxes define the J15 switch inputs to the Auxiliary PCB. These are identified by the double-lined box labeled P15, at the top right of the overlay. The two arrows by the COIN-1 and COIN-2 pushbuttons identify the slide switch positions for the different games.

C. Connecting PBS-1

Figure THREE-1 illustrates how PBS-1 is connected on your test bench. Please be aware of the following warning.

WARNING

There is a differential voltage of 180 volts DC on the Auxiliary, Score and Match/Credit PCBs. Use extreme caution when touching these PCBs to prevent the hazard of electrical shock.

PBS-1 is relatively easy to connect. Just connect the harness plugs labeled with a P-number to the proper PCB connector labeled with the same J-number. When connecting the P8 connector plug to the Processor PCB, please be aware of the following caution:

CAUTION

If you incorrectly plug P8 onto Processor PCB connectors J7 or J6, then apply power, you will blow a hell of a lot of circuits. DON'T DO IT! P8 belongs on connector J8.

D. Testing Atari Pinball PCBs

There are four test procedures immediately following this chapter. The test procedure for The Atarians is in Table 3-1, Time 2000 in Table 3-2, Airborne Avenger in Table 3-3, and Middle Earth in Table 3-4.

The four test procedures are written in basically the same order. Although the order may vary slightly, it is based on the following format:

<u>Test Step</u>	<u>Test Question</u>	<u>PCB Under Test</u>
1. Apply power	Attract?	Processor PCB
	Lamps?	Processor & Auxiliary PCB
	Solenoids off?	Processor PCB
	Display?	Processor, Auxiliary, and Display PCBs
2. Coin	Timer?	Processor
	Audio?	Processor & Auxiliary PCBs
3. Start	Display?	Processor & Display PCBs
	Audio?	Processor
4. Self-Test, Step 1	Display?	Processor & Display PCBs
5. Self-Test, Step 2	Lamps?	Processor PCB
6. Self-Test, Step 3	Switches?	Processor PCB
	Solenoids?	Processor PCB

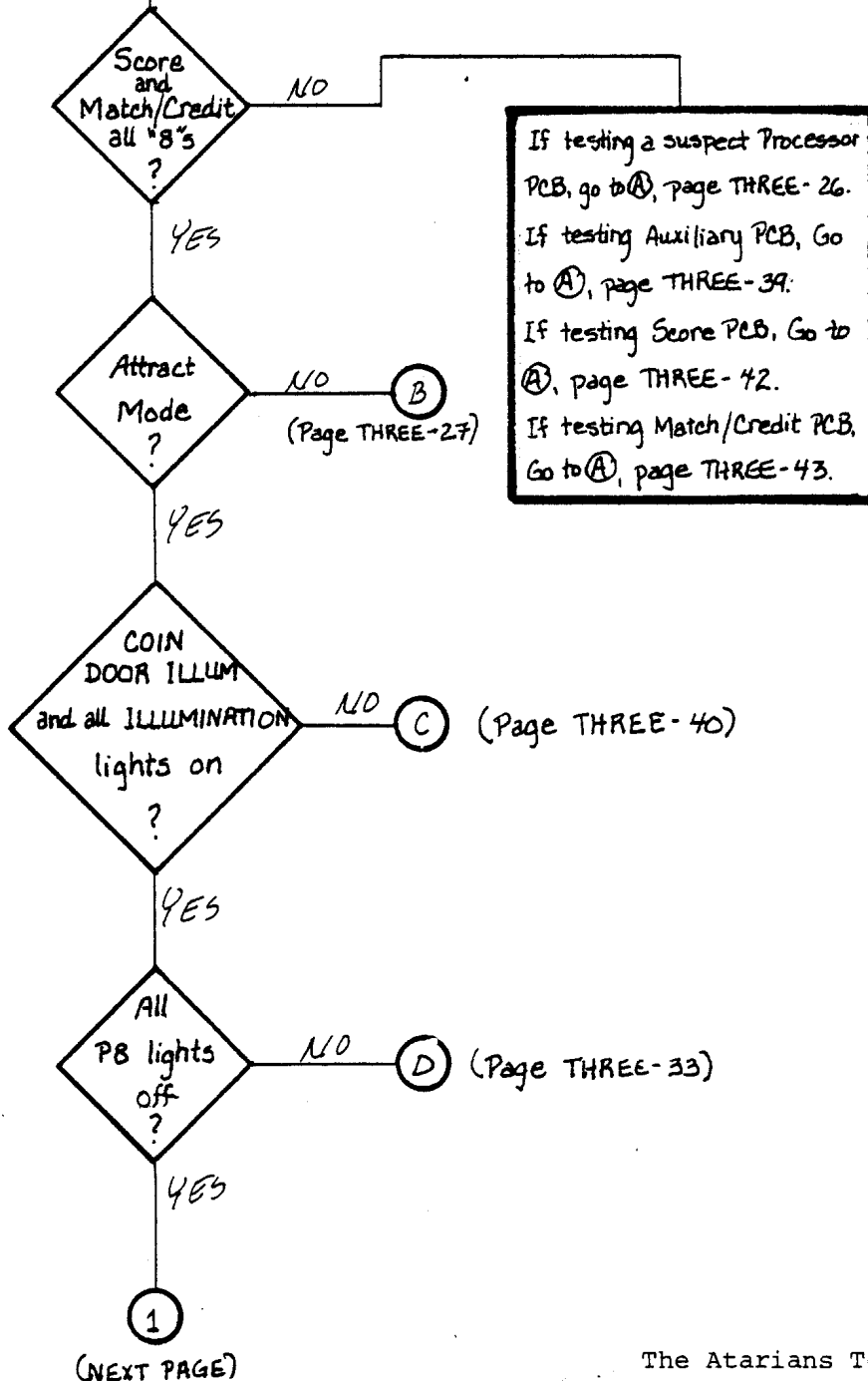
The test procedures are presented in the form of a flowchart. In these charts a rectangle represents an instruction. A diamond represents a decision. The progression of the test flowchart is to first perform the instruction (press switches), then make a decision (is the proper light on? - Yes? No?). Of course, if a decision results in a No, then a failure exists and you begin troubleshooting.

To troubleshoot, match the alphabetic letter of the No extension of the diamond to the proper Troubleshooting Flowchart. The Troubleshooting Flowcharts are immediately following the four Test Flowcharts. Please see Table of Contents for arrangement of flowcharts.

We have attempted to provide Troubleshooting Flowcharts that steer you in the direction of the failing circuit. Section THREE provides schematics that isolate the circuits and therefore may be quite helpful for isolating the failing circuit.

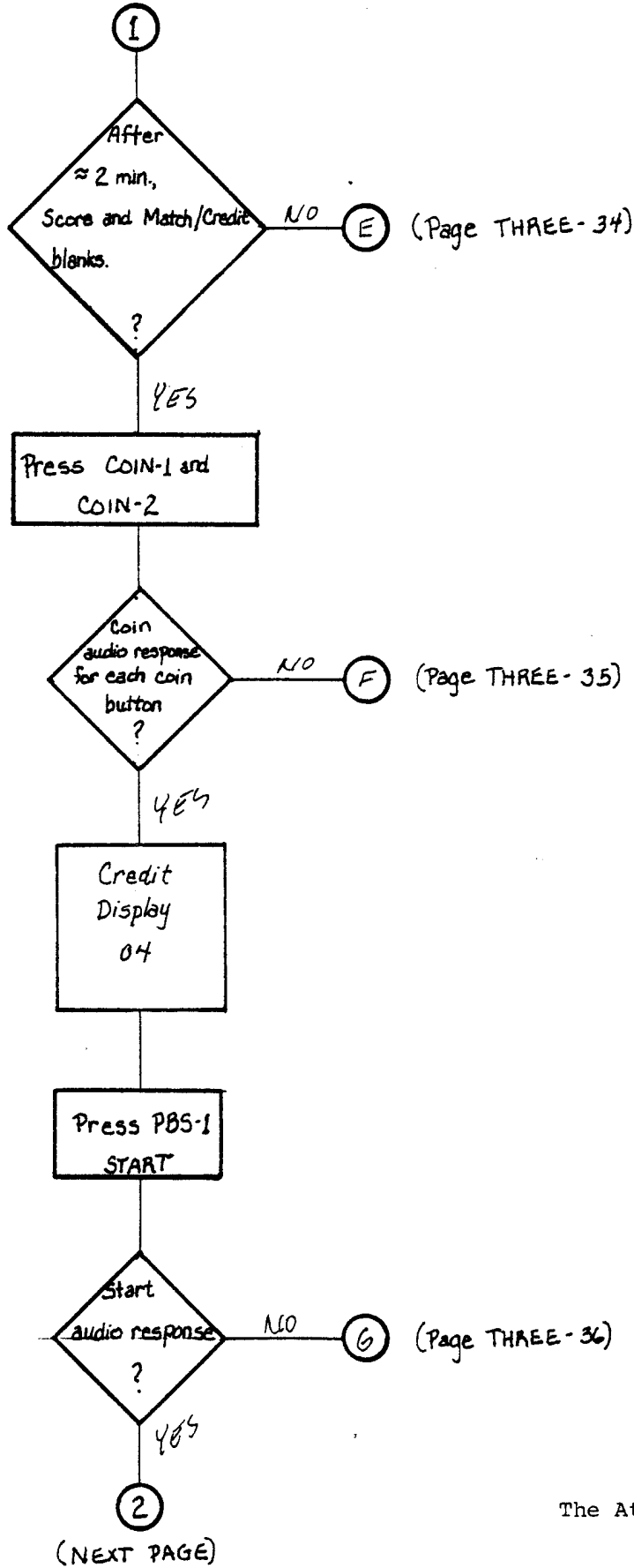
Substitute PCB into system. On the Processor PCB, set all F2 and F4 switch toggles to OFF. Set REPLAY rotary switch to 0. Set PBS-1 POWER switch to ON. See Note.

NOTE: If the +90 and/or -90VDC Display voltage on the Auxiliary PCB is bad (too high, too much ripple, etc.), the Score and Match/Credit Displays could be damaged. Therefore, if testing a suspect Auxiliary PCB, leave plug P14 disconnected until you verify that the Display voltages are correct.



If testing a suspect Processor PCB, go to (A), page THREE-26.
 If testing Auxiliary PCB, Go to (A), page THREE-39.
 If testing Score PCB, Go to (A), page THREE-42.
 If testing Match/Credit PCB, Go to (A), page THREE-43.

(From Previous Page)



The Atarians Test Procedure
Flowchart 3-1

(From Previous Page)

②

Set Processor PCB PROG SW1 (F2), toggle 1 to ON, press RESET, then set PROG SW1 toggle 1 to OFF.

Score Display
040 000
030 000
020 000
1

Press PBS-1
START

Score Display
040 000
030 000
020 000
2

All
labeled PBS-1
P1 and P-2
lights on
?

NO

H

(Page THREE - 37)

NOTE 1: Do not be concerned if some unlabeled lights are on.

YES

Press PBS-1
START

③

(NEXT PAGE)

The Atarians Test Procedure
Flowchart 3-1

(From Previous Page)

3

Score Display
040 000
030 000
020 000
3

One at a time, press
all labeled PBS-1 but-
tons (except START).

Audio
response for
each pressed
button
?

NO

NOTE 2: Do not be concerned if
pressing some unlabeled
button results in an
audio response.

Troubleshoot SWITCH
OUTPUT AND INPUT
circuit.

YES

See Note 3.
Press PBS-1
START

NOTE 3: When START is pressed,
P8 lights begin light-
ing immediately.

Solenoids
activate as
listed in Table on
next page
?

NO

I (Page THREE-38)

Score Display
040 000
030 000
020 000
4

Set PBS-1 power off.
PCB is OK.

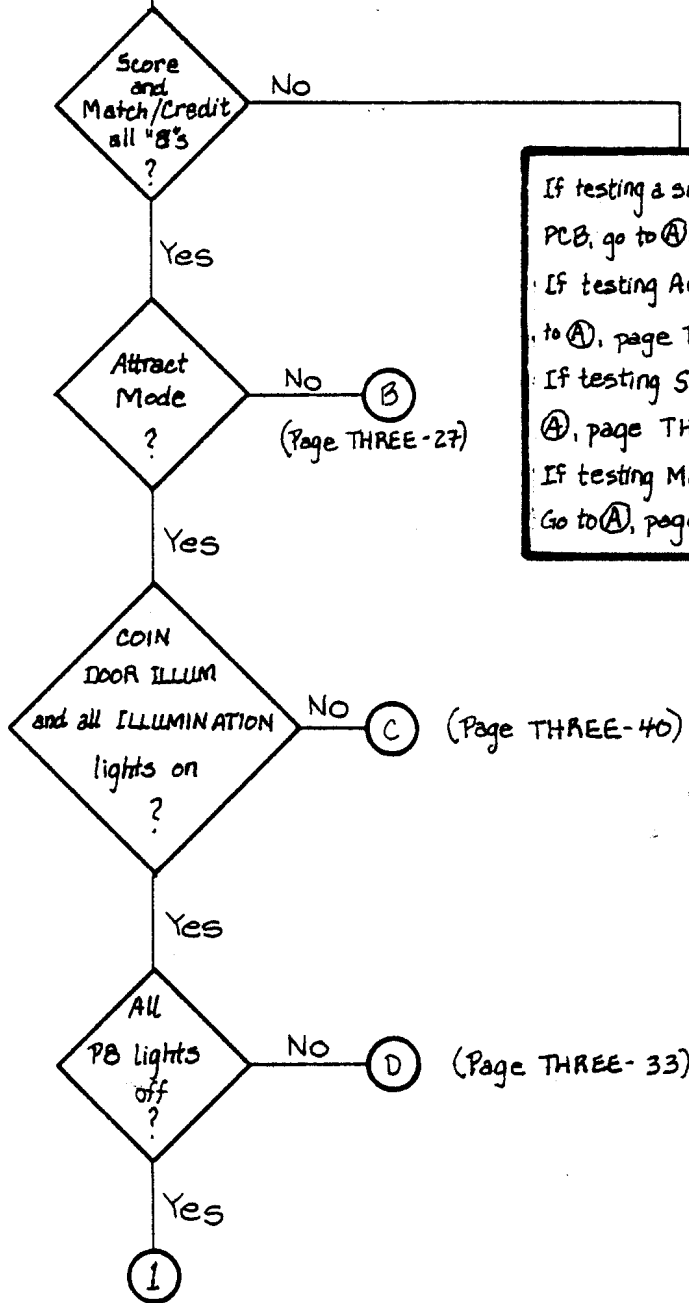
The Atarians Solenoid Test

Table 3-1

CREDIT DISPLAY NUMBER	SOLENOID
1	18 LEFT GATE
2	17 RIGHT GATE
3	19 LEFT FLIPPER
4	20 RIGHT FLIPPER
5	14 ATARI HOLE KICKER
6	8 RIGHT HOLE KICKER
7	3 LEFT HOLE KICKER
8	16 RIGHT HOLE KICKER
9	6 CENTER POP BUMPER
10	4 LEFT POP BUMPER
11	9 LEFT SLINGSHOT
12	13 RIGHT SLINGSHOT
13	10 OUT-HOLE KICKER

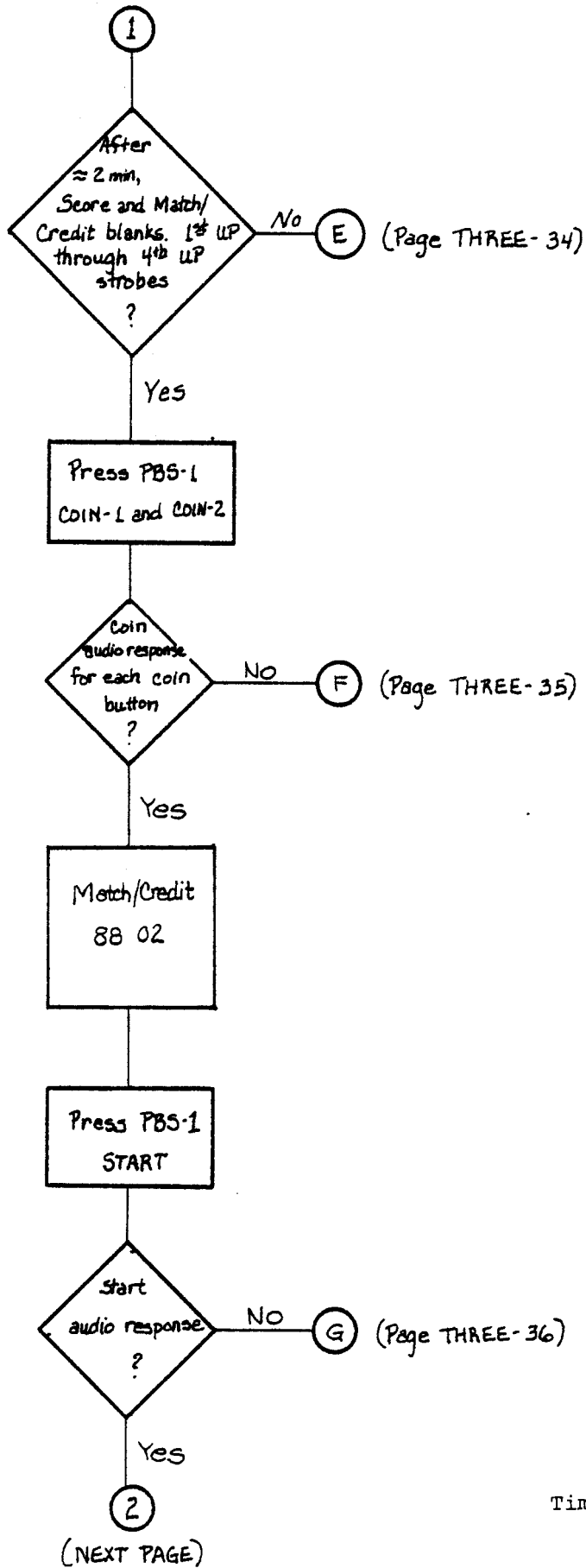
Substitute PCB into system.
 On the Processor PCB, set all F2
 and F4 switch toggles to OFF. Set
 REPLAY rotary switch to 0. Set
 PBS-1 POWER switch to ON. See Note.

NOTE: If the +90 and/or -90VDC
 Display voltage on the
 Auxiliary PCB is bad (too
 high, too much ripple, etc.),
 the Score and Match/Credit
 Displays could be damaged.
 Therefore, if testing a sus-
 pect Auxiliary PCB, leave
 plug P14 disconnected until
 you verify that the Display
 voltages are correct.



(NEXT PAGE)

(From Previous Page)



Time 2000 Test Procedure
Flowchart 3-2

(From Previous Page)

2

Set Processor PCB PROG SW1
(F2), toggle 1 to ON, press RESET,
then set PROG SW1 toggle 1 to OFF

Score Display
080 000
060 000
040 000
1

ALL
labeled
PBS-1 P1 and P2
lights on
?

No

H

(Page THREE-37)

NOTE 1: Do not be concerned
if some unlabeled
lights are on.

Yes

Press PBS-1
START

Score Display
080 000
060 000
040 000
2

One at a time, press
all labeled PBS-1 buttons
(except START)

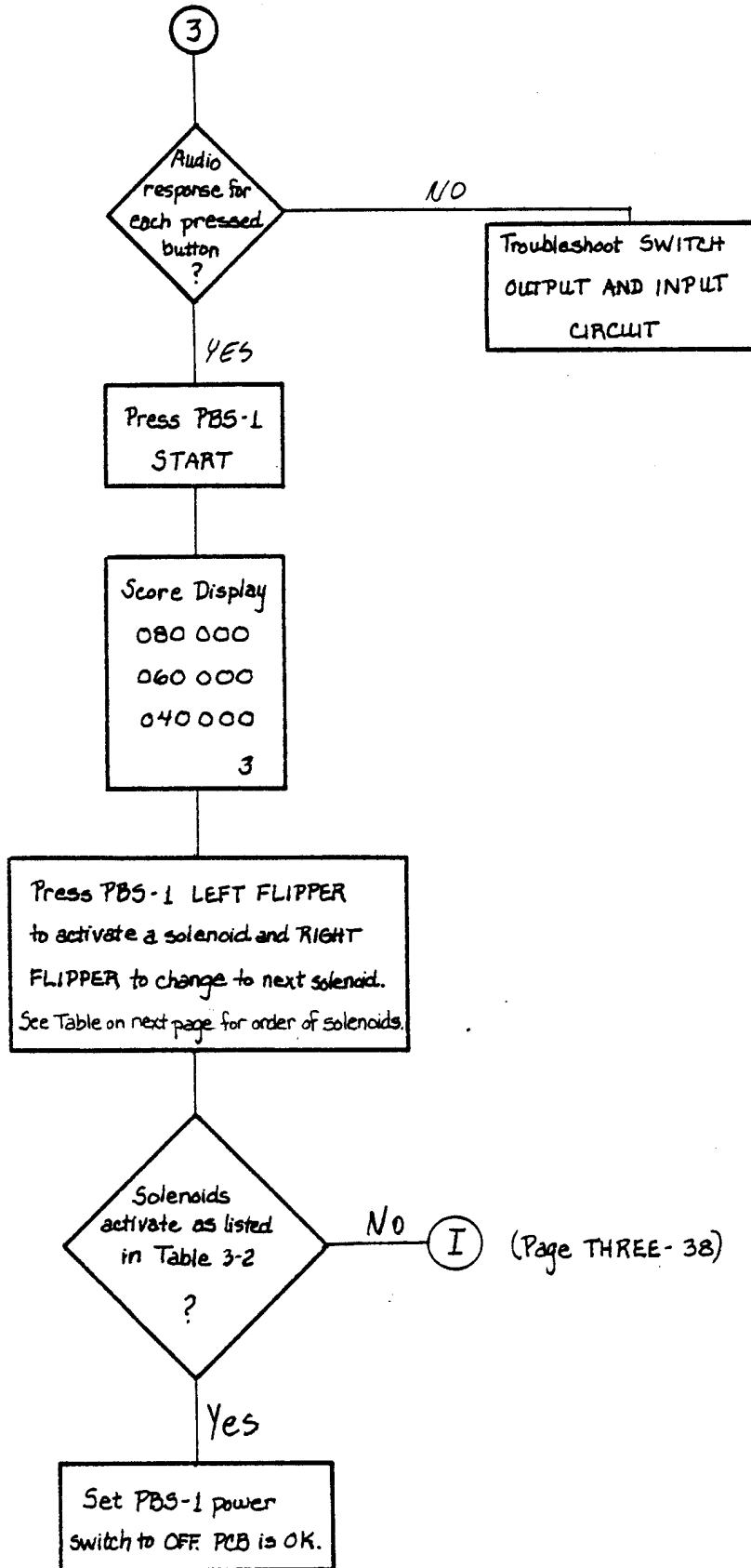
3

(NEXT PAGE)

Time 2000 Test Procedure
Flowchart 3-2

THREE-13

(From Previous Page)



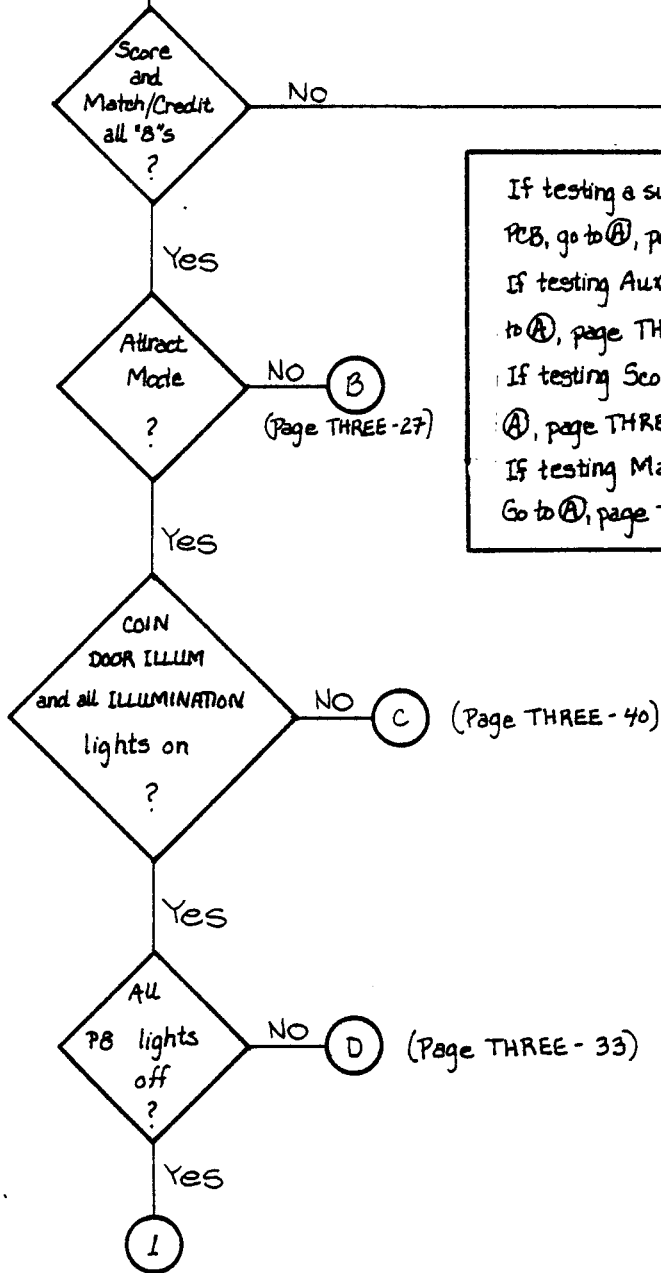
Time 2000 Test Procedure
Flowchart 3-2

Time 2000 Solenoid Test
Table 3-2

CREDIT DISPLAY NUMBER	SOLENOID
1	3 GATE
2	16 RIGHT POP BUMPER
3	4 LEFT POP BUMPER
4	14 RIGHT HOLE KICKER
5	8 CENTER HOLE KICKER
6	1 RIGHT FLIPPER
7	12 RIGHT CENTER FLIPPER
8	5 LEFT CENTER FLIPPER
9	11 LEFT FLIPPER
10	13 RIGHT SLINGSHOT
11	9 LEFT SLINGSHOT
12	10 OUT-HOLE KICKER
13	2 UPPER DROP TARGET
14	6 LOWER DROP TARGET

Substitute PCB into system. On the Processor PCB, set all F2 and F4 switch toggles to OFF. Set REPLAY rotary switch to 0. Set PBS-1 POWER switch to ON. See Note.

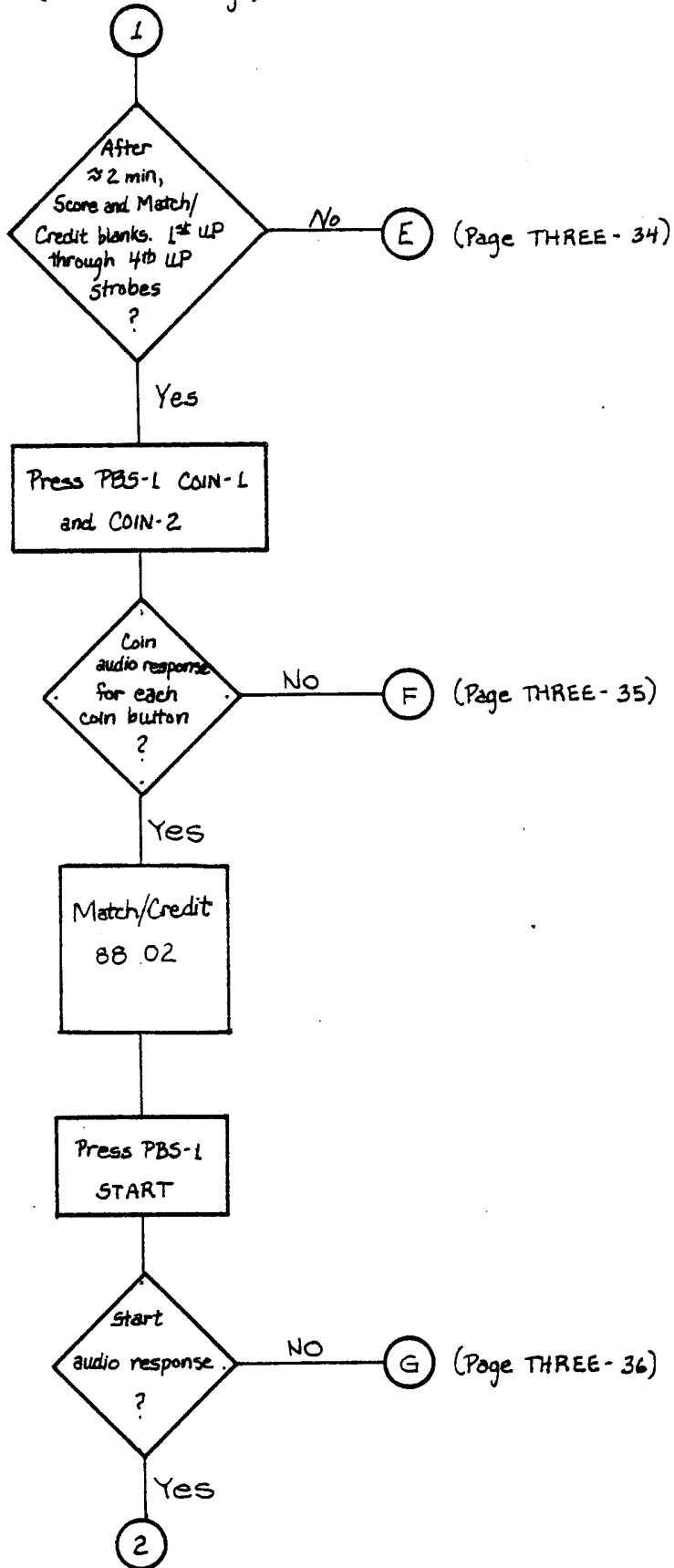
NOTE: If the +90 and/or -90VDC Display voltage on the Auxiliary PCB is bad (too high, too much ripple, etc.), the Score and Match/Credit Displays could be damaged. Therefore, if testing a suspect Auxiliary PCB, leave plug P14 disconnected until you verify that the Display voltages are correct.



If testing a suspect Processor PCB, go to (A), page THREE-26.
 If testing Auxiliary PCB, Go to (A), page THREE-39.
 If testing Score PCB, Go to (A), page THREE-42.
 If testing Match/Credit PCB, Go to (A), page THREE-43.

(NEXT PAGE)

(From Previous Page)



(NEXT PAGE)

(From Previous Page)

2

Press PBS-1 TEST SWITCH (COIN DOOR)

Score Display
090 000
070 000
050 000
1

All labeled PBS-1 P1 and P2 lights on ?

NO (H) (Page THREE-37)

Yes

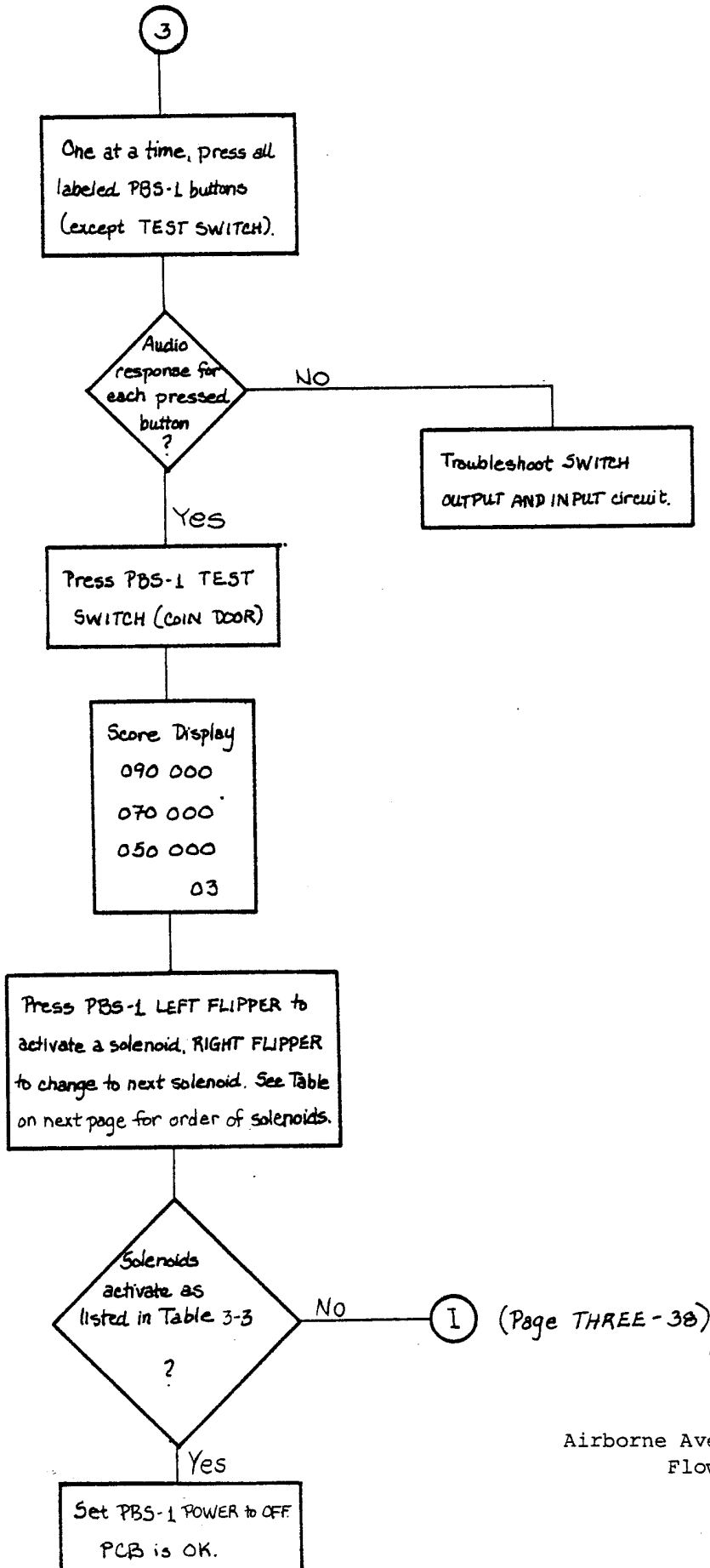
Press PBS-1 TEST SWITCH (COIN DOOR)

Score Display
090 000
070 000
050 000
2

3

(NEXT PAGE)

(From Previous Page)



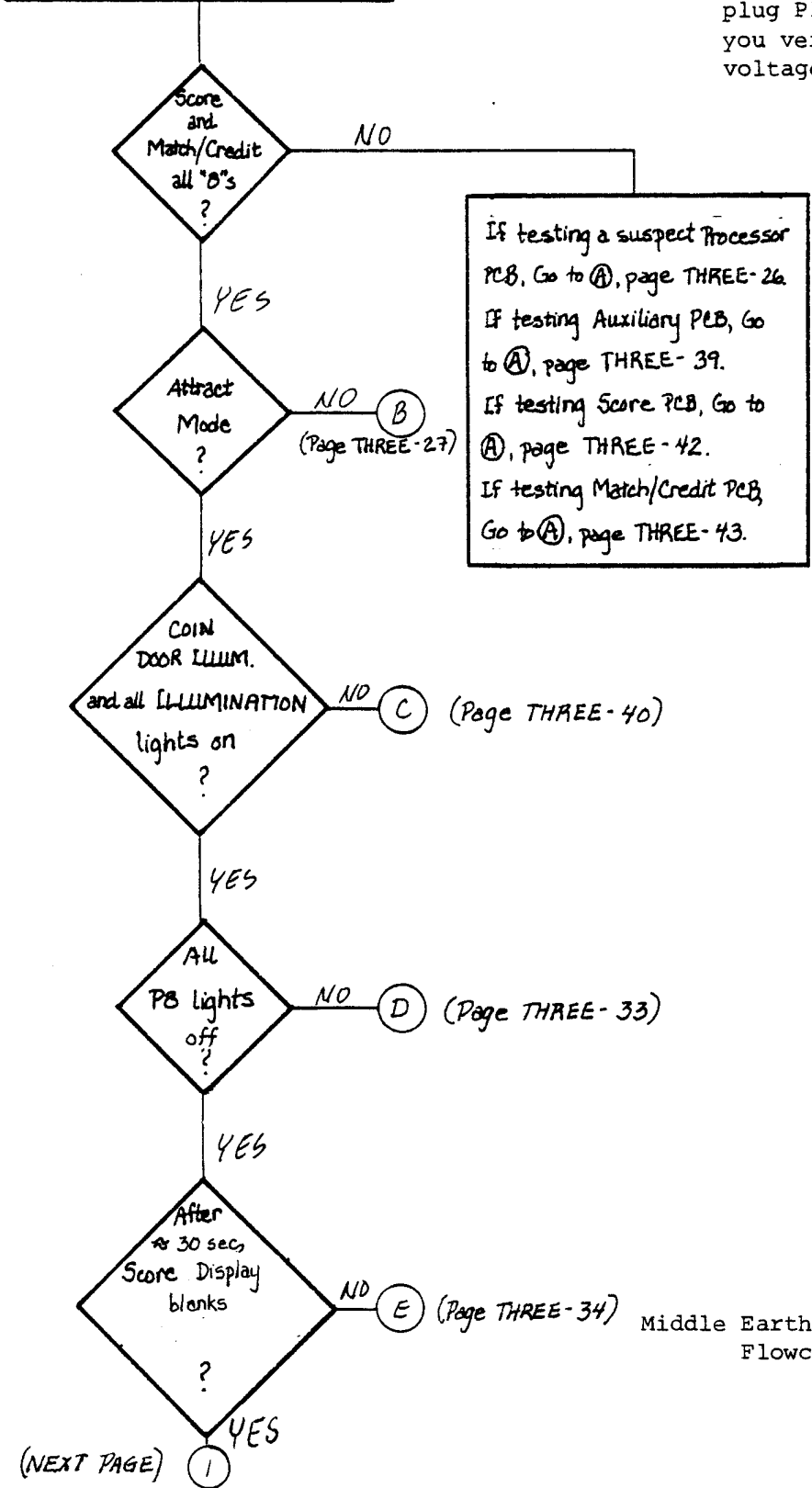
Airborne Avenger Test Procedure
Flowchart 3-3

Airborne Avenger Solenoid Test
Table 3-3

CREDIT DISPLAY NUMBER	SOLENOID		
1	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">GATE</td> </tr> </table>	3	GATE
3	GATE		
2	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">11</td> <td style="padding: 2px 5px;">LEFT FLIPPER</td> </tr> </table>	11	LEFT FLIPPER
11	LEFT FLIPPER		
3	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">RIGHT FLIPPER</td> </tr> </table>	1	RIGHT FLIPPER
1	RIGHT FLIPPER		
4	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">10</td> <td style="padding: 2px 5px;">OUT HOLE KICKER</td> </tr> </table>	10	OUT HOLE KICKER
10	OUT HOLE KICKER		
5	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">LEFT SLINGSHOT</td> </tr> </table>	9	LEFT SLINGSHOT
9	LEFT SLINGSHOT		
6	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">13</td> <td style="padding: 2px 5px;">RIGHT SLINGSHOT</td> </tr> </table>	13	RIGHT SLINGSHOT
13	RIGHT SLINGSHOT		
7	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">LEFT EJECT POCKET</td> </tr> </table>	5	LEFT EJECT POCKET
5	LEFT EJECT POCKET		
8	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">LEFT BALL EJECT</td> </tr> </table>	8	LEFT BALL EJECT
8	LEFT BALL EJECT		
9	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">14</td> <td style="padding: 2px 5px;">RIGHT BALL EJECT</td> </tr> </table>	14	RIGHT BALL EJECT
14	RIGHT BALL EJECT		
10	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">12</td> <td style="padding: 2px 5px;">RIGHT EJECT POCKET</td> </tr> </table>	12	RIGHT EJECT POCKET
12	RIGHT EJECT POCKET		
11	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">UPPER LEFT THUMPER</td> </tr> </table>	4	UPPER LEFT THUMPER
4	UPPER LEFT THUMPER		
12	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">16</td> <td style="padding: 2px 5px;">UPPER RIGHT THUMPER</td> </tr> </table>	16	UPPER RIGHT THUMPER
16	UPPER RIGHT THUMPER		
13	<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">LOWER RIGHT THUMPER</td> </tr> </table>	2	LOWER RIGHT THUMPER
2	LOWER RIGHT THUMPER		

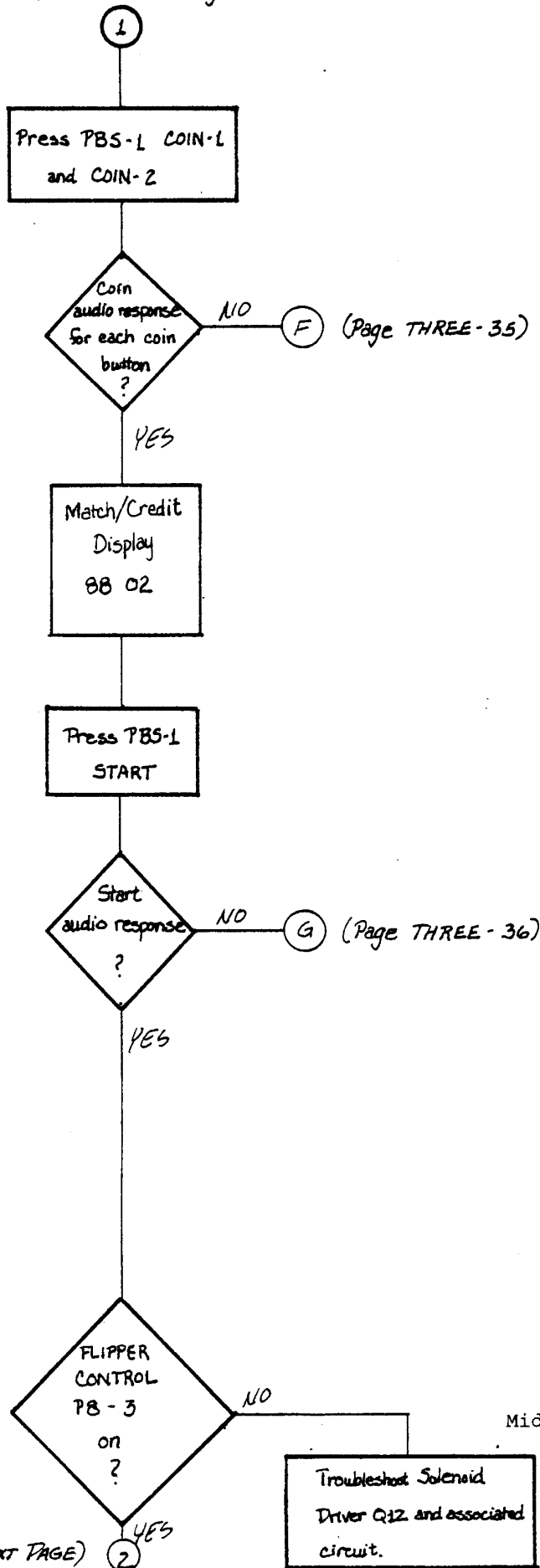
Substitute PCB into system. On Processor PCB, set all F2 and F4 switch toggles to OFF. Set REPLAY rotary switch to 0. Set PBS-1 POWER switch to ON.

NOTE: If the +90 and/or -90VDC Display voltage on the Auxiliary PCB is bad (too high, too much ripple, etc.), the Score and Match/Credit Displays could be damaged. Therefore, if testing a suspect Auxiliary PCB, leave plug P14 disconnected until you verify that the Display voltages are correct.



Middle Earth Test Procedure
Flowchart 3-4

(From Previous Page)

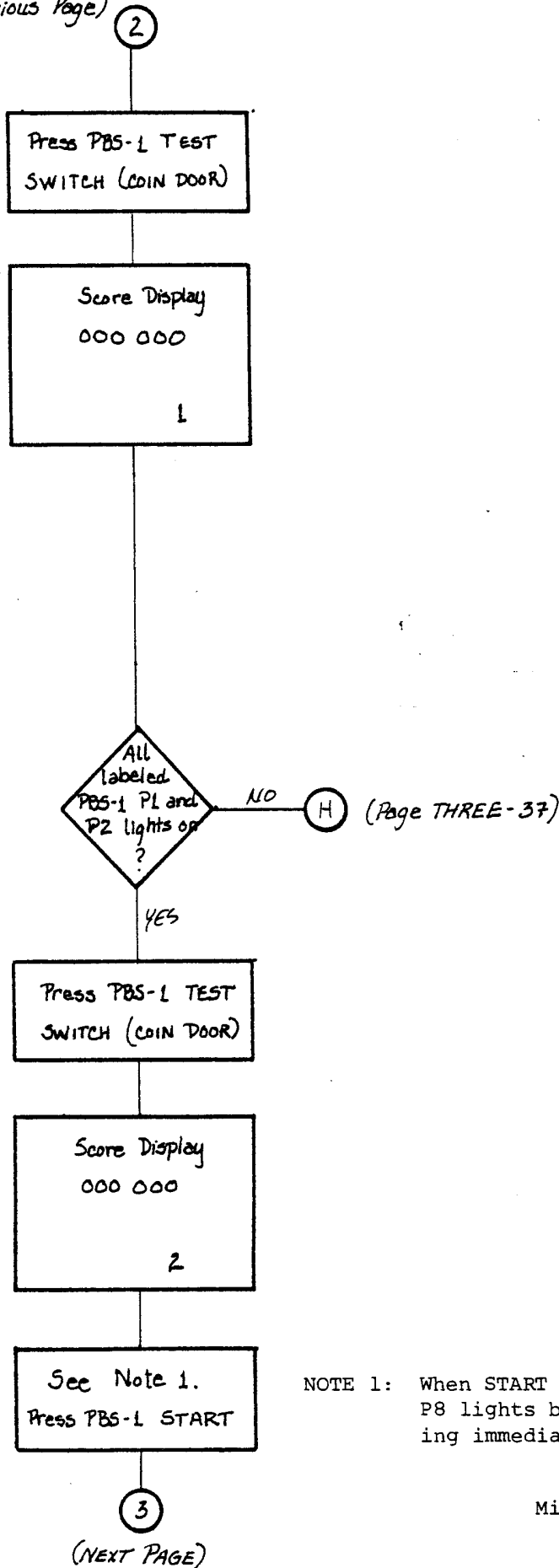


THREE-22

Middle Earth Test Procedure
Flowchart 3-4

(NEXT PAGE)

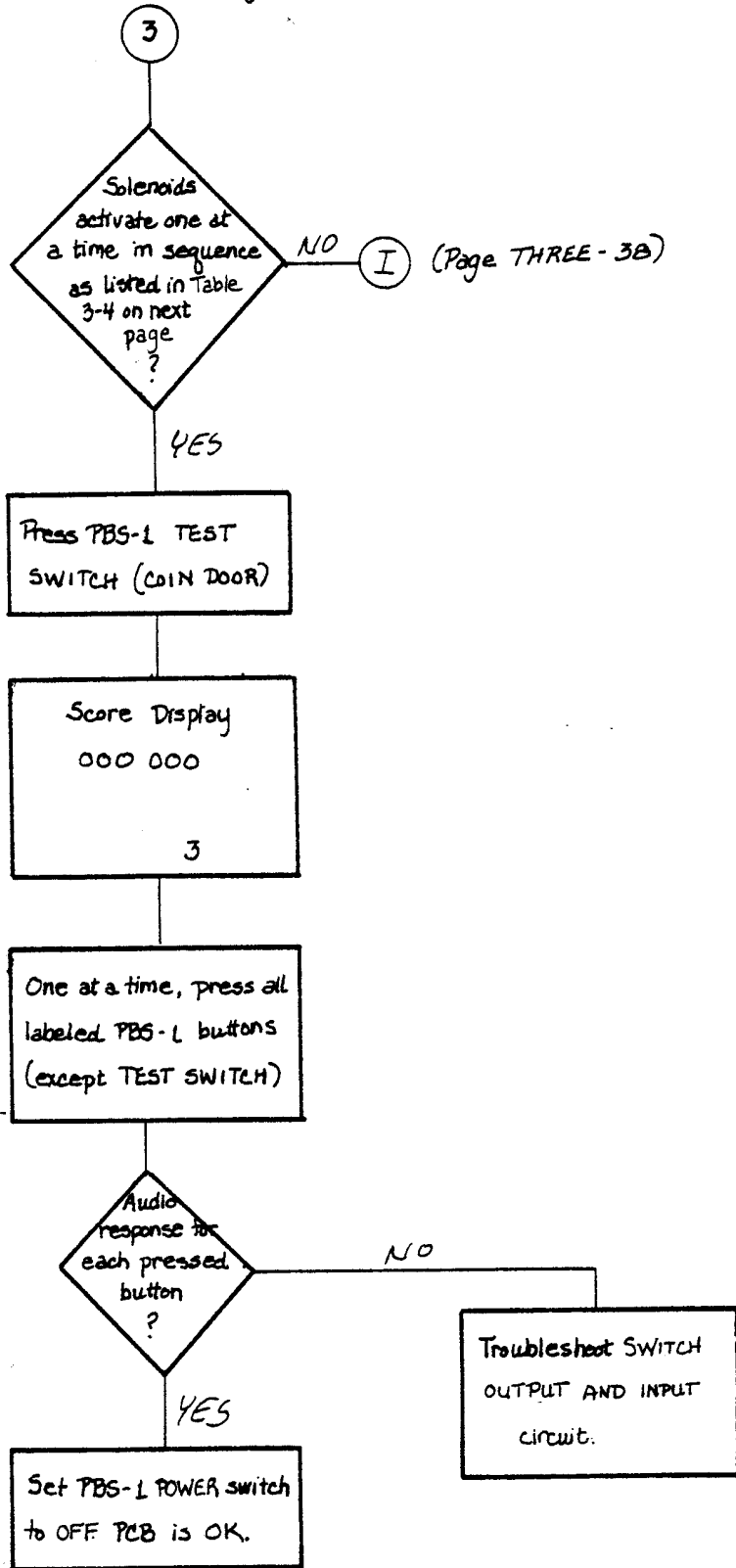
(From Previous Page)



NOTE 1: When START is pressed, P8 lights begin lighting immediately.

Middle Earth Test Procedure
Flowchart 3-4

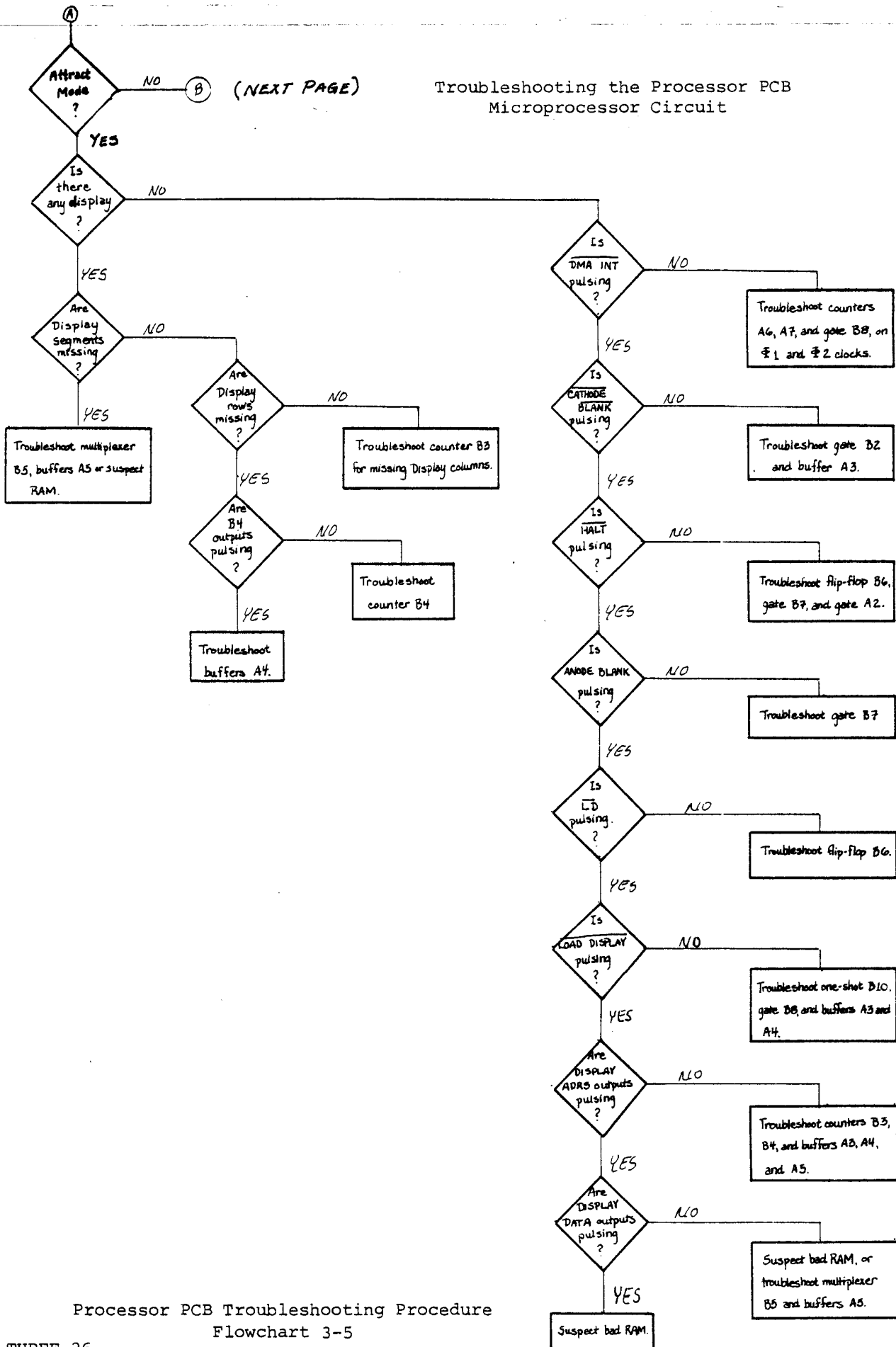
(From Previous Page)



Middle Earth Solenoid Test
Table 3-4

CREDIT DISPLAY NUMBER	SOLENOID
1	2 OUTHOLE KICKER
2	9 RIGHT SLINGSHOT
3	10 UPPER DROP TARGET
4	1 RIGHT THUMPER-BUMPER
5	4 LEFT THUMPER BUMPER
6	11 LOWER DROP TARGET
7	13 LEFT SLINGSHOT
8	10 LOCKOUT COIL

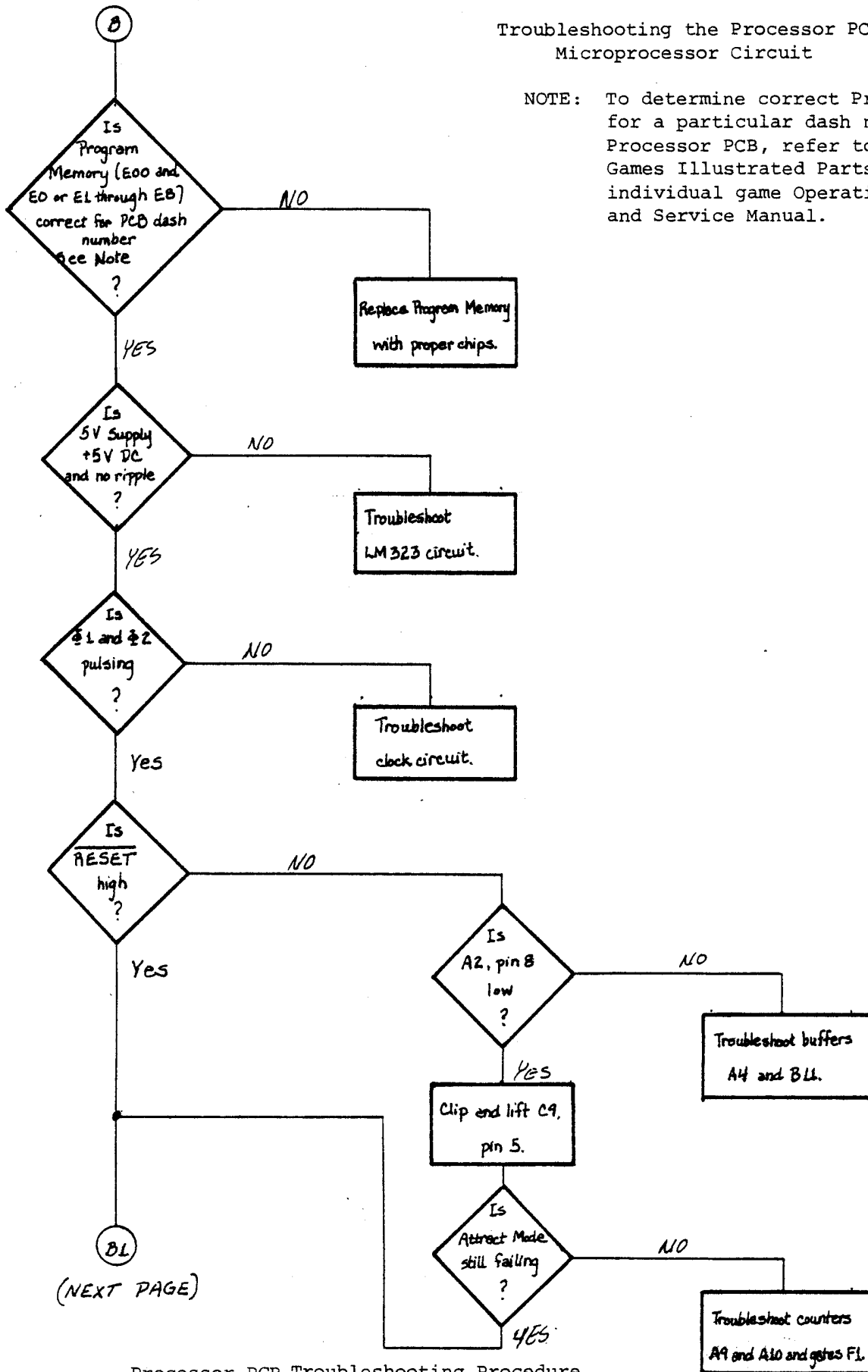
Troubleshooting the Processor PCB
Microprocessor Circuit



(From Previous Page)

Troubleshooting the Processor PCB Microprocessor Circuit

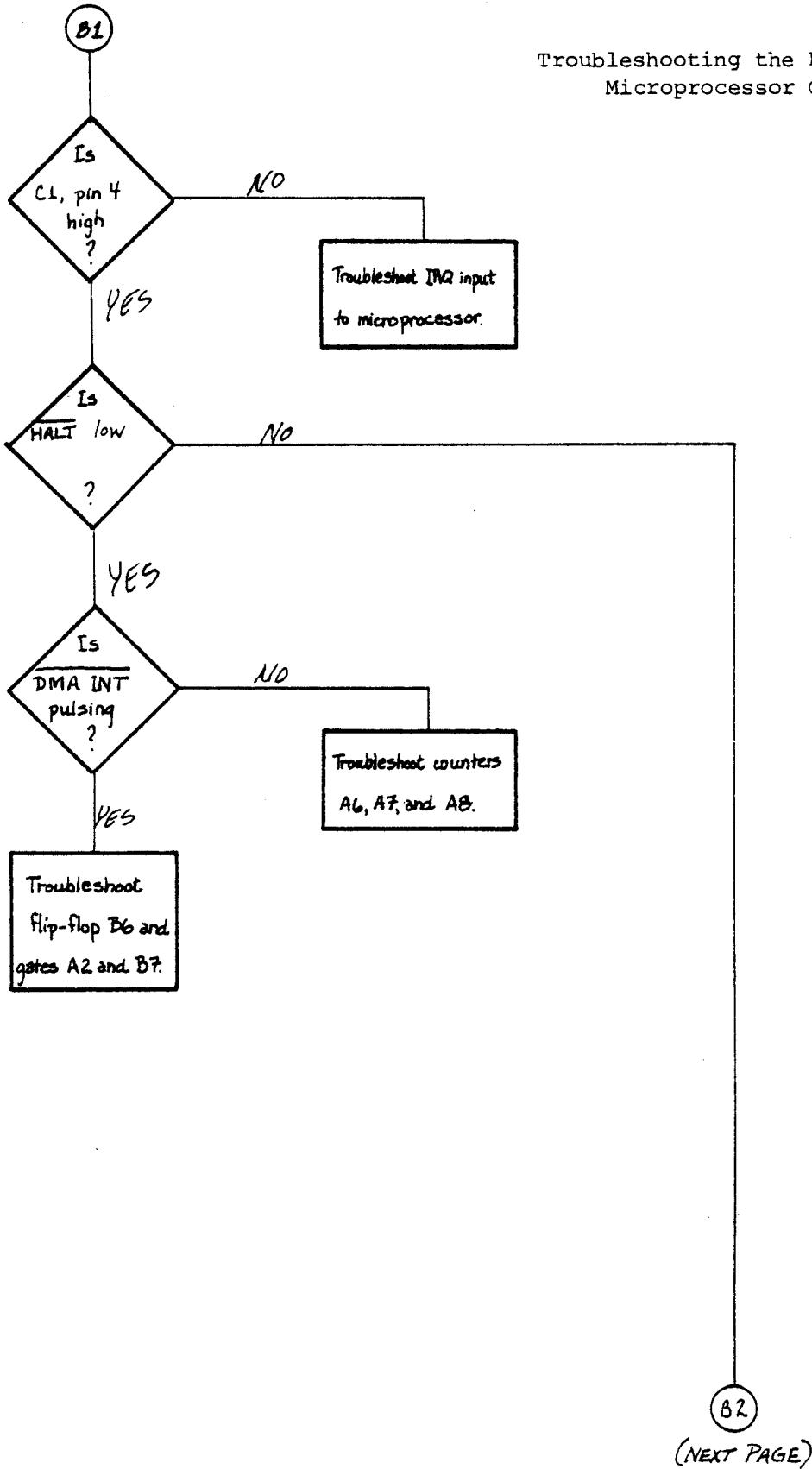
NOTE: To determine correct Program Memory for a particular dash number of Processor PCB, refer to Atari Pinball Games Illustrated Parts Catalog or individual game Operation, Maintenance and Service Manual.



(NEXT PAGE)

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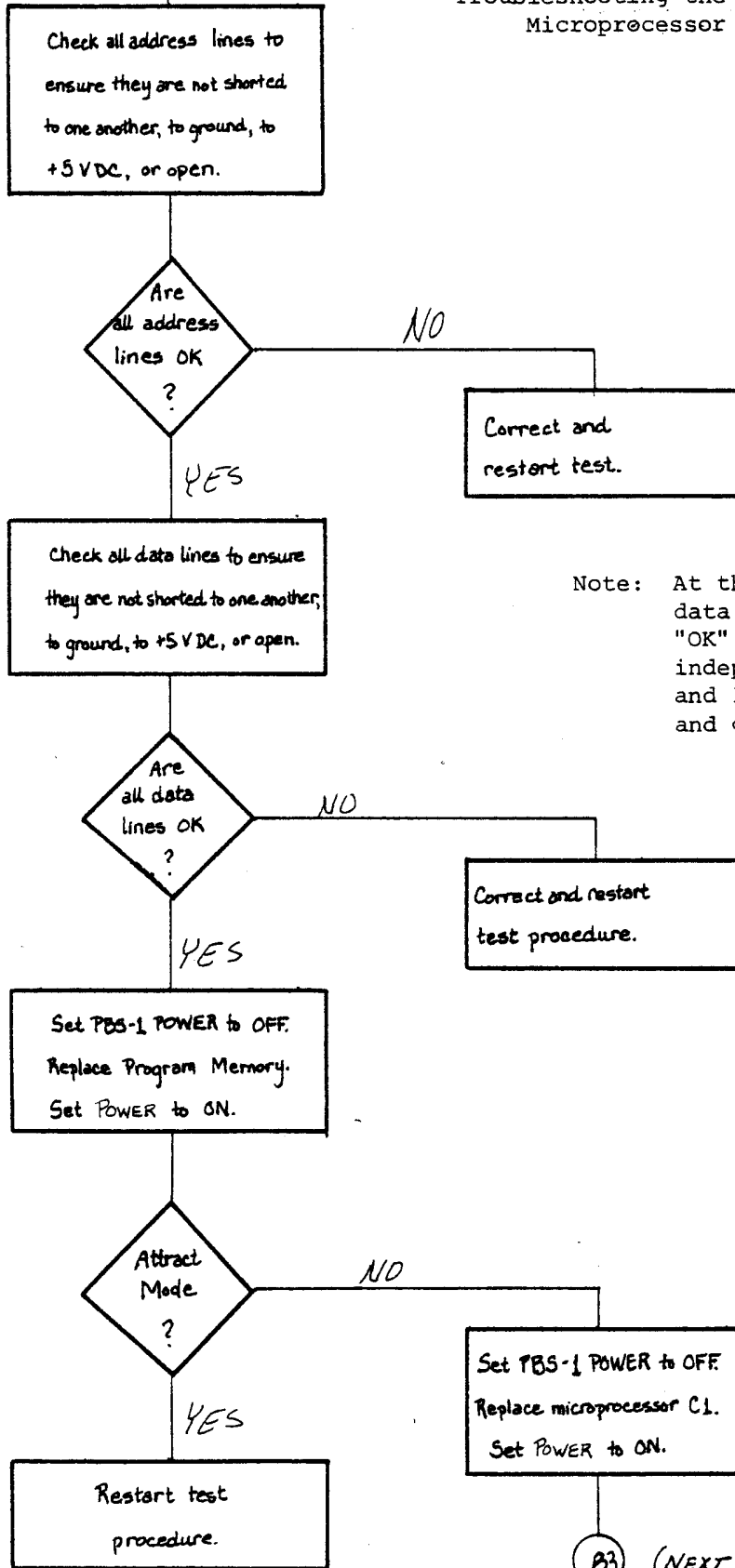
Troubleshooting the Processor PCB
Microprocessor Circuit



(From Previous Page)

B2

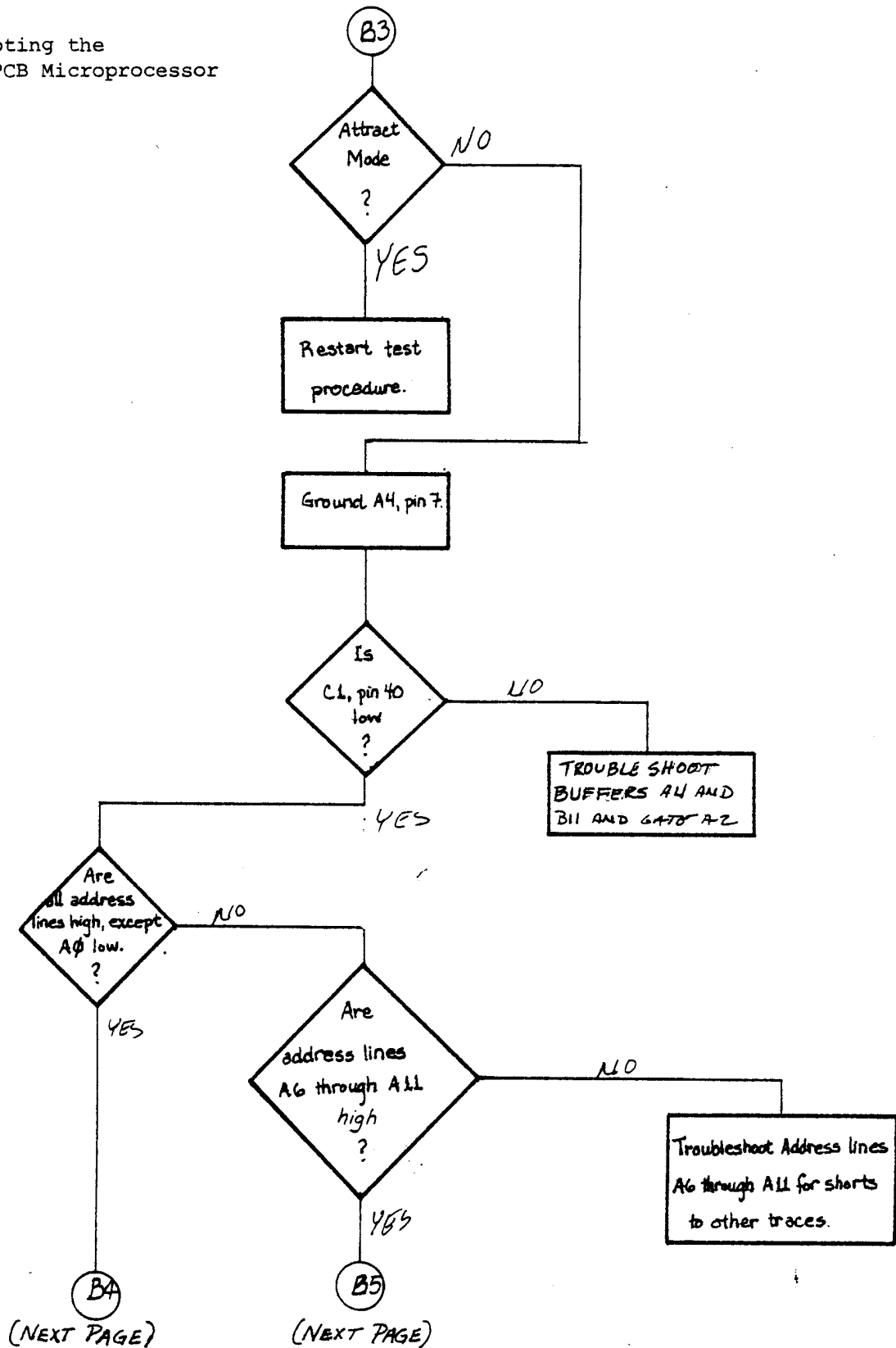
Troubleshooting the Processor PCB Microprocessor Circuit



Note: At this point, address and data lines are considered "OK" if they appear to be independently pulsing high and low, i.e. less than 0.7V and greater than 3.8V.

Troubleshooting the
Processor PCB Microprocessor
Circuit

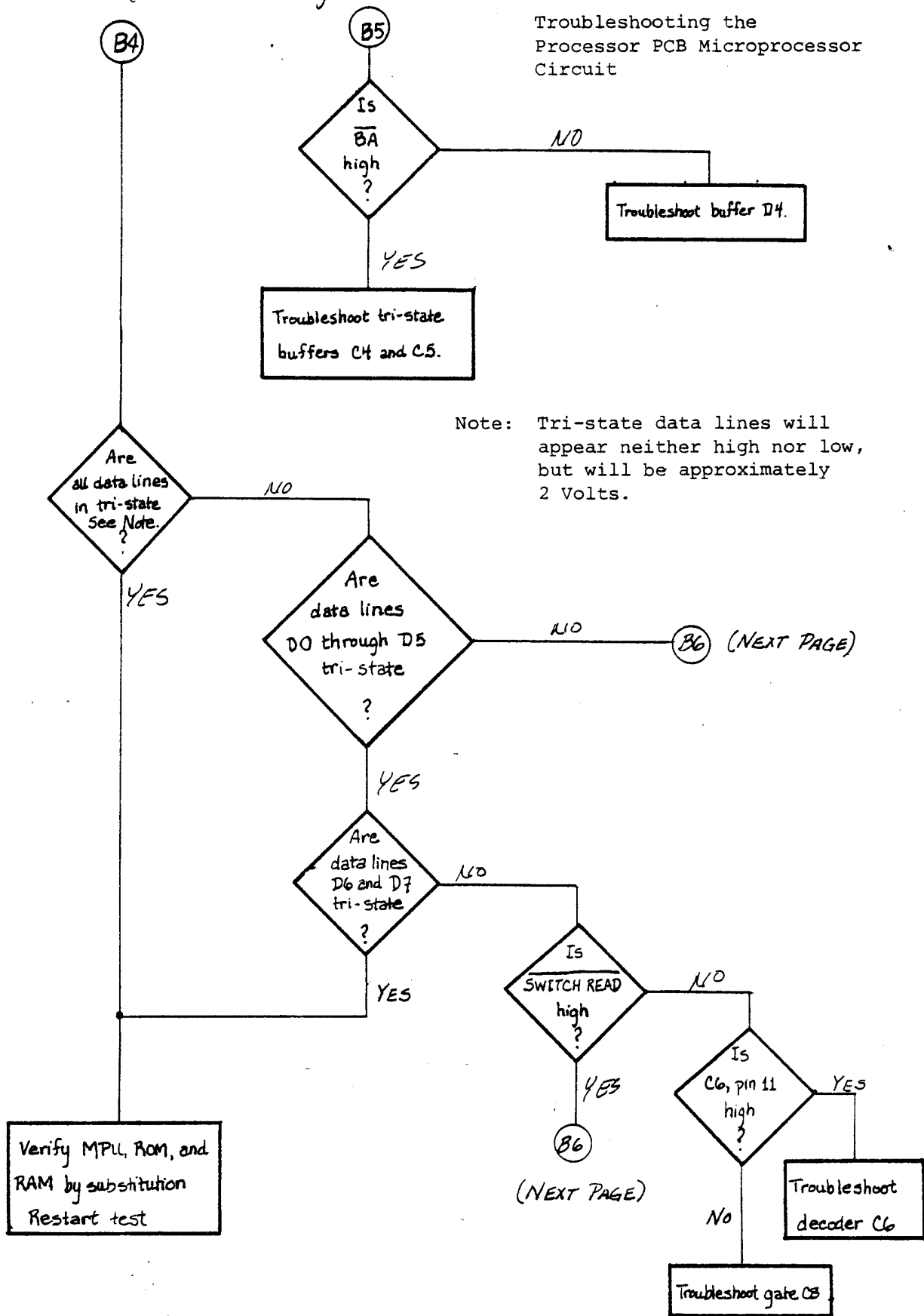
(From Previous Page)



Processor PCB Troubleshooting Procedure
Flowchart 3-5

(From Previous Page)

Troubleshooting the Processor PCB Microprocessor Circuit

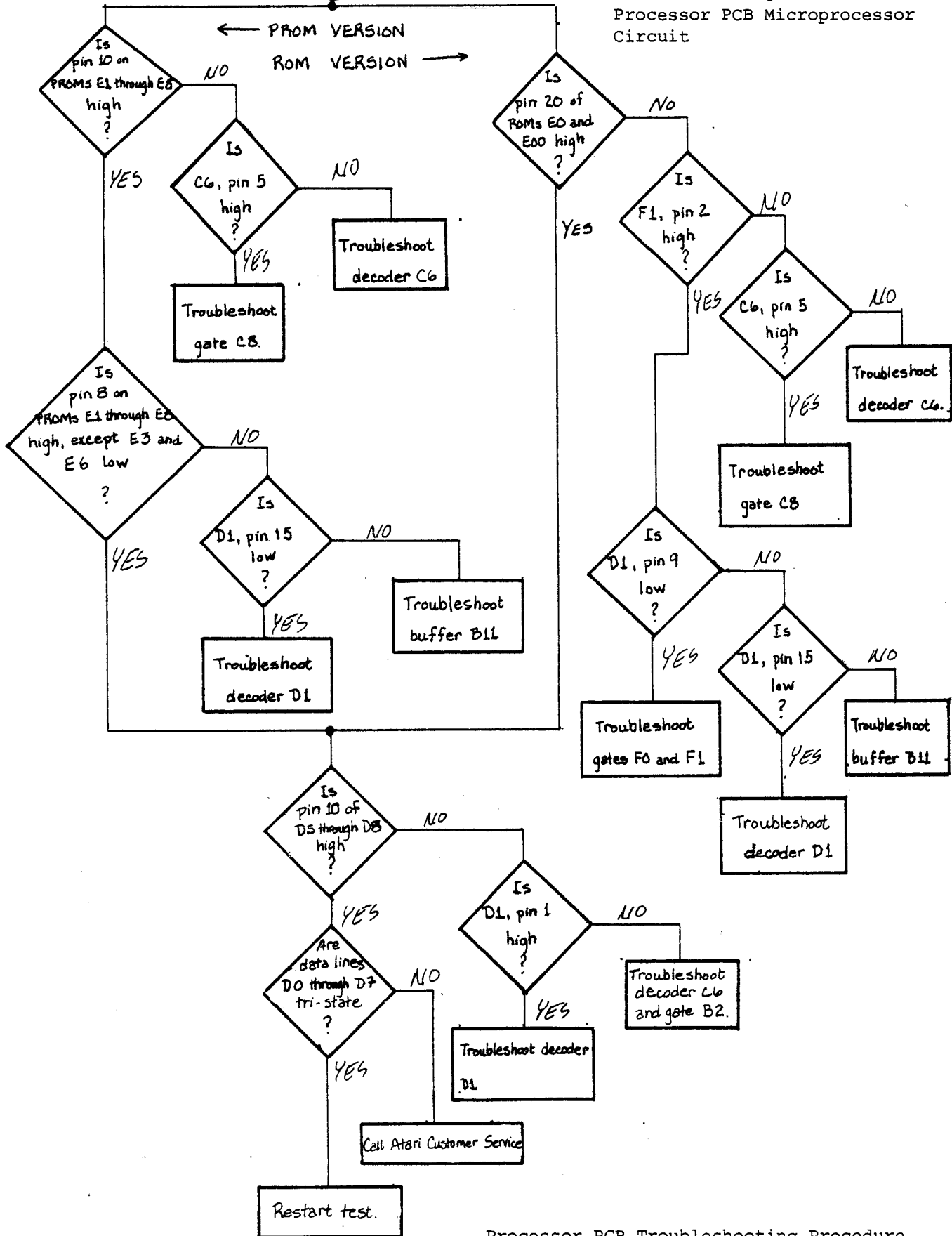


Note: Tri-state data lines will appear neither high nor low, but will be approximately 2 Volts.

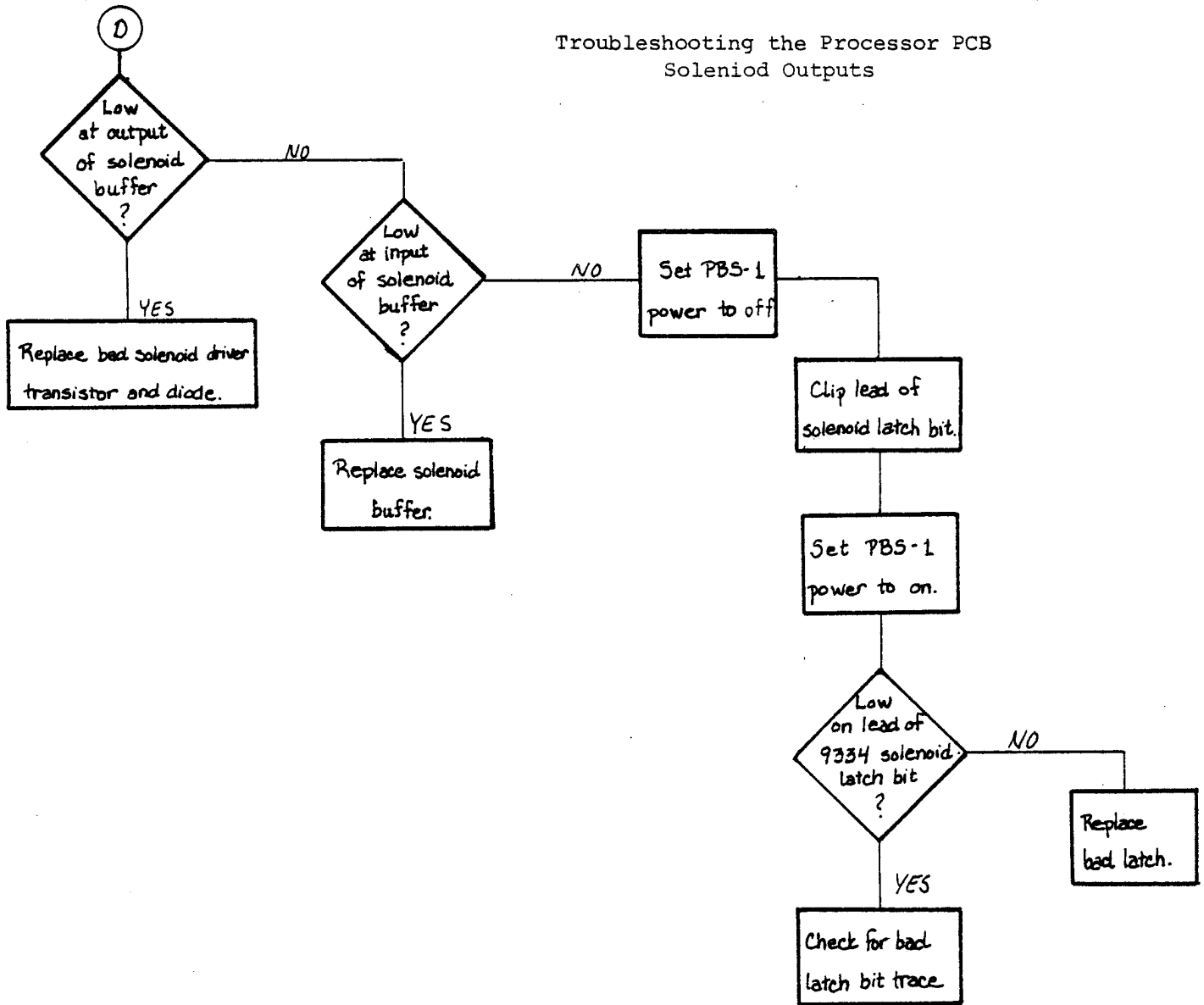
(From Previous Page)

86

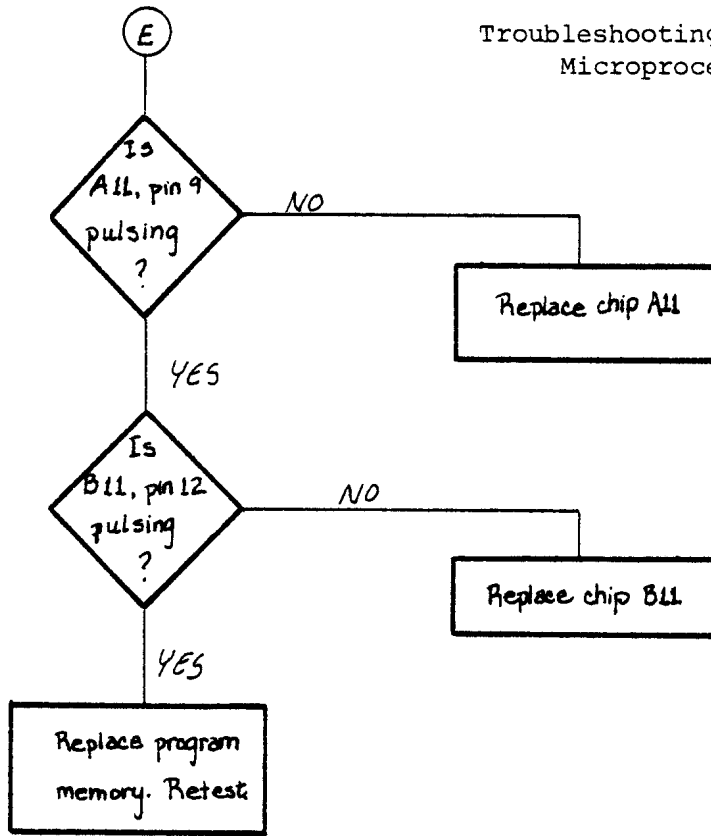
Troubleshooting the Processor PCB Microprocessor Circuit



Troubleshooting the Processor PCB
Solenoid Outputs

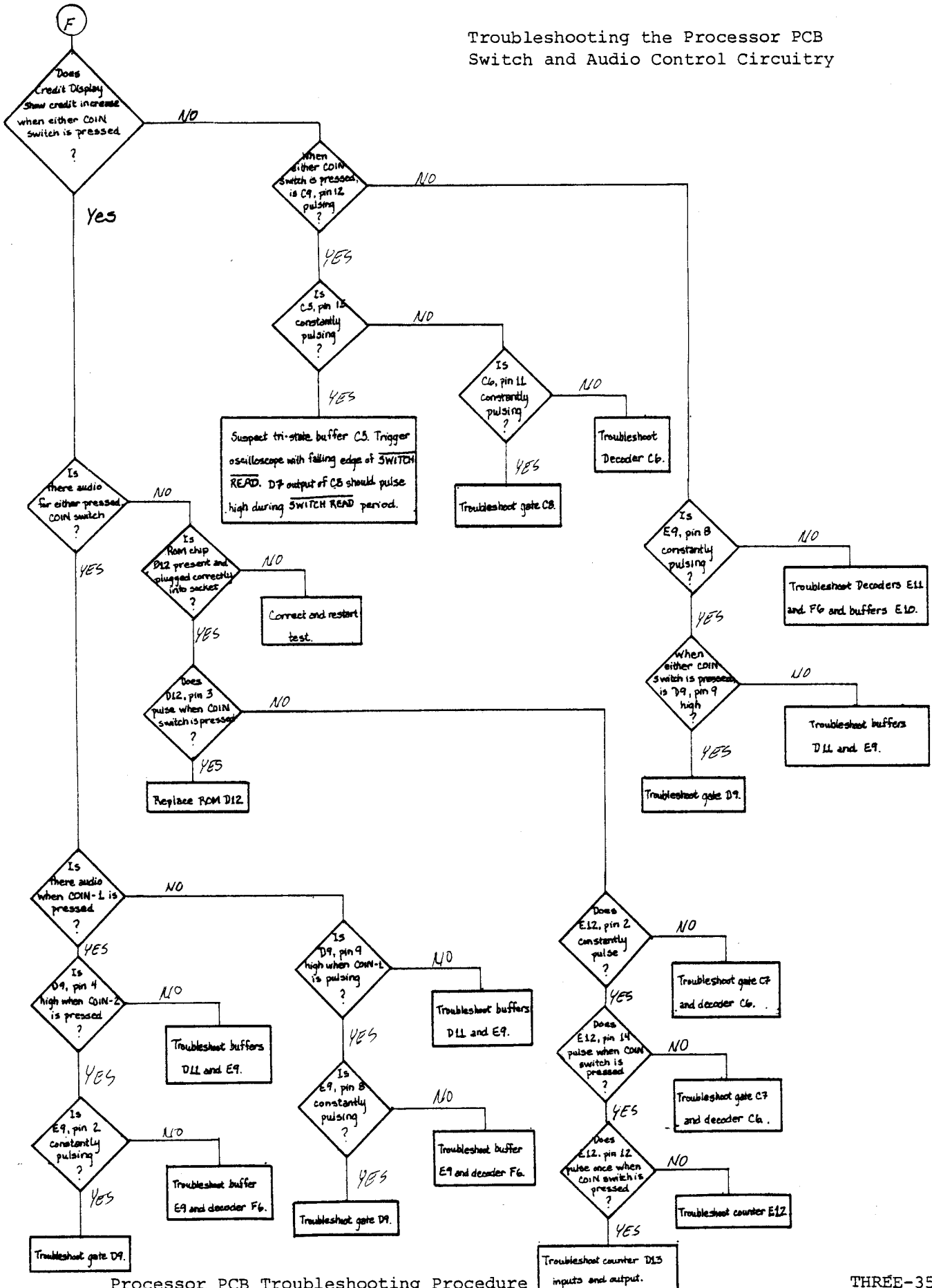


Troubleshooting the Processor PCB
Microprocessor Circuit

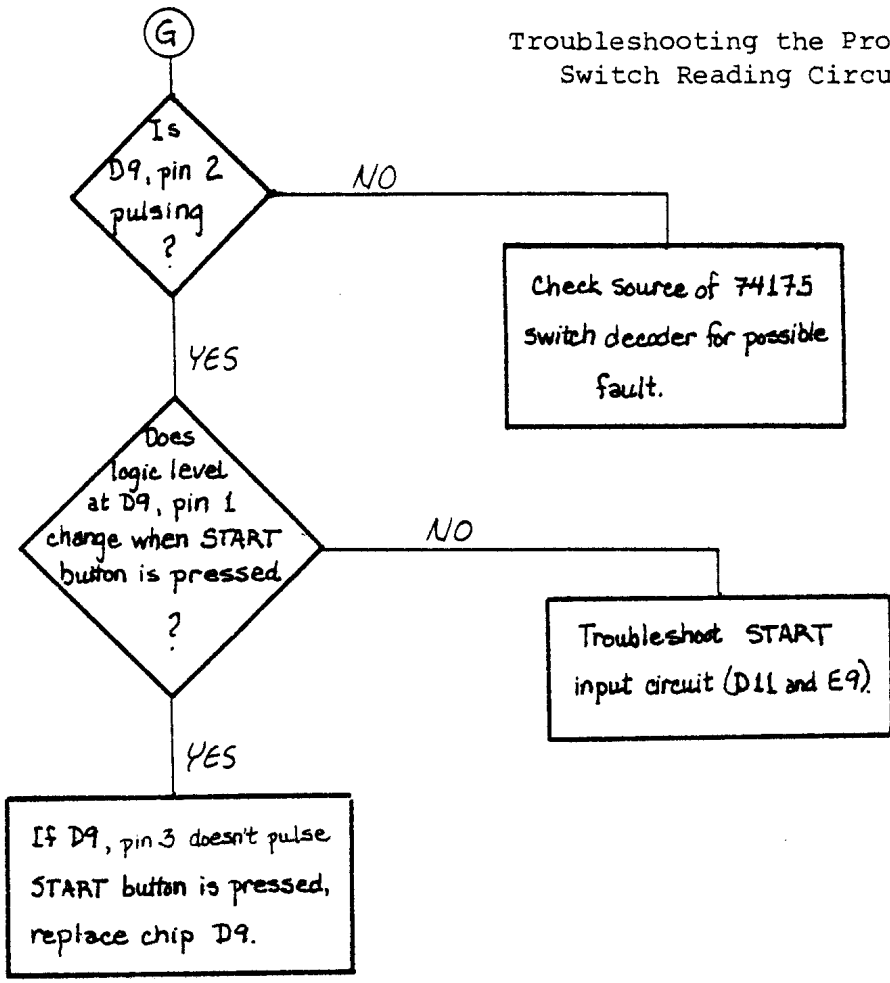


Processor PCB Troubleshooting Procedure
Flowchart 3-5

Troubleshooting the Processor PCB
Switch and Audio Control Circuitry

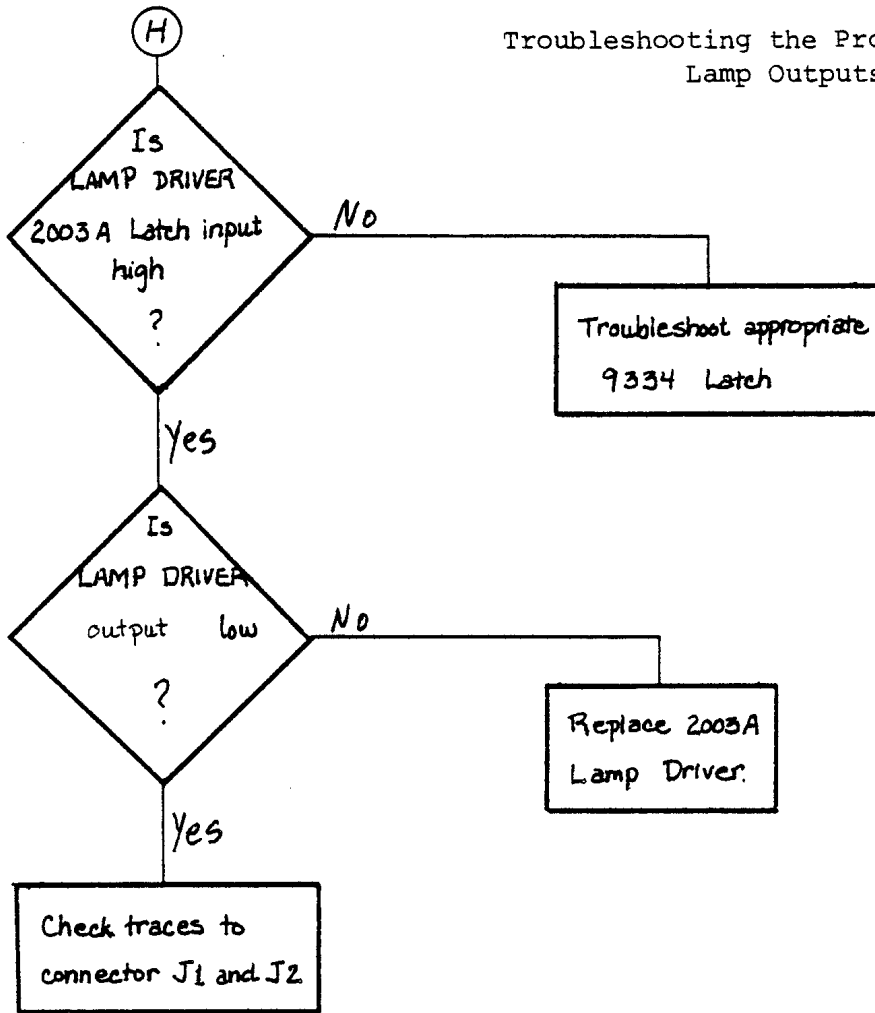


Troubleshooting the Processor PCB
Switch Reading Circuitry

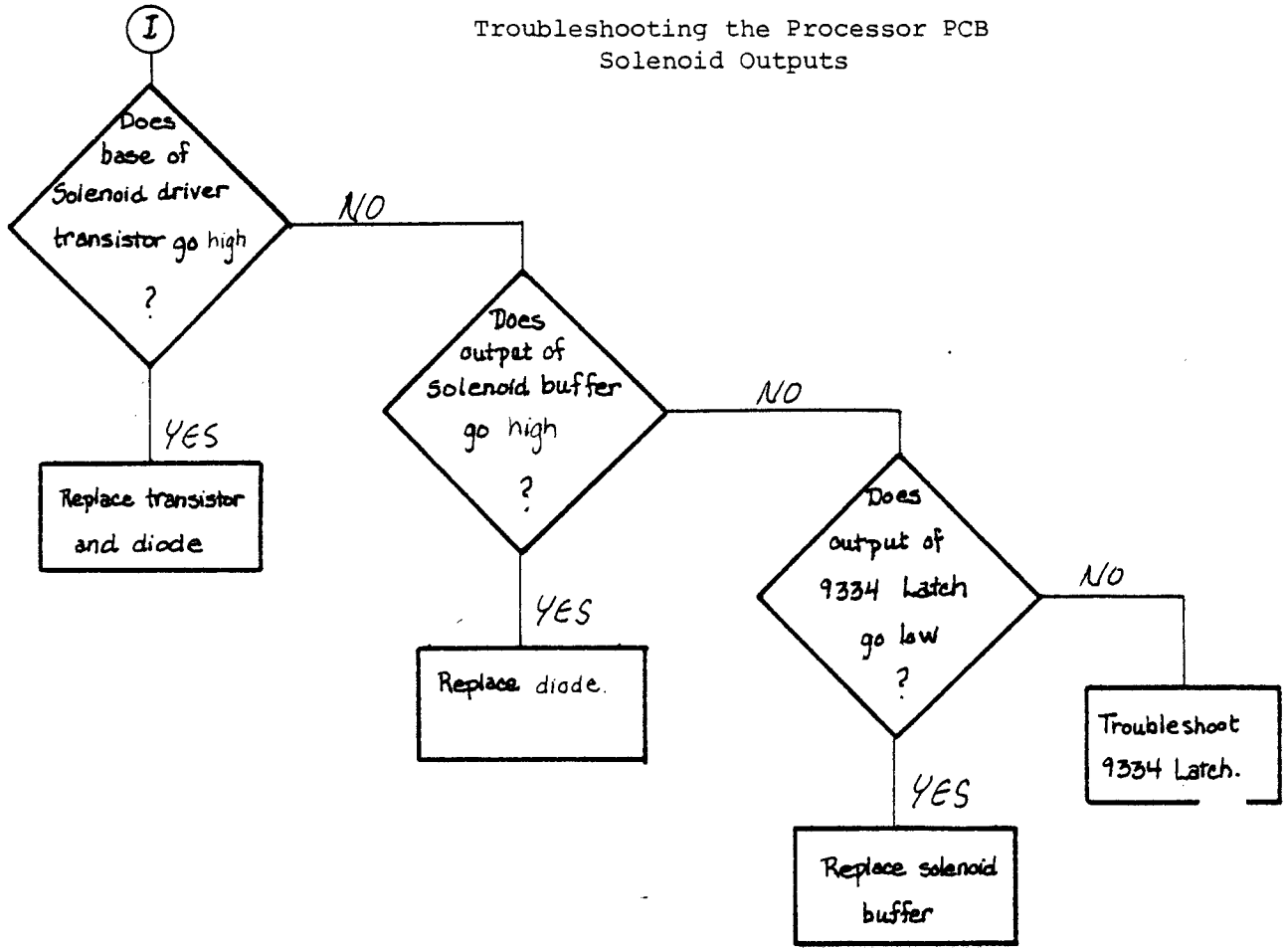


Processor PCB Troubleshooting Procedure
Flowchart 3-5

Troubleshooting the Processor PCB
Lamp Outputs

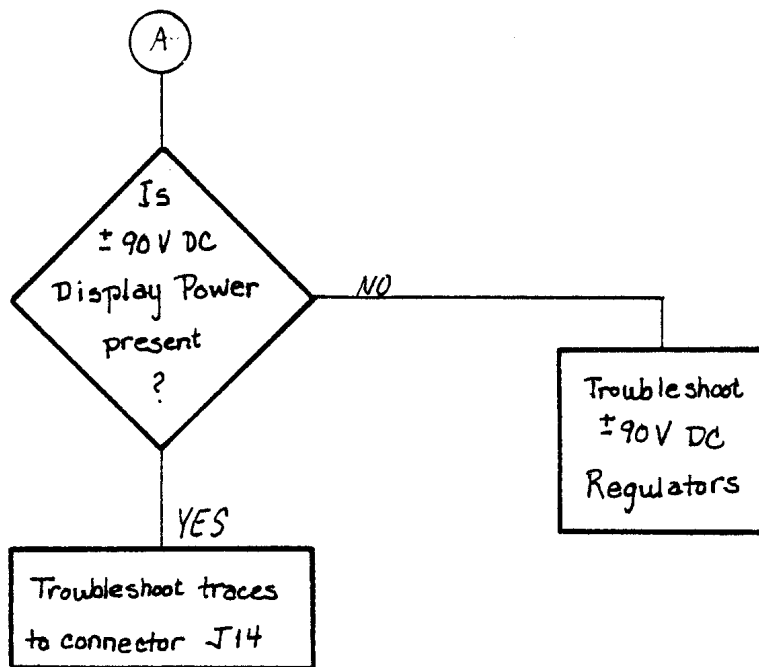


Troubleshooting the Processor PCB
Solenoid Outputs

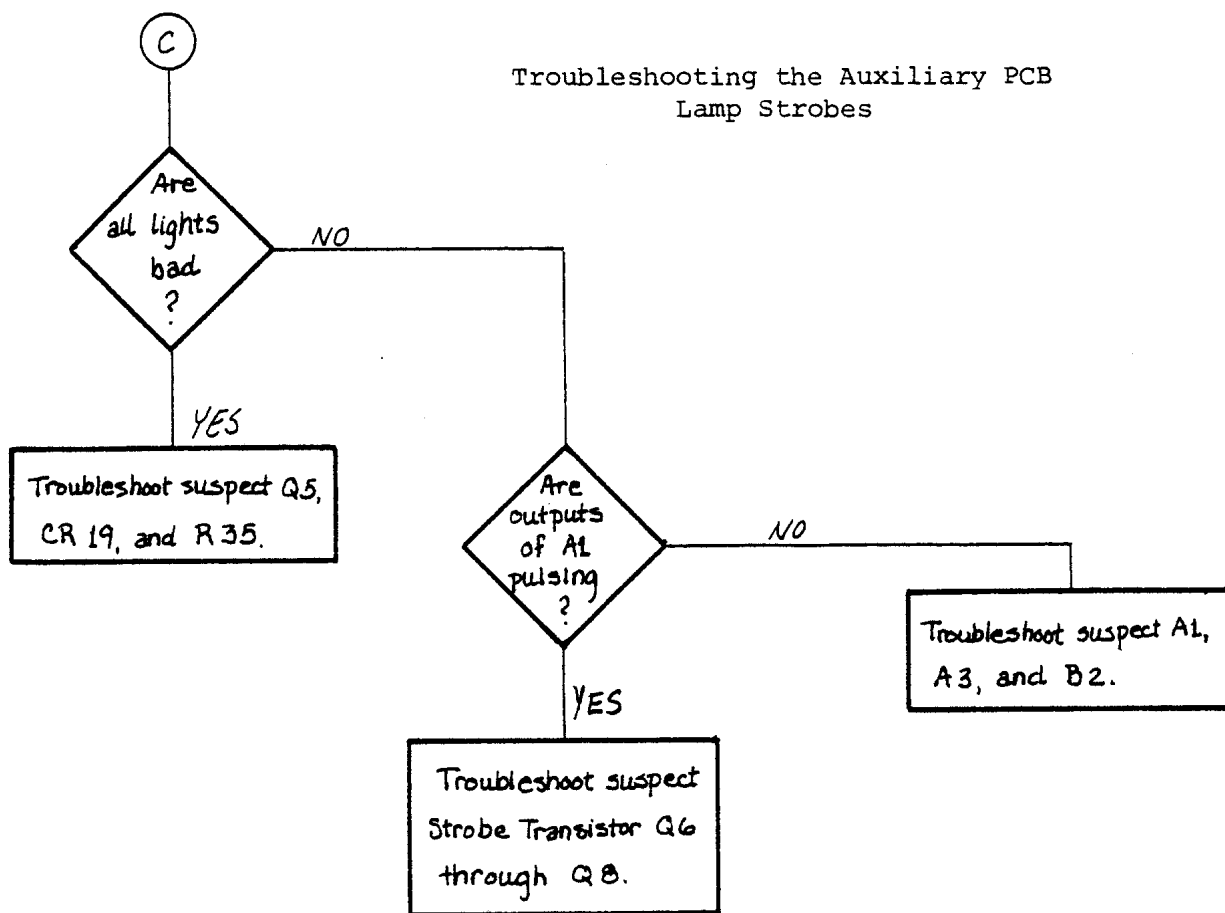


Processor PCB Troubleshooting Procedure
Flowchart 3-5

Troubleshooting the Auxiliary PCB
Display Power Supply

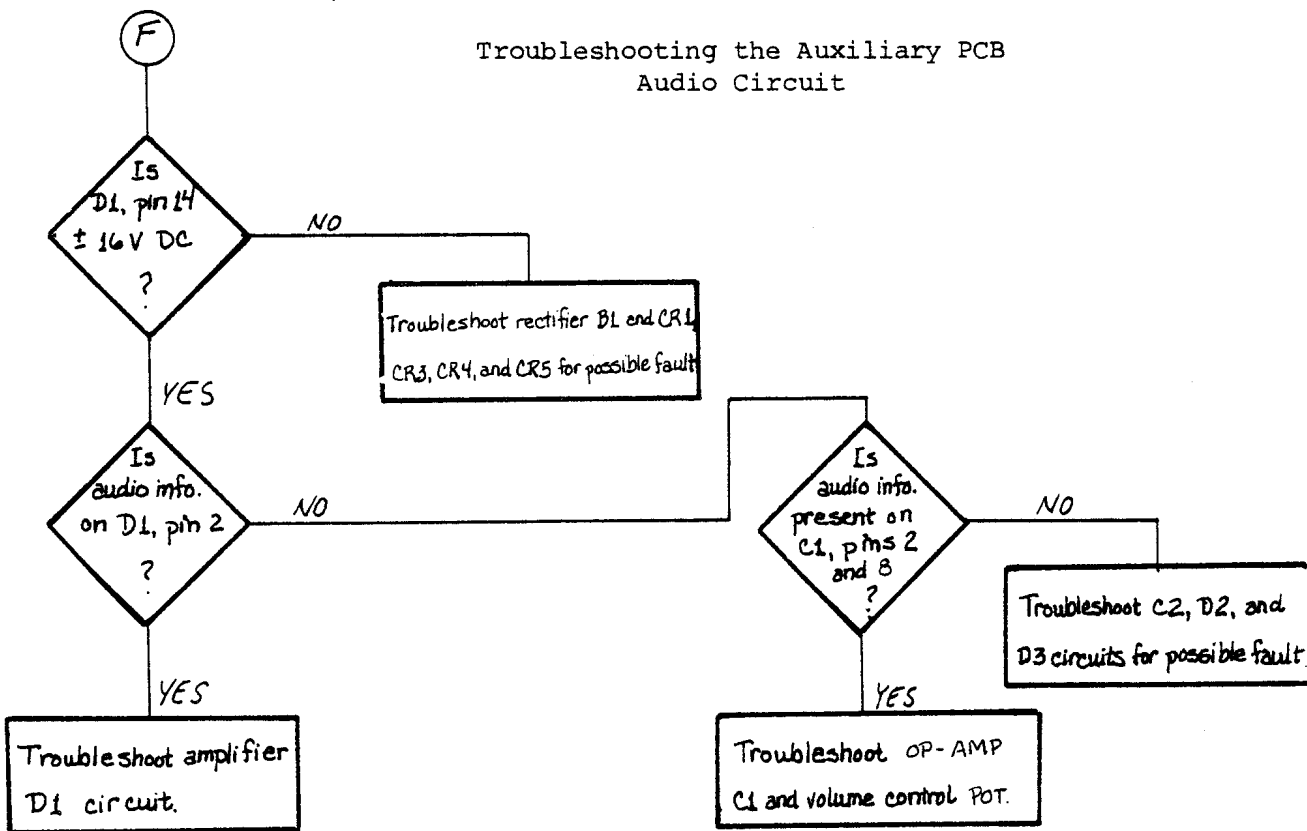


Troubleshooting the Auxiliary PCB
Lamp Strobes

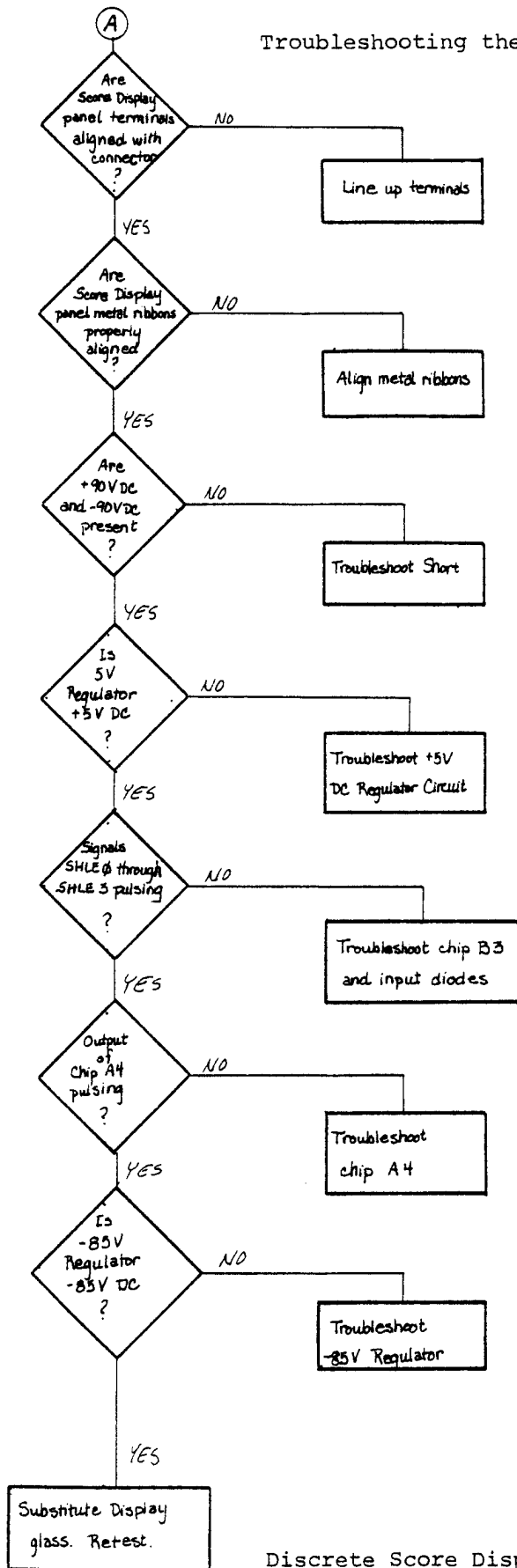


Auxiliary PCB Troubleshooting Procedure
Flowchart 3-6

Troubleshooting the Auxiliary PCB
Audio Circuit

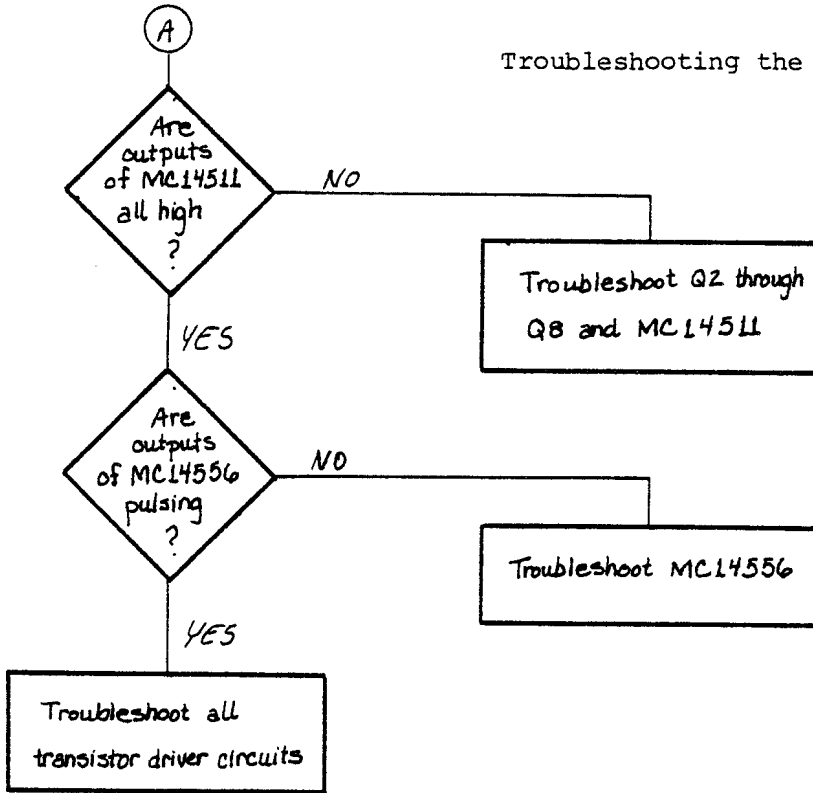


Troubleshooting the Score Display PCB



Discrete Score Display Troubleshooting Procedure:
 Discrete Display A020704-01
 Flowchart 3-7

Troubleshooting the Match/Credit PCB



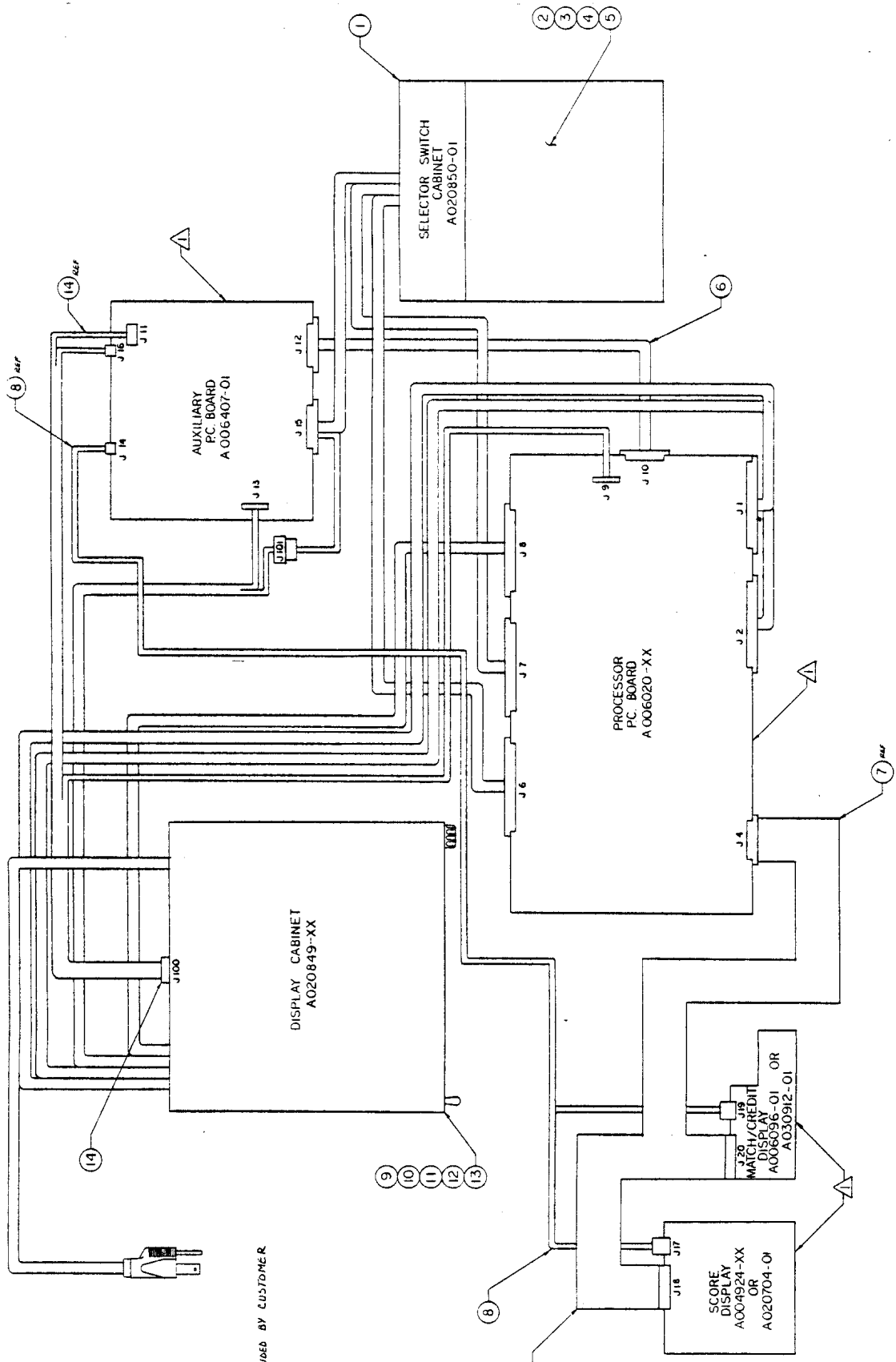
FOUR

The following pages consist of Engineering Drawings of the Pinball Simulator PBS-1. They are organized in the following order:

Top Assembly Interconnect Diagram and Parts List	A020851-01 through -05
Display Cabinet Assembly and Parts List	A020849-01 through -05
Display Cabinet Front Panel Assembly and Parts List	A020764-01
Display P.C. Board Assembly and Parts List	A020754-01
Display P.C. Board Schematic	020754-01
Switch Cabinet Drawing and Parts List	A020850-01
Selector Switch P.C. Board Schematic and Parts List	020756-01
Power Supply Schematic	020859-01
Solenoid Cable Assembly	A020816-01
#1 Switches Cable Assembly	A020817-01
#2 Switches Cable Assembly	A020818-01
#1 Lamps Cable Assembly	A020819-01
#2 Lamps Cable Assembly	A020820-01
Coin Door Cable Assembly	A020821-01
Display Cable Assembly	A020822-01
Display Power Cable Assembly	A020823-01
Interconnect Cable Assembly	A020824-01
Power Cable Assembly	A020825-01
Strobes Cable Assembly	A020826-01

Top Assembly Interconnect Diagram
 A020851-01 - For Use in U.S.A.
 A020851-02 - For Use in Germany

A020851-03 - For Use in Australia
 A020851-04 - For Use in England
 A020851-05 - For Use in Japan



NOTES:
 PROVIDED BY CUSTOMER



Top Assembly Parts List

A020851-01 For Use in U.S.A.
 A020851-02 For Use in Germany
 A020851-03 For Use in Australia
 A020851-04 For Use in England
 A020851-05 For Use in Japan

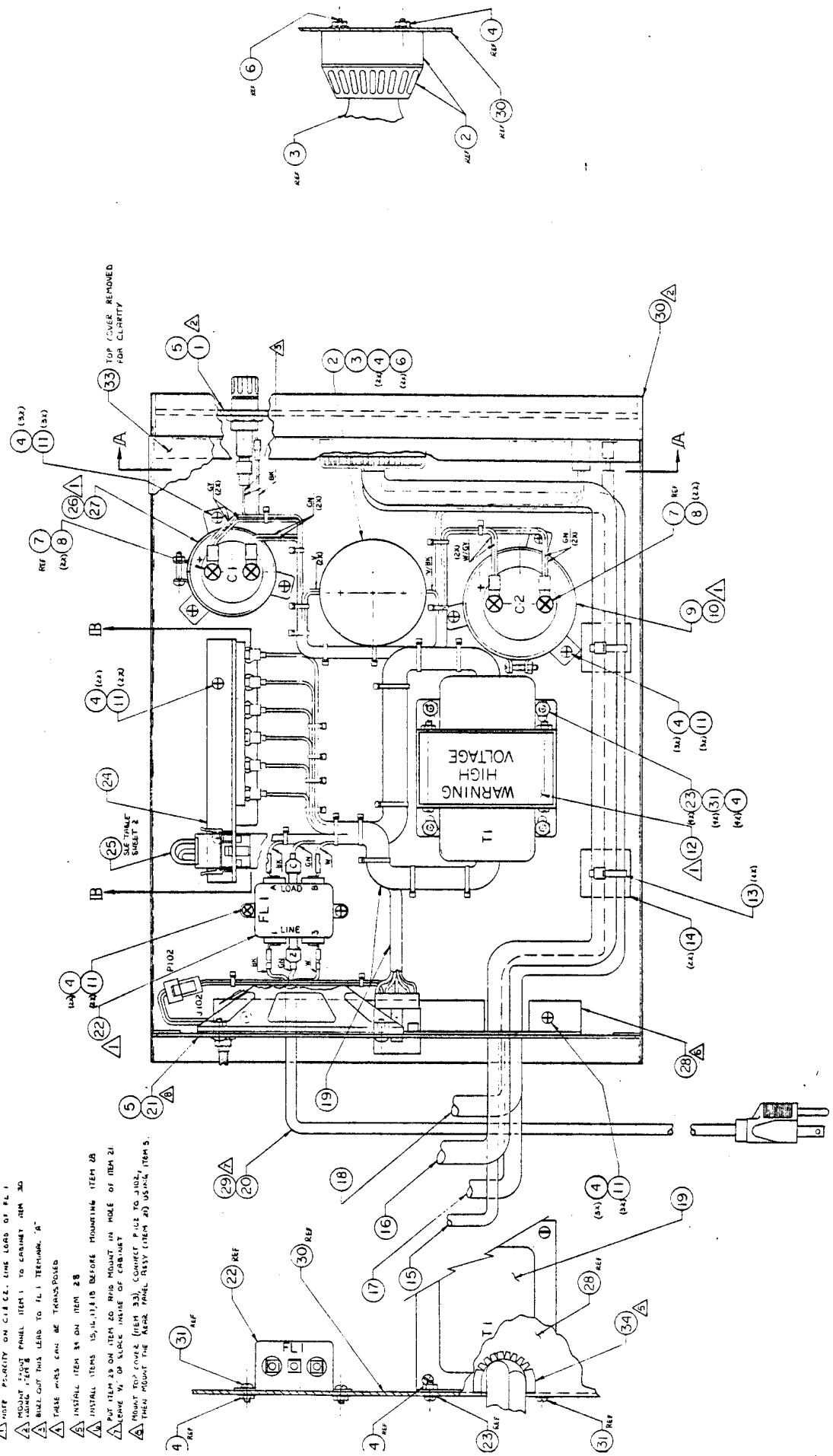
Item	Part Number	Qty.	Description
1	A020850-01	1	Assembly, Selector Switch Cabinet
2	020780-01	1	Overlay, Switch - Atarians
3	020781-01	1	Overlay, Switch - Time 2000
4	020782-01	1	Overlay, Switch - Airborne Avenger
5	020783-01	1	Overlay, Switch - Middle Earth
6	A020824-01	1	Cable Assembly, Interconnect
7	A020822-01	1	Cable Assembly, Display
8	A020823-01	1	Cable Assembly, Display Power
9	A020849-01	1	Assembly, Display Cabinet - For Use in U.S.A.
	A020849-02	1	Assembly, Display Cabinet - For Use in Germany
	A020849-03	1	Assembly, Display Cabinet - For Use in Australia
	A020849-04	1	Assembly, Display Cabinet - For Use in England
	A020849-05	1	Assembly, Display Cabinet - For Use in Japan
10.	020784-01	1	Overlay, Display - Atarians
11.	020785-01	1	Overlay, Display - Time 2000
12.	020786-01	1	Overlay, Display - Airborne Avenger
13.	020787-01	1	Overlay, Display - Middle Earth
14.	A020825-01	1	Cable Assembly, Power
15.	TM-114	1	Manual, Technical

A020849-03 - For Use in Australia
 A020849-04 - For Use in England
 A020849-05 - For Use in Japan

Display Cabinet Assembly
 A020849-01 - For Use in U.S.A.
 A020849-02 - For Use in Germany

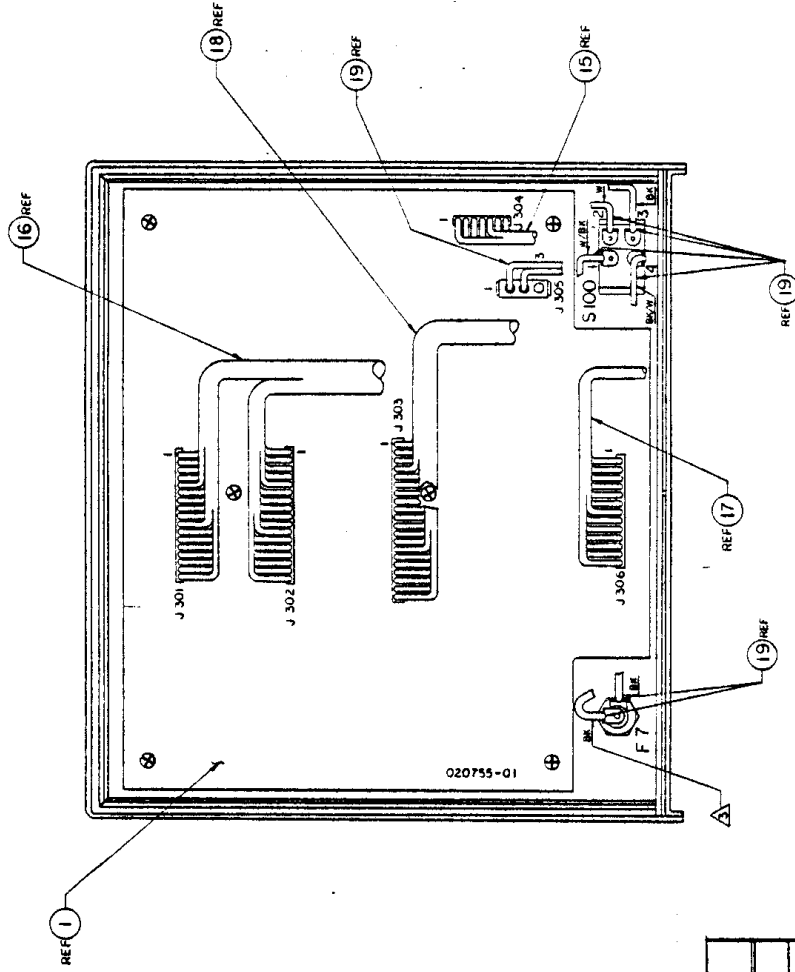
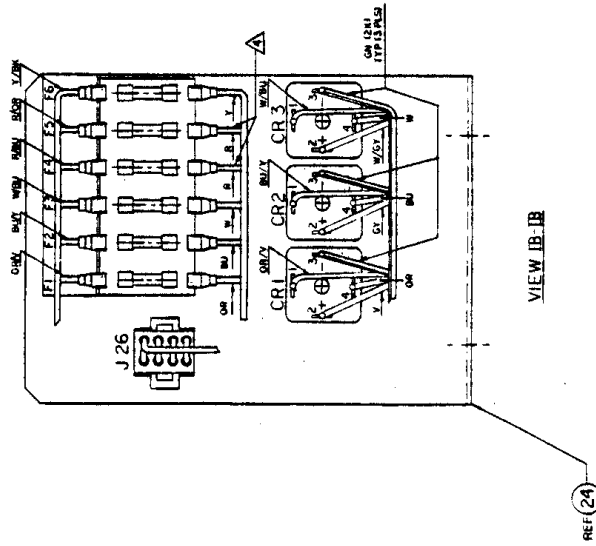
FIGURE 6

- NOTES:
- ▲ INSTALL ITEM 19 ON ITEM 28
 - ▲ INSTALL ITEM 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000



Display Cabinet Drawing and Parts List
 •A020849-01 - For Use in U.S.A.
 A020849-02 - For Use in Germany

A020849-03 - For Use in Australia
 A020849-04 - For Use in England
 A020849-05 - For Use in Japan



VIEW A
 (ROTATED 90° CCW)

DASH TABULATION				
DASH	CABLE ASSY POWER	SHIELDING PUSH	LINE VOLTS AC	COUNTRY
-01	A 020821-01	A 010025-03	117V	USA
-02	A 020821-02	A 020025-02	220V	GERMANY
-03	A 020821-03	A 010025-02	230V	AUSTRALIA
-04	A 020821-01	A 020025-02	220V	ENGLAND
-05	A-010821-01	A020025-01	100V	JAPAN



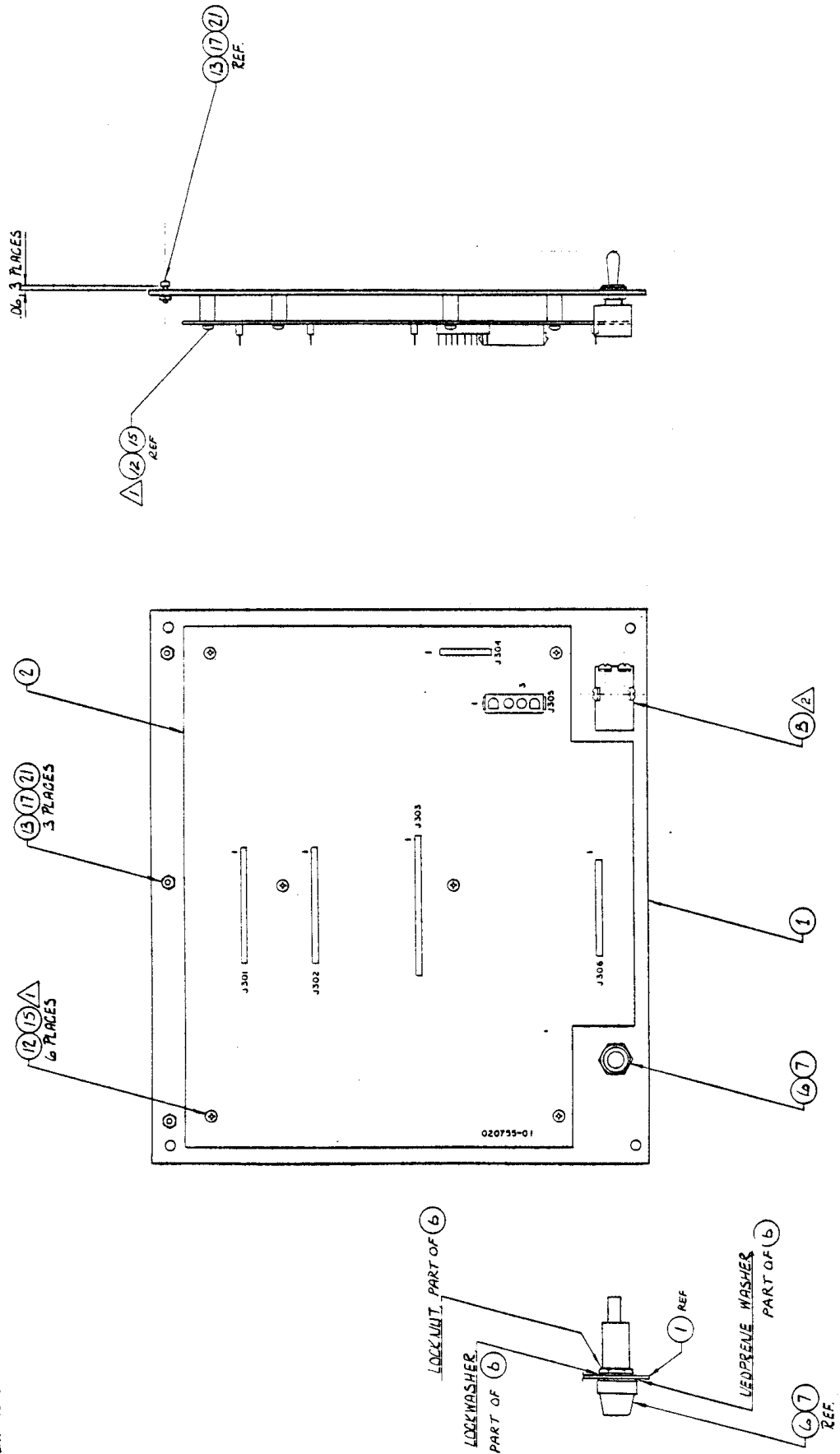
Display Cabinet Assembly Parts List

A020849-01 For Use in U.S.A.
 A020849-02 For Use in Germany
 A020849-03 For Use in Australia
 A020849-04 For Use in England
 A020849-05 For Use in Japan

Item	Part Number	Qty.	Description
1	A020764-01	1	Front Panel Assembly
2	79-4332	1	Socket, Lamp Ceramic
3	70-161101	1	Lamp, 100W, 120V, (GE)
4	75-99518	15	Nut, Kep #8-32 Unc
5	See Note 2	-	Screw, Pan Hd. Self Tapping #6-32 x 3/8 Lg 8 Res
6	78-1812S	2	Screw, Pan Hd. Phillips #8-32 x 1/2" Lg
7	See Note 1	Ref	Screw, Pan Hd. Phillips #10-32 x 3/8 Lg
8	75-040	4	Washer Splitlock #10
9	29-058	1	Cap 22,000 MFD, 40 WV (C2)
10	78-70503SC	1	Bracket, Cap Mount
11	78-1806S	13	Screw, Pan Hd. Phillips #8-32 x 3/8 Lg
12	020835-01	1	Label, High Voltage Warning
13	78-24003	2	Wrap, Tie, Nylon ("Panduit" #PLT-25)
14	78-07002	2	Mount, Adhesive Back
15	A020826-01	1	Cable Assembly, Strobes
16	A020819-01	1	Cable Assembly, #1, Lamps
17	A020816-01	1	Cable Assembly, Solenoids
18	A020820-01	1	Cable Assembly, #2, Lamps
19	A020828-01	1	Harness Assembly, Internal
20	A020827-01	1	Cable Assembly, Power - For Use in U.S.A., England, and Japan
	A020827-02	1	Cable Assembly, Power - For Use in Germany
	A020827-03	1	Cable Assembly, Power - For Use in Australia
21	A020766-01	1	Rear Panel Assembly
22	41-2009	1	Filter, RFl (FL1)
23	72-038	4	Washer, External Tooth Lock #8
24	A020880-01	1	Bracket Assembly Power Supply
25	A020025-03	1	Shorting Plug Assembly P26
26	29-057	1	Cap 18,000 MFD, 25WV (C1)
27	78-0501SC	1	Bracket, Cap Mount
28	A020769-01	1	Bracket, Connector, Display Cabinet
29	78-2112P	1	Bushing, Strain Relief
30	020771-01	1	Base Mod, Display Cabinet
31			
32			
33		Ref	Top Cover (Part of 78-0503) (Item 30)
34	02-91700ECC	2.3"	Gutter Track, Richco #SNGS-2
<p>NOTES: 1. Screws Provided with Items 9 and 26. 2. Screws Provided with Item 30 by Vendor.</p>			

NOTES:

- △ DO NOT EXCEED 8 3/4 IN. LBS. TIGHTENING TORQUE
- ② ORIENT AS SHOWN



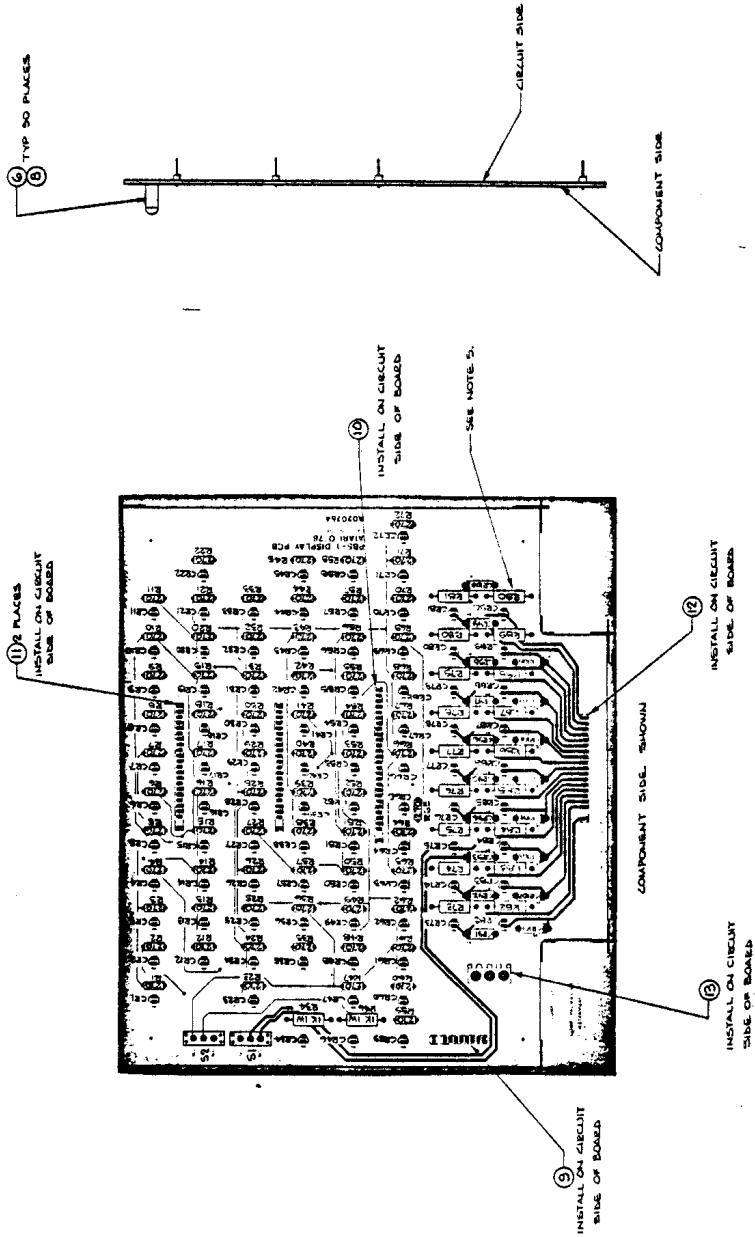


Display Cabinet Front Panel Assembly Parts List
A020764-01

Item	Part Number	Qty.	Description
1	020763-01	1	Front Panel, Mod.
2	A020754-01	1	Assembly, Display P.C. Board
3			
4			
5			
6	79-4411006	1	Fuseholder (Littelfuse 342838)
7	46-2012002	1	Fuse, 2A, 250V, Slow Blow
8	61-062A	1	Power Sw, DPST (Carlingswitch 2GK54-73)
9			
10			
11			
12	72-1605S	6	Screw, Pan Hd., Phillips 6-32 x 5/16 Lg
13	72-8406	3	Screw, Skt Hd., Hex Dr, 4-40 x 3/2
14			
15	75-046	6	Washer, Splitlock #6
16			
17	75-044	3	Washer, Split-Lock, 4
18			
19			
20			
21	75914S	3	Nut, Hex, 4-40

Display P.C. Board

020754-01



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL 1W RESISTORS ARE 2.2KΩ.
2. ALL DIODES ARE 1N5401.
3. ALL LEADS ARE ATARI #30-4550 (YELLOW).
4. CATHODE LEAD OF LEDS TO GO IN PAD WITH ETCHED LINE NEXT TO IT: 108 CATHODE.
5. MOUNTING HEIGHT OF RESISTORS AND DIODES NOT TO EXCEED .400 ABOVE BOARD.



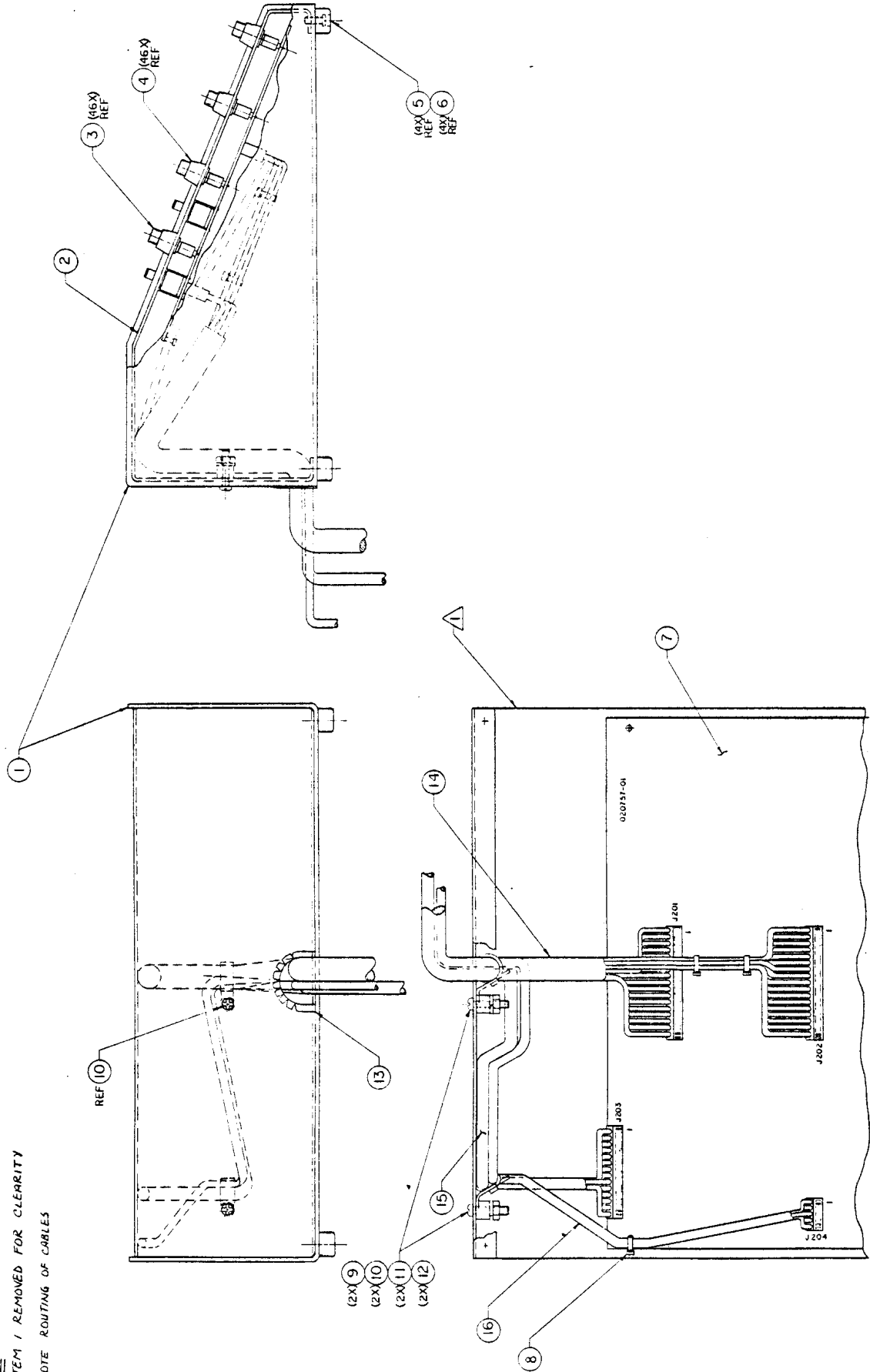
Display P.C. Board
020754-01

Item	Part Number	Qty.	Description
1	020755-01	1	DISPLAY P.C.B.
2	10-5271	70	RES, CARB. COMP. $\frac{1}{2}W$, 5% 270 OHM
3	12-5102	2	RES, CARB. COMP. 1W, 5% 1K OHM
4	12-5222	18	RES, CARB. COMP. 1W, 5% 2.2K OHM
5	31-1N5401	18	DIODE, 1N5401
6	38-4550	90	LED, YELLOW
7	61-131C	2	TOGGLE SWITCH, SPDT S1, S2
8	74-A00009	90	STANDOFF, 3/8"LG x 1/4"OD x .115 I.D.
9	79-58165	1	CONNECTOR, 10 POSITION
10	79-58235	1	CONNECTOR, 28 POSITION
11	79-58236	2	CONNECTOR, 23 POSITION
12	79-58237	1	CONNECTOR, 19 POSITION
13	79-58243	1	HEADER, 3 PIN

NOTES:

1. ITEM 1 REMOVED FOR CLARITY

2. NOTE ROUTING OF CABLES





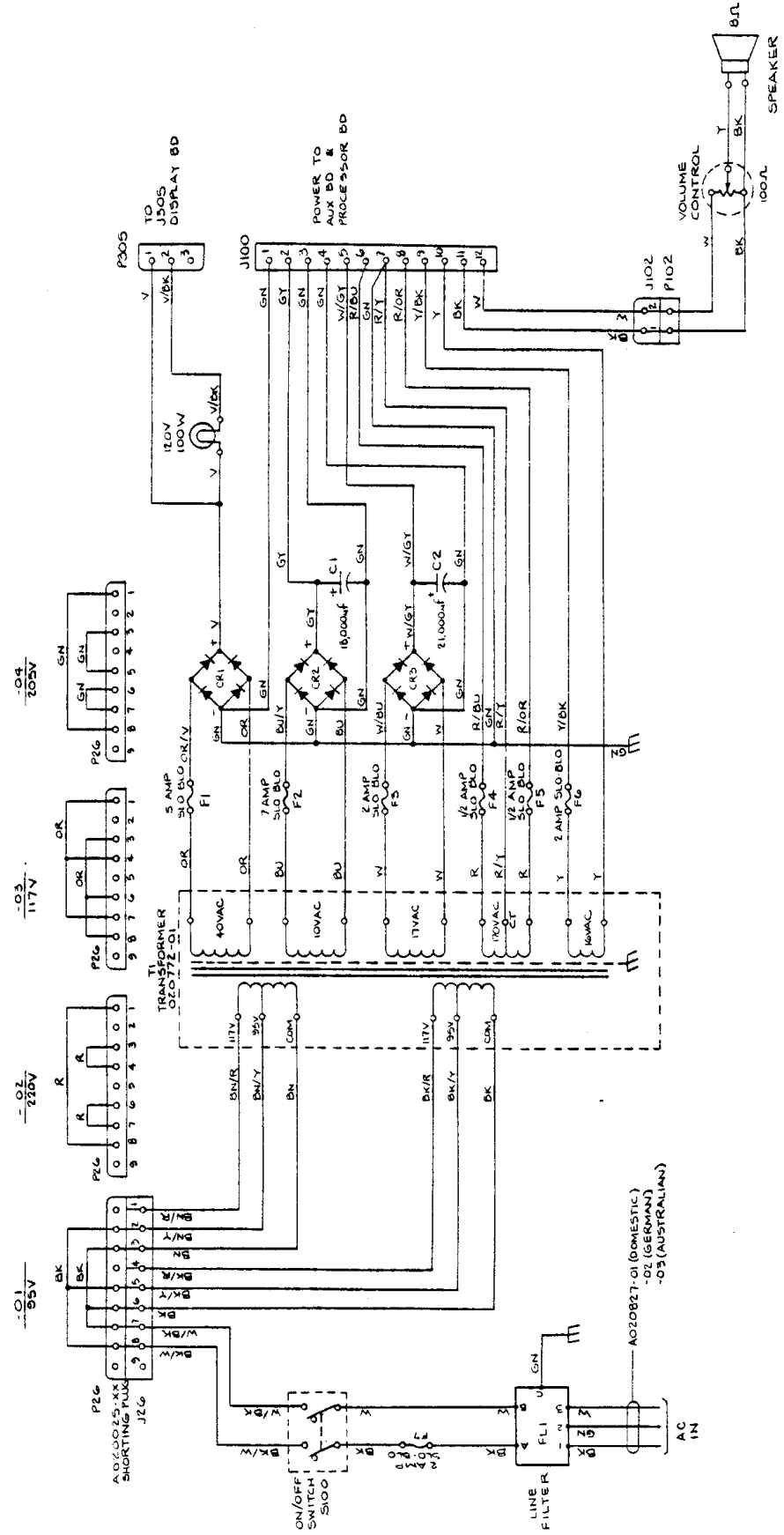
Switch Cabinet Assembly Parts List

A020850-01

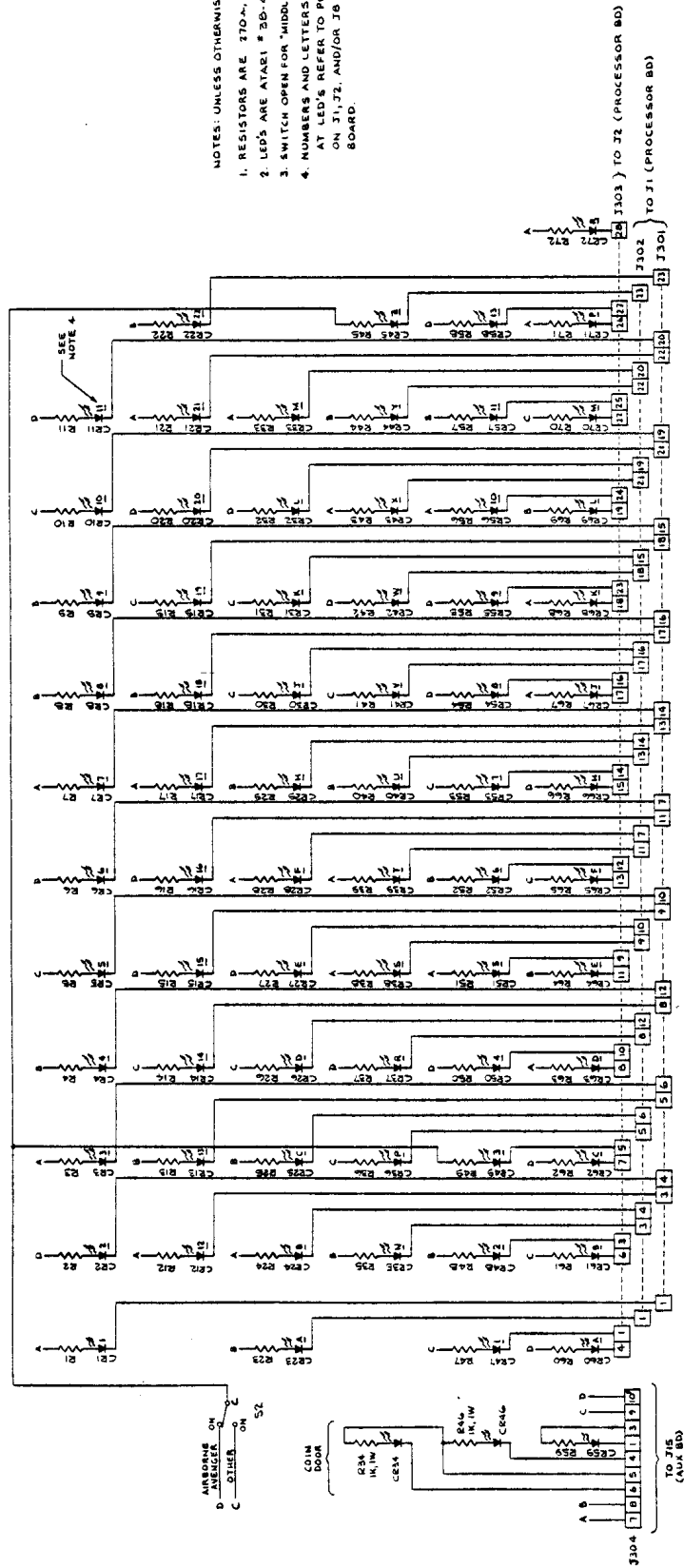
Item	Part Number	Qty.	Description
1	020876-01	1	Wrapper, 4-12-10
2	020758-01	1	Insert, 4-12-10
3	See Note 1	Ref	Cap, Medium, Pushbutton, -Black (46 each)
4	See Note 1	Ref	Nut, Dress, Pushbutton (46 each)
5	See Note 2	Ref	Foot, Rubber (4 each)
6	See Note 2	Ref	Screw, Phillips Pan Hd. #6-32 UNC X, 38 Lg Self Tapping (4 each)
7	A020756-01	1	PCB Assembly, Selector Switch
8	78-24001	1	Wrap, Tie (Small)
9	78-25002	2	Wrap, Tie - Screw Down Type #10 "Panduit" #PLC-2S-S10
10	72-1608S	2	Screw, Phillips Pan Hd. #6-32 UNC x 1/2 Lg
11	75-046	2	Washer, Splitlock #6
12	75-916S	2	Nut, Hex #6-32 UNC
13	C2-91700ECC	2.3"	Track, Gutter "Richco" #SNGS-2
14	A020818-01	1	Cable Assembly #2, Switches
15	A020817-01	1	Cable Assembly #1, Switches
16	A020821-01	1	Cable Assembly, Coin Door
<p>NOTES:</p> <ol style="list-style-type: none"> Items 3 and 4 are part of #62-007 pushbutton assembly on A020756-01. Install on this assembly. Items 5 and 6 are furnished by vendor of Items 1 and 2. Install on this assembly. 			

Power Supply Schematic

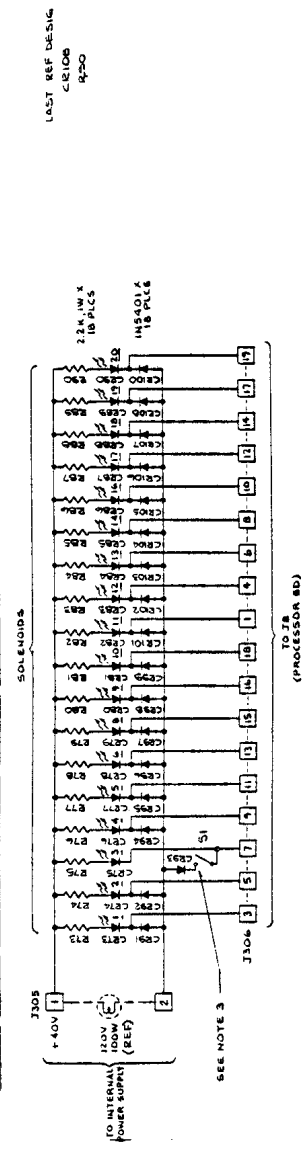
020859-01



PLAYFIELD



- NOTES: UNLESS OTHERWISE SPECIFIED,
1. RESISTORS ARE 270Ω, 1/4W, ±5%.
 2. LED'S ARE AT&E1 # 30-45/50.
 3. SWITCH OPEN FOR "MIDDLE EARTH" ONLY.
 4. NUMBERS AND LETTERS UNDERLINED AT LED'S REFER TO PIN ASSIGNMENTS ON J1, J2, AND/OR J8 ON PROCESSOR BOARD.

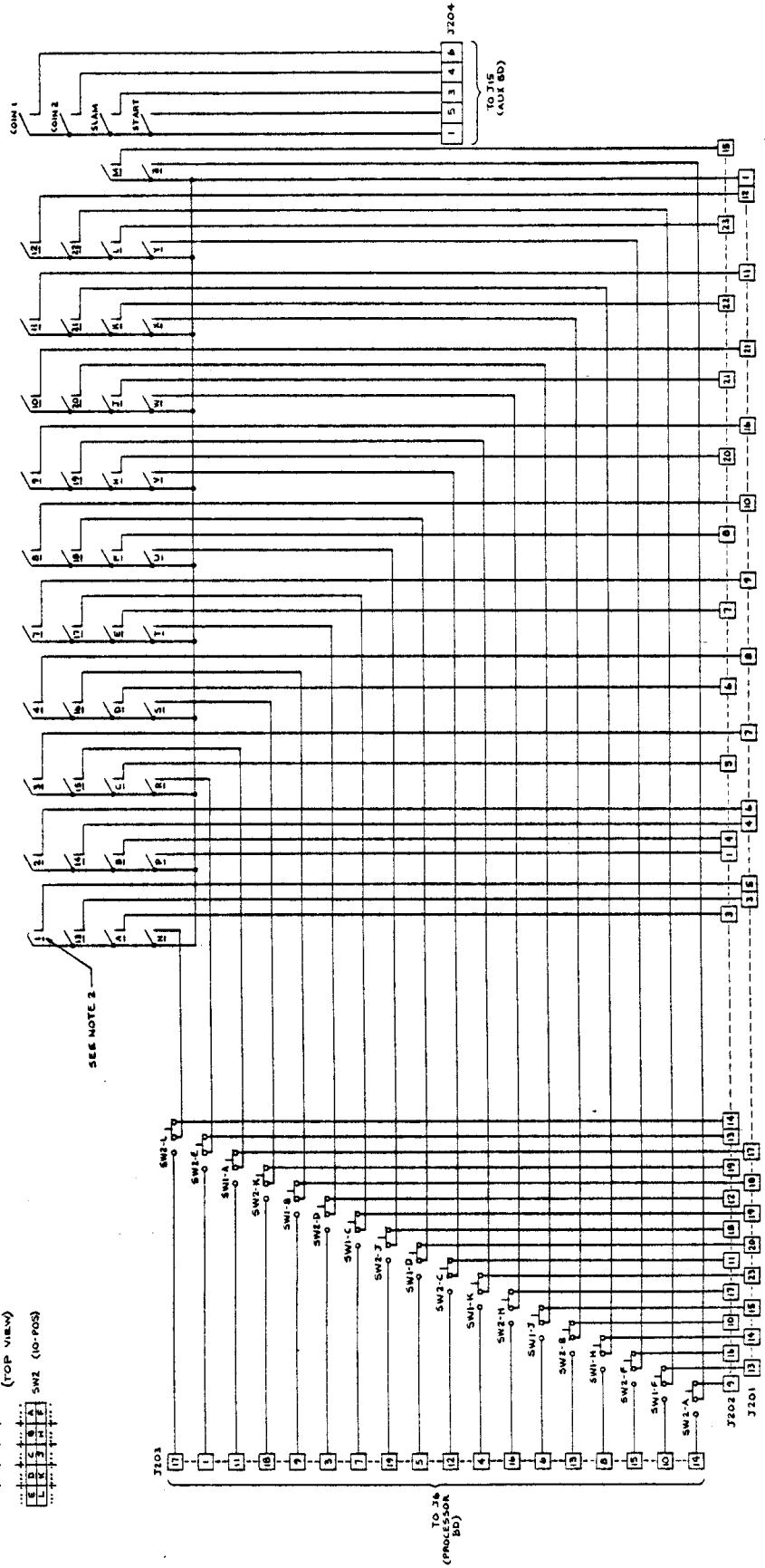
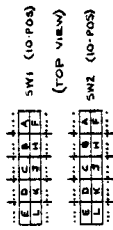


O20754-01

Display P.C. Board Schematic

Selector Switch P.C. Board Schematic

020756-01



NOTES:

1. SW1 & SW2 SHOWN IN CORRECT POSITION FOR ALL GAMES EXCEPT 'ATARIANS'.
2. NUMBERS AND LETTERS UNDERLINED AT PUSHBUTTON SWITCHES REFER TO PIN ASSIGNMENTS ON J6 AND/OR J7 ON PROCESSOR BOARD.



Selector Switch P.C. Board Parts List

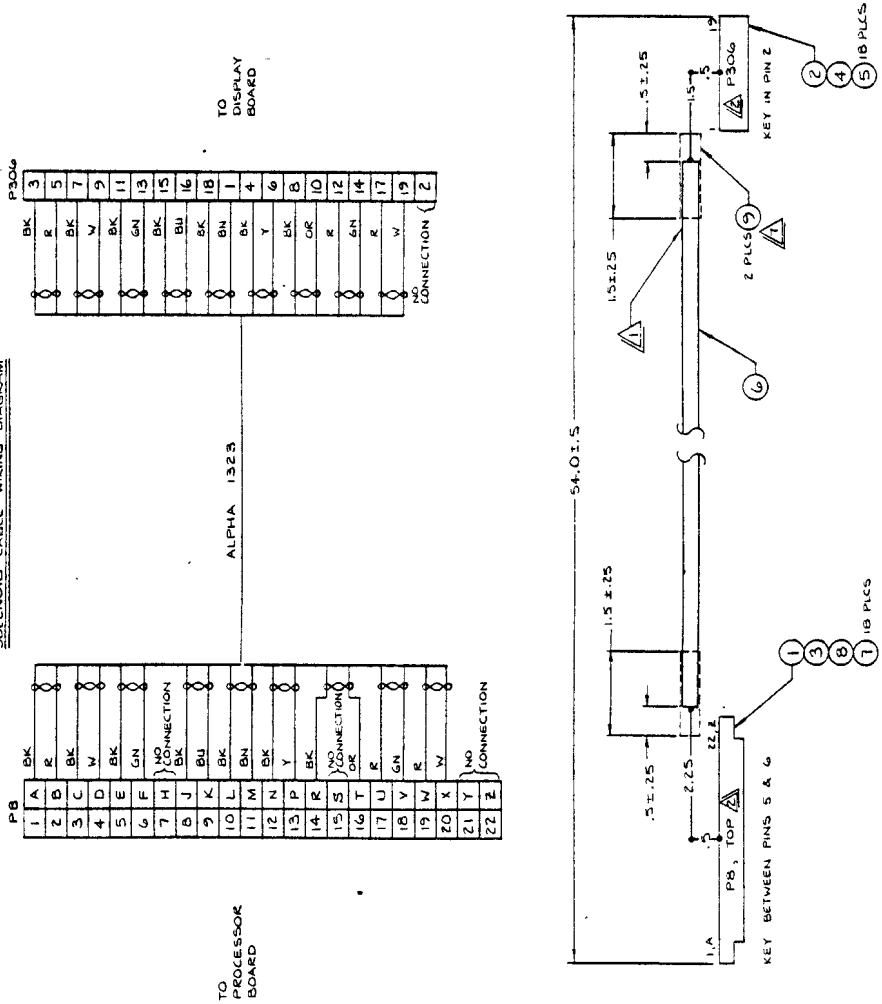
020756-01

Item	Part Number	Qty.	Description
1	020757-01	1	SELECTOR SWITCH P.C.B.
2	62-007	46	PUSH BUTTON SWITCH W/ DRESS NUT & MEDIUM CAP (BLACK)
3	69-026	2	SLIDE SWITCH, 10P3T
4	79-58237	1	CONNECTOR, 19 POSITION J203
5	79-58236	2	CONNECTOR, 23 POSITION J201, J202
6	79-58234	1	CONNECTOR, 6 POSITION J204
7	T020760-01	REF	JIG PLATE, SWITCH ALIGNMENT FIXTURE

Solenoid Cable Assembly

A020816-01

SOLENOID CABLE WIRING DIAGRAM





Solenoid Cable Assembly
A020816-01

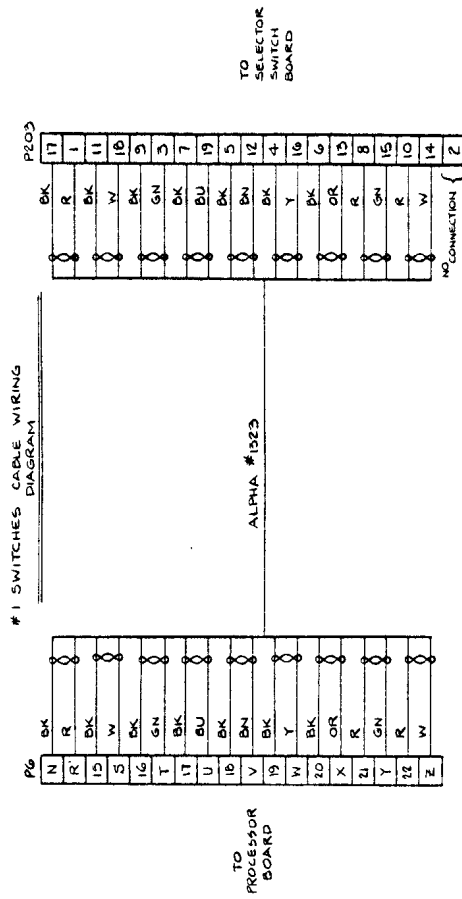
Item	Part Number	Qty.	Description
1	79-51C122 OR 79-51D2122	1	Edge Conn. 22ckt. Cinch #250-22-30-170 (P8) OR SAE #SCC22S/1-2 (P8)
2	79-58240	1	Connector, 19ckt. Molex #22-01-2191 (P306)
3	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-2222
4	79-58244	1	Key, Molex #15-04-9209
5	79-20347	18	Terminal, Molex #08-50-0114 (22-30 AWG)
6	59-010	*54.0"	Cable, Alpha #1323
7	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
8	78-142050	A/R	Solder
9	78-2C024	3"	Tubing, Blk., Alpha #FIT-105-3/8" OR Raychem #RT-300-3/8"

*This length is not the cut length.

Note: A wire routing list is not required for this harness.

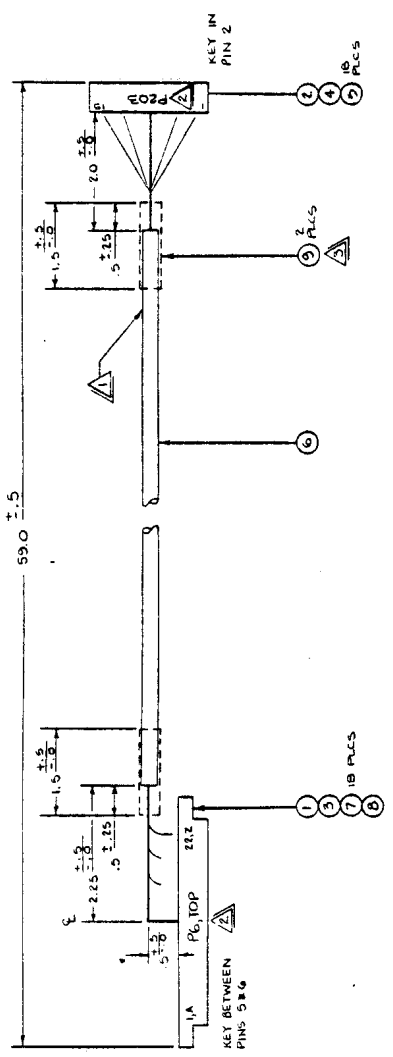
#1 Switches Cable Assembly

A020817-01



NOTES

1. IDENTIFY THIS END WITH ATARI DRAWING NUMBER & LATEST REVISION LETTER (METHOD OPTIONAL).
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. INSULATE WITH SHRINK TUBING AS SHOWN.
4. ∞∞∞ DENOTES TWISTED PAIR.
5. SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRING DIAGRAM.
6. A WIRE ROUTING LIST IS NOT REQUIRED.





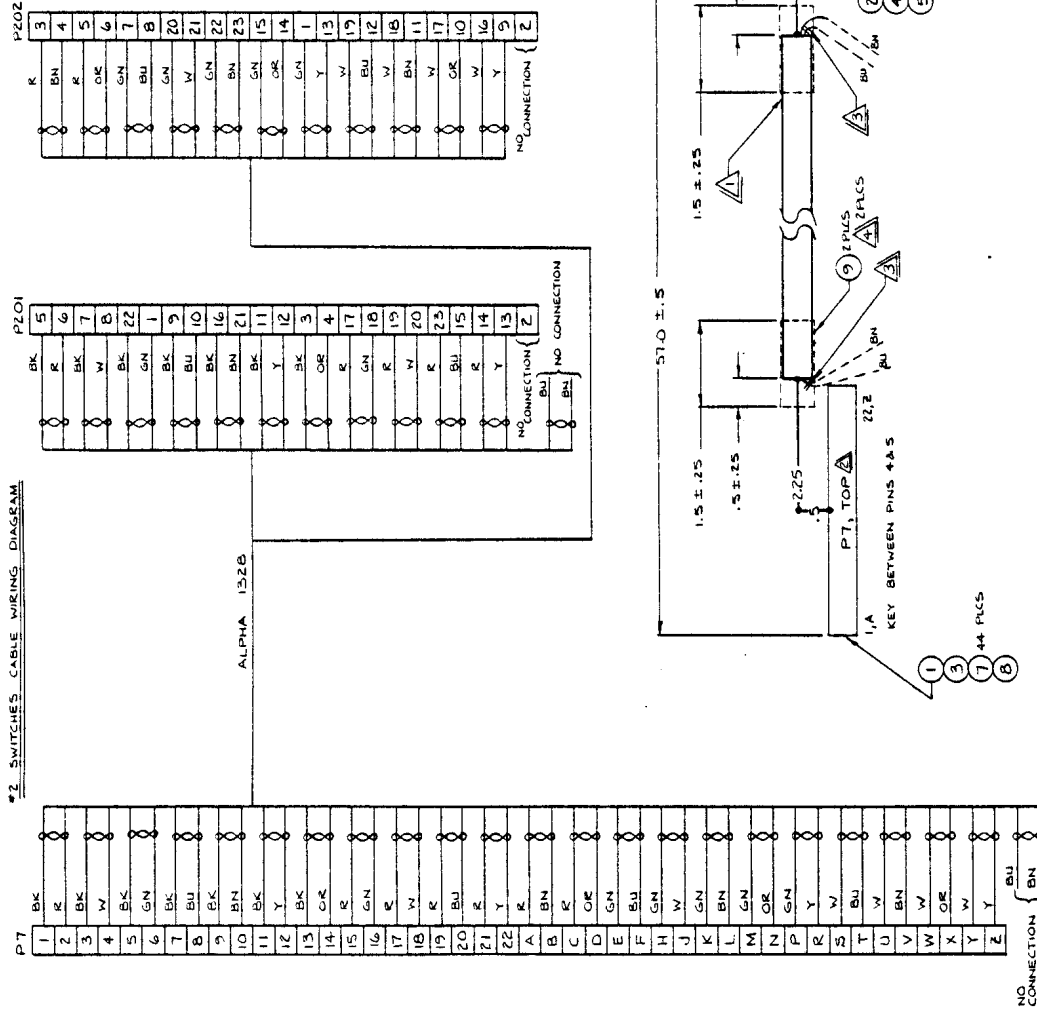
#1 Switches Cable Assembly
A020817-01

Item	Part Number	Qty.	Description
1	79-51B222 OR 79-51D2222	1	Edge Conn. 44 ckt, Cinch #251-22-30-160 (P6) OR SAE #SCC22D/1-2 (P6)
2	79-58240	1	Connector, 19ckt., Molex #22-01-2191 (P203)
3	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
4	79-58244	1	Key, Molex #15-04-9209
5	79-20347	18	Terminal, Molex #08-50-0114 (22-30 AWG)
6	59-010	*59.0'	Cable, Alpha #1323
7	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
8	78-142050	A/R	Solder
9	78-2C024	A/R	Tubing, Blk., Alpha #FIT-105-3/8" OR Raychem #RT-800-3/8"
			*This length is not the cut length.
			<u>Note:</u> A wire routing list is not required for this harness.

#2 Switches Cable Assembly

A020818-01

#2 SWITCHES CABLE WIRING DIAGRAM

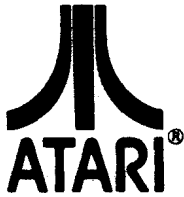


NOTES

1. IDENTIFY THIS END WITH ATARI DWG. NUMBER & LATEST REVISION LETTER (METHOD OPTIONAL).
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. CUT BLUE & BROWN WIRES BACK TO JACKET BEFORE INSULATING WITH SHRINK TUBING.
4. INSULATE WITH SHRINK TUBING AS SHOWN.
5. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (1.5/-0) OR AS INDICATED.
6. XXX DENOTES TWISTED PAIR.
7. SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRING DIAGRAM. (THIS SHEET)
8. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.

TO
PROCESSOR
BOARD

NO
CONNECTION



#2 Switches Cable Assembly
A020818-01

Item	Part Number	Qty.	Description
1	79-51B22 OR 79-51D2222	1	Edge Conn, 44 ckt, Cinch #251-22-30-160 (P7) OR SAE #SCC 22D/1-2 (P7)
2	79-58241	2	Connector, 23 ckt, Molex #22-01-2231 (P201, P202)
3	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
4	79-58244	2	Key, Molex #15-04-9209
5	79-20347	44	Terminal, Molex #08-50-0114 (22-30 AWG)
6	59-009	* 61"	Cable, Alpha #1328
7	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
8	78-142050	A/R	Solder
9	78-2C048	3"	Tubing, Blk, Alpha #FIT-105-3/4" OR Raychem #RT-800-3/4"
10	78-24001	2	Tie Wrap (Miniature)

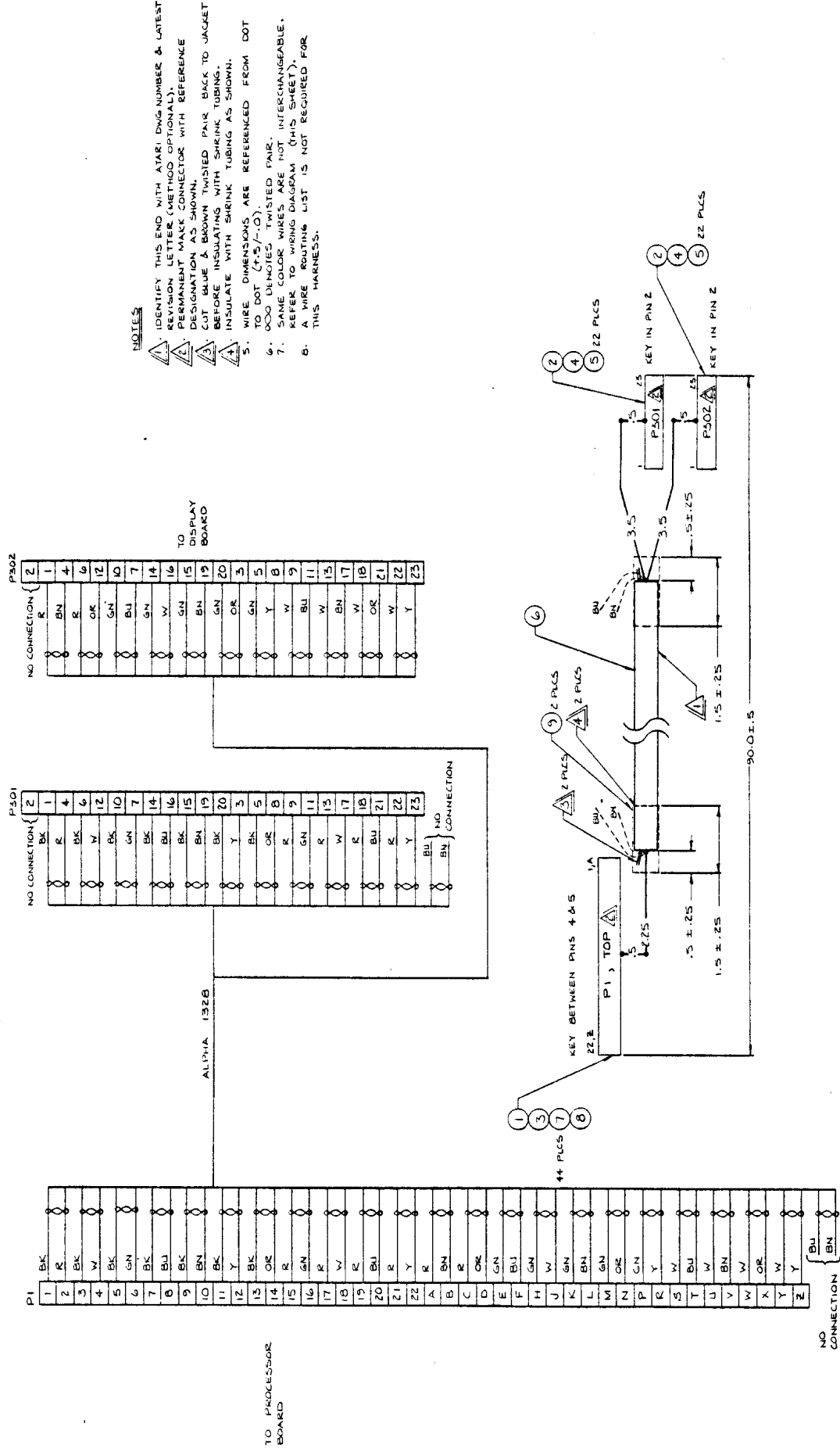
*This length is not the cut length.

Note: A wire routing list is not required for this harness.

#1 Lamps Cable Assembly

A020819-01

#1 LAMPS CABLE WIRING DIAGRAM





#1 Lamps Cable Assembly
A020819-01

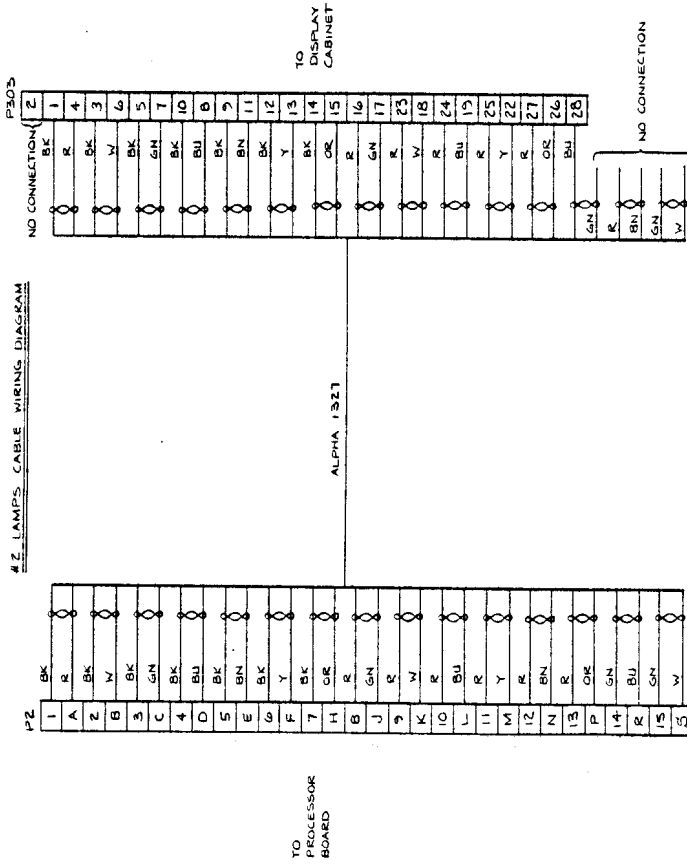
Item	Part Number	Qty.	Description
1	79-51B22 2 OR 79-51D2222	1	Edge Conn., 44 ckt, Cinch #251-22-30-160 (P1) OR SAE #SCC 22D/1-2 (P1)
2	79-58241	2	Connector, 23 ckt, Molex #22-01-2231 (P301, 302)
3	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
4	79-58244	2	Key, Molex #15-04-9209
5	79-20347	44	Terminal, Molex #08-50-0114 (22-30 AWG)
6	59-009	*90.0"	Cable, Alpha #1328
7	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
8	78-142050	A/R	Solder
9	78-2C048	3"	Tubing, Blk, Alpha #FIT-105-3/4" OR Raychem #RT-800-3/4"

*This length is not the cut length.

Note: A wire routing list is not required for this harness.

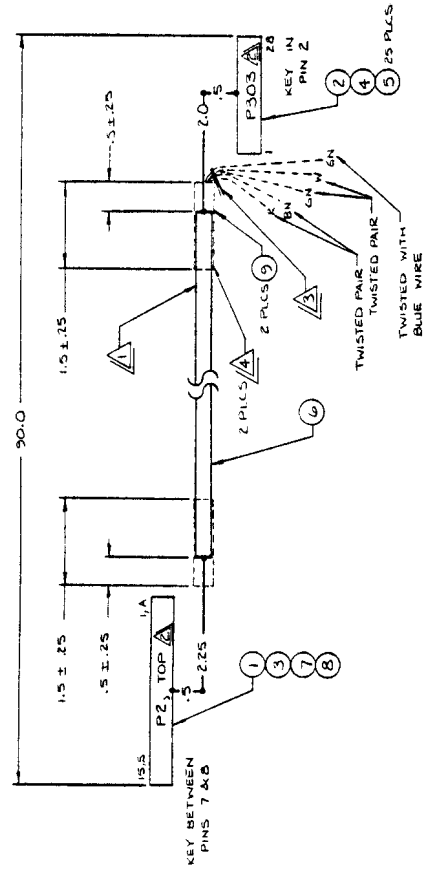
#2 Lamps Cable Assembly

A020820-01



NOTES

1. IDENTIFY THIS END WITH ATA(K) DWG. NUMBER & LATEST REVISION LETTER. (METHOD OPTIONAL)
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. CUT ONLY WIRES SHOWN BACK TO JACKET BEFORE INSULATING WITH SHRINK TUBING.
4. INSULATE WITH SHRINK TUBING AS SHOWN.
5. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (+/- .010).
6. 000 DENOTES TWISTED PAIR.
7. SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRE ROUTING LIST.
8. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.





#2 Lamps Cable Assembly
A020820-01

Item	Part Number	Qty.	Description
1	79-51B222 OR 79-51D2222	1	Edge Conn, 44 ckt., Cinch #251-22-30-160 (P2) OR SAE #SCC22D/1-2 (P2)
2	79-58242	1	Connector, 28 ckt, Molex #22-01-2281 (P303)
3	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
4	79-58244	1	Key, Molex #15-04-9209
5	79-20347	25	Terminal, Molex #08-50-0114 (22-30 AWG)
6	59-008	*90.0"	Cable, Alpha #1327
7	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
8	78-142050	A/R	Solder
9	78-2C032	3"	Tubing, Blk, Alpha #FIT-105-1/2" OR Raychem #RT-800-1/2"

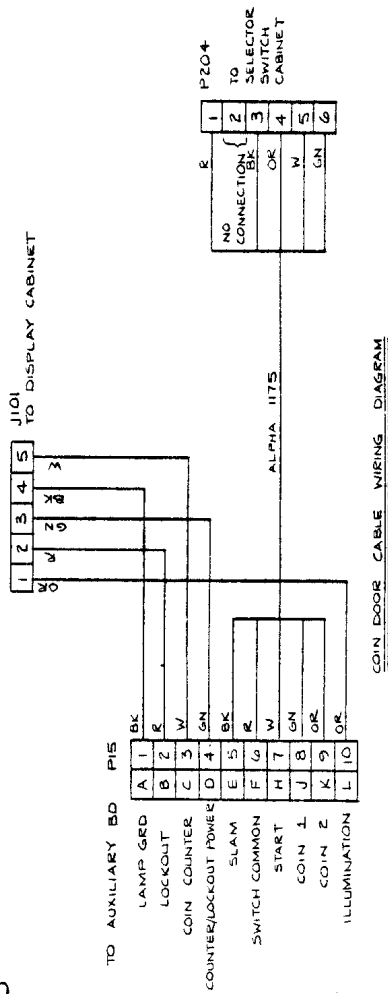
*This length is not the cut length.

Note: A wire routing list is not required for this harness.

Coin Door Cable Assembly

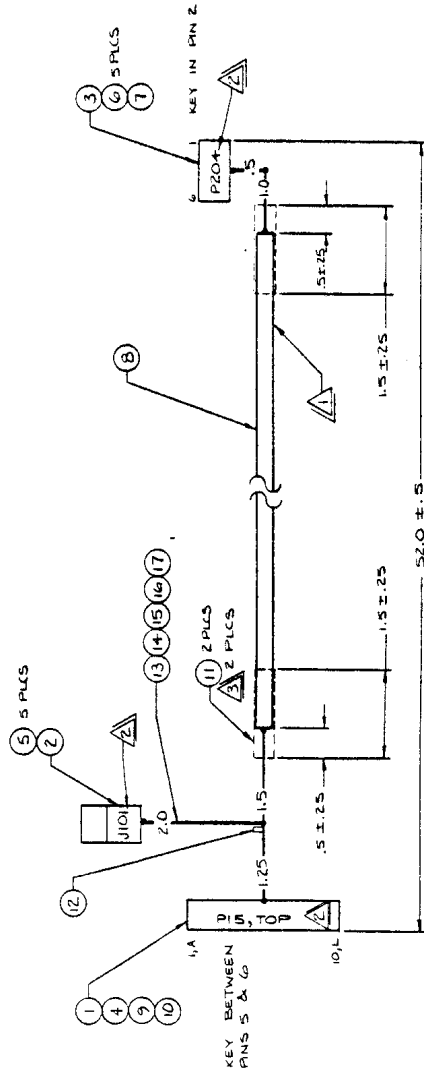
A020821-01

FOUR-30



COIN DOOR CABLE WIRING DIAGRAM

- NOTES**
- IDENTIFY THIS END WITH ATARI DWG. NO. & LATEST REVISION LETTER. (METHOD OPTIONAL)
 - PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
 - INSULATE WITH SHRINK TUBING AS SHOWN.
 - WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (I.E.)
 - SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRING DIAGRAM (THIS SHEET).
 - A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.





Coin Door Cable Assembly
A020821-01

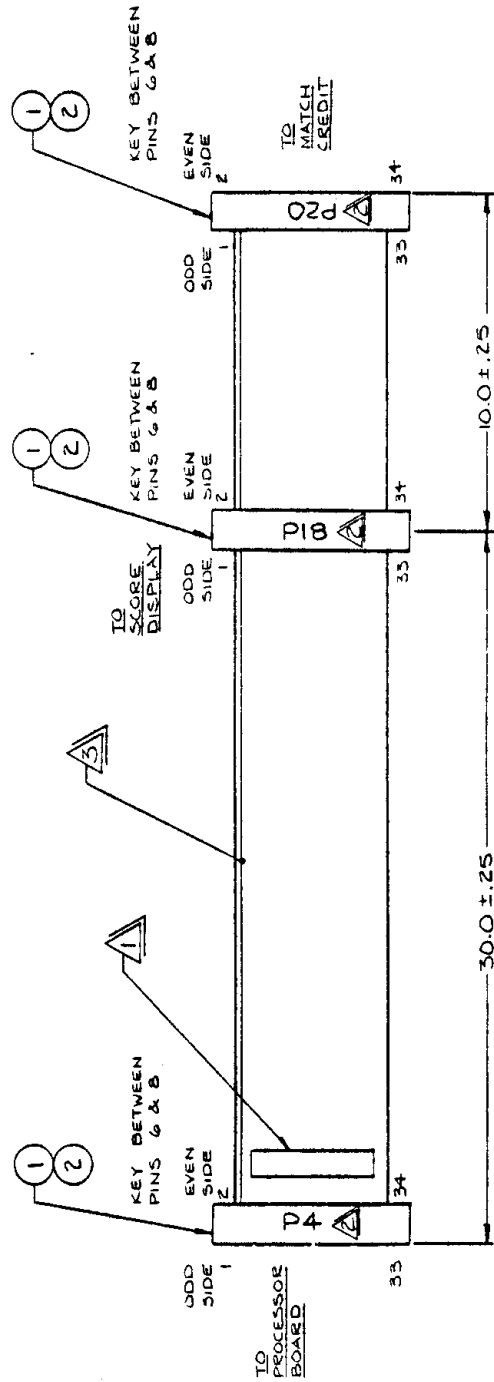
Item	Part Number	Qty.	Description
1	79-51B210 OR 79-51D2210	1	Edge Conn, 20 ckt, Cinch #251-10-30-160 (P15) OR SCC 10D/1-2 (P15)
2	79-58115	1	Cap Housing, 5 ckt, AMP #1-480764-0 (J101)
3	79-58239	1	Connector, 6 ckt, Molex #22-01-2061 (P204)
4	79-511005 OR 79-511014	1	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
5	79-20154	5	Pin Contact, AMP #350690-1 (24-18 AWG)
6	79-20347	5	Terminal, Molex #08-50-0114 (22-30 AWG)
7	79-58244	1	Key, Molex #15-04-9209
8	59-007	*52.0"	Cable, Alpha #1175
9	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/8"
10	78-142050	A/R	Solder
11	78-2C016	3"	Tubing, Blk, Alpha #FIT-105-1/4" OR Raychem, #RT-800-1/4"
12	78-24001	1	Tie Wrap (Miniature)
13	51-22200	A/R	Wire, Stranded, Tinned Copper, UL1061, 22AWG, BK
14	51-22222	A/R	Wire, Stranded, Tinned Copper, UL1061, 22AWG, R
15	51-22233	A/R	Wire, Stranded, Tinned Copper, UL1061, 22AWG, OR
16	51-22255	A/R	Wire, Stranded, Tinned Copper, UL1061, 22AWG, GN
17	51-22299	A/R	Wire, Stranded, Tinned Copper, UL1061, 22AWG, W

*This length is not the cut length.

Note: A wire routing list is not required for this harness.

Display Cable Assembly

A020822-01



NOTES

1. IDENTIFY WITH ATARI DRAWING NUMBER & LATEST REVISION LETTER. (METHOD OPTIONAL)
2. PERMANENT MARK REFERENCE DESIGNATION ON CONNECTOR AS SHOWN.
3. ALIGN COLOR TRACER WITH PIN 1 OF EACH CONNECTOR.
4. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.

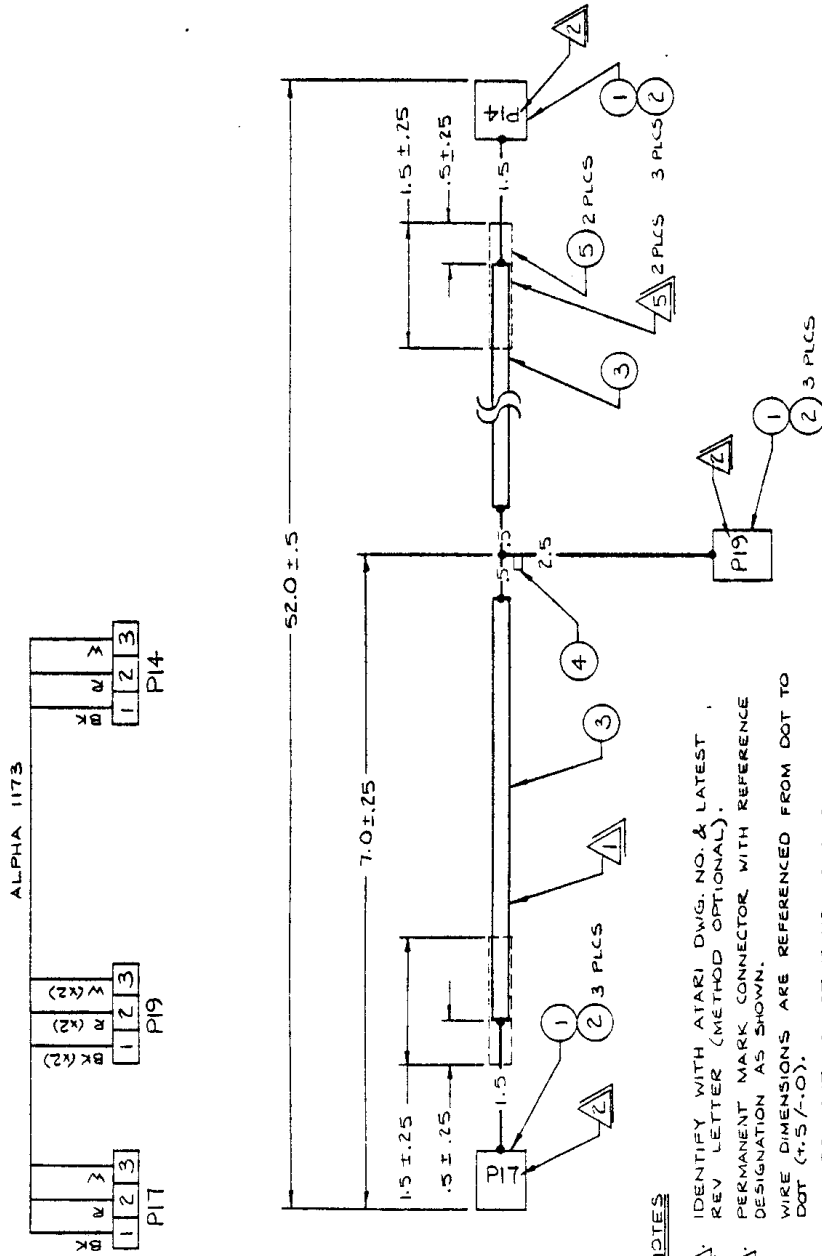


Display Cable Assembly
A020822-01

Item	Part Number	Qty.	Description
1	79-540534 OR 79-540434	3	Edge Conn., 34ckt, 3M #3463-0001 (P4, P18, P20) OR AMP #88104-1 (P4, P18, P20)
2	79-511009 OR 79-511003	3	Key, 3M #3439-0000 OR AMP #88113-1
3	55-13034	10.0"	Cable, Flat Ribbon, 3M #3350/34 OR Spectra Strip #455-241-34

Note: A wire routing list is not required for this harness.

DISPLAY POWER CABLE WIRING DIAGRAM



NOTES

1. IDENTIFY WITH ATARI DWG. NO. & LATEST REV LETTER (METHOD OPTIONAL).
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (.5 / -.0).
4. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS. FOR WIRING INFORMATION SEE WIRING DIAGRAM (THIS SHEET).
5. INSULATE WITH SHRINK TUBING AS SHOWN.
6. THE DESIGNATION (XZ) DENOTES TWO WIRES OF THE SAME COLOR TERMINATED TOGETHER.



Display Power Cable Assembly
A020823-01

Item	Part Number	Qty.	Description
1	79-51306	3	Edge Conn., 3ckt, AMP #640136-3 (P14, P17, P19)
2	79-20349	9	Terminal, AMP #350011-3 (24-18 AWG)
3	59-013	*57.0"	Cable, Alpha #1173
4	78-24001	1	Tie Wrap (Miniature)
5	78-2C016	A/R	Tubing, Blk., Alpha #FIT-105 -1/4" OR Raychem #RT-800 -1/4"

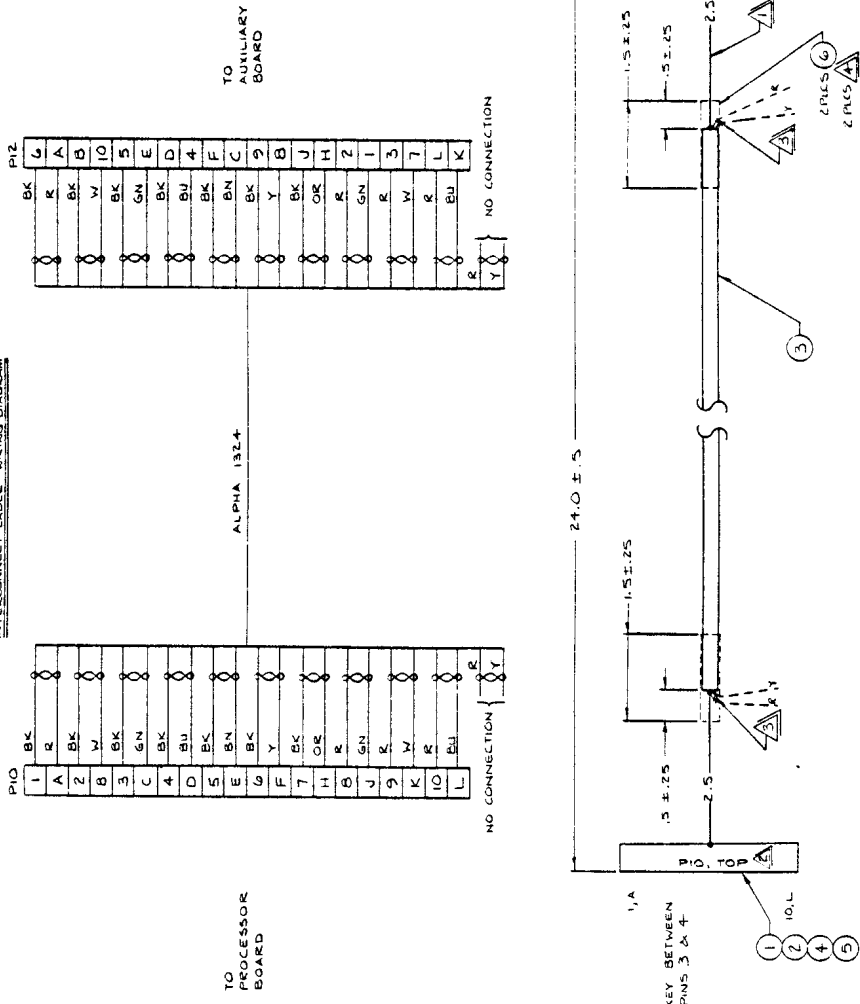
*This length is not the cut length.

Note: A wire routing list is not required for this harness.

Interconnect Cable Assembly

A020824-01

INTERCONNECT CABLE WIRING DIAGRAM



NOTES

1. IDENTIFY WITH ATARI DRAWING NUMBER & LATEST REVISION LETTER. (METHOD OPTIONAL)
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. CUT RAY TWISTED WIRES BACK TO JACKET BEFORE INSULATING WITH SHRINK TUBING.
4. INSULATE WITH SHRINK TUBING AS SHOWN.
5. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (P. 4/10).
6. OX DENOTES TWISTED PAIR.
7. SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRING DIAGRAM (THIS SHEET).
8. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.



Interconnect Cable Assembly
A020824-01

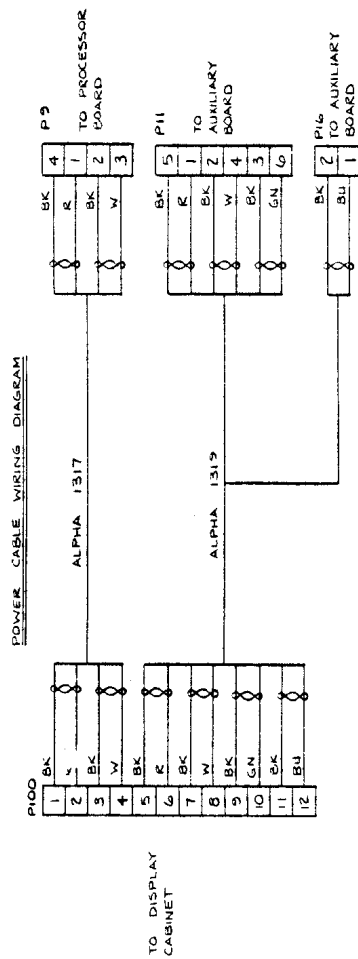
Item	Part Number	Qty.	Description
1	79-51B210 OR 79-51D2210	2	Edge Conn, 20ckt., Cinch #251-i0-30-160 (P10, P12) OR SAE #SCC 10 D/1-2 (P10, P12)
2	79-511005 OR 79-511014	2	Key, Cinch #456-07-35-003 OR SAE #057-002-0000
3	59-005	*24.0"	Cable, Alpha #1324
4	78-28C04	A/R	Tubing, Clear, Alpha #FIT-221-1/3"
5	78-142050	A/R	Solder
6	78-2C032	3"	Tubing, Bl'k., Alpha #FIT-105-1/2" OR Raychem #RT-300-1/2"

*This length is not the cut length.

Note: A wire routing list is not required for this harness.

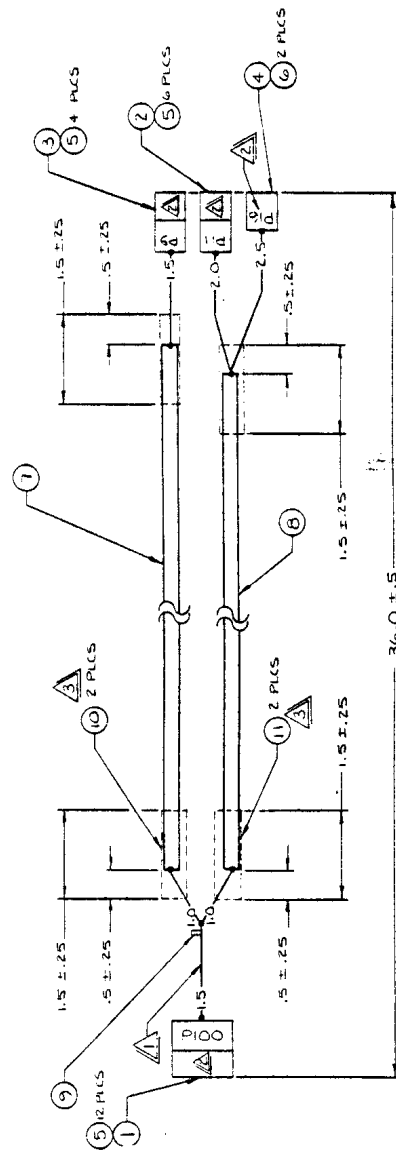
Power Cable Assembly

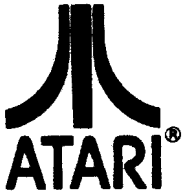
A020825-01



NOTES

1. IDENTIFY WITH ATARI DRAWING NUMBER & LATEST REVISION LETTER. (METHOD OPTIONAL)
2. PERMANENT MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. INSULATE WITH SHRINK TUBING AS SHOWN.
4. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (N.S./-O).
5. OOO DENOTES TWISTED PAIR.
6. SAME COLOR WIRES ARE NOT INTERCHANGEABLE. REFER TO WIRING DIAGRAM (THIS SHEET).
7. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS.





Power Cable Assembly
A020825-01

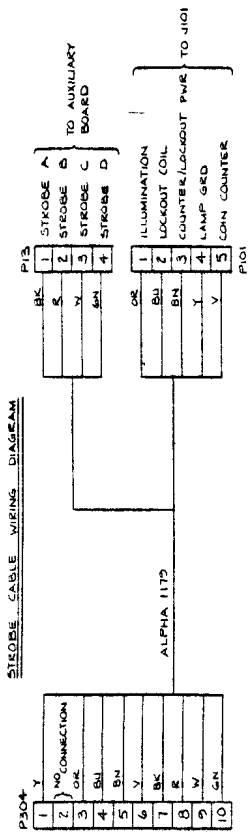
Item	Part Number	Qty.	Description
1	79-58026	1	Plug Housing, 12 ckt, AMP #1-480708-0 (P100)
2	79-58125	1	Plug Housing, 6 ckt, AMP #1-480704-0 (P11)
3	79-58112	1	Plug Housing, 4 ckt, AMP #1-480702-0 (P9)
4	79-51307	1	Edge Conn, 2 ckt, AMP #640136-2 (P16)
5	79-20251	22	Socket Contact, AMP #350689-1 (24-18 AWG)
6	79-20349	2	Terminal, AMP #350011-3 (24-18AWG)
7	59-012	*36.0"	Cable, Alpha #1317
8	59-011	*36.0"	Cable, Alpha #1319
9	78-24001	1	Tie Wrap, (Miniature)
10	78-2C016	3"	Tubing, Blk, Alpha #FIT-105-1/4" OR Raychem #RT-800-1/4"
11	78-2C024	3"	Tubing, Blk, Alpha #FIT-105-3/8" OR Raychem #RT-800-3/8"

*This length is not the cut length.

Note: A wire routing list is not required for this harness.

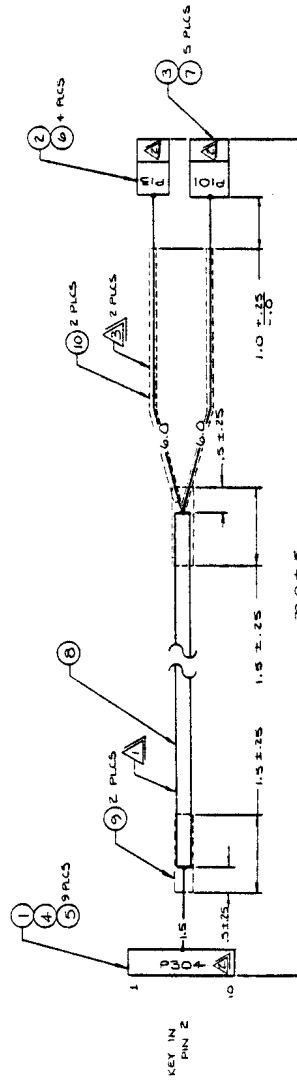
Strobes Cable Assembly

A020826-01



NOTES

1. IDENTIFY THIS END WITH AT&T DWS, NO. & LATEST REVISION LETTER (METHOD OPTIONAL).
2. REQUEST MARK CONNECTOR WITH REFERENCE DESIGNATION AS SHOWN.
3. SLEEVE INDIVIDUAL LEGS TO WITHIN ONE INCH OF CONNECTOR.
4. WIRE DIMENSIONS ARE REFERENCED FROM DOT TO DOT (D-T-O).
5. A WIRE ROUTING LIST IS NOT REQUIRED FOR THIS HARNESS. SEE WIRING DIAGRAM (THIS SHEET).





Strobes Cable Assembly
A020826-01

Item	Part Number	Qty.	Description
1	79-58238	1	Connector, 10 ckt., Molex #22-01-2101 (P304)
2	79-58112	1	Plug Housing, 4 ckt., AMP #1-480702-0 (P13)
3	79-58114	1	Plug Housing, 5 ckt., AMP #1-480763-0 (P101)
4	79-58244	1	Key, Molex #15-04-9209
5	79-20347	9	Terminal, Molex #08-50-0114 (22-30 AWG)
6	79-20154	4	Pin Contact, AMP #350690-1 (24-18 AWG)
7	79-20251	5	Socket Contact, AMP #350689-1 (24-18 AWG)
8	59-006	*70.0"	Cable, Alpha #1179
9	78-2C016	3"	Tubing, Blk, Alpha #FIT-105-1/4" OR Raychem #RT-800-1/4"
10	78-2C012	10"	Tubing, Blk, Alpha #FIT-105-3/16" OR Raychem #RT-800-3/16"

*This length is not the cut length.

Note: A wire routing list is not required for this harness.