Figure 1

The Auxiliary PCB Math Box Circuitry

The Math Box Circuitry of the Battlezone Auxiliary PCB is connected to the Analog Vector-Generator PCB via the PCB harness interconnector. The Math Box Circuitry receives addresses EAB0 thru EAB4 (external address bus 0 thru 4) and provides data EDB0 thru EDB7 that results in the three-dimensional video of the Battlezone™ game.

A second connector on the Auxiliary PCB connects the control signals of the signature analyzer (SA). This header accepts a special harness connector that makes signature analysis extremely easy.
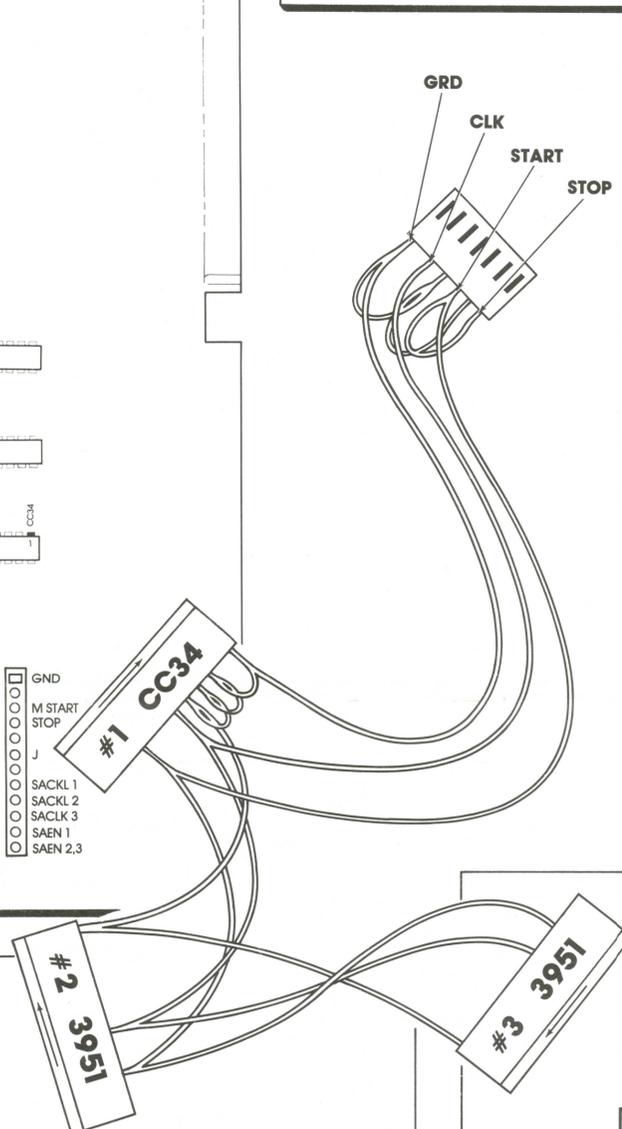
Signature Analysis of the Math Box Circuitry

During the self-test procedure, the Math Box Circuitry is quizzed. **T** displayed in the upper right-hand corner of the self-test video display indicates that the Math Box Circuitry does not answer the question in the amount of time expected. Therefore, a **T** indicates a Math Box Circuitry failure.

Due to the complexity of this circuitry, we offer signature analysis as a simple means of isolating failing circuits. Signatures for this circuitry are presented in two forms:

1) at the actual test points in the Auxiliary PCB Math Box Circuitry schematic diagram (on Sheet 3, Side B), and

2) for your convenience, on the detail drawing of the Auxiliary PCB to the left of this text.

Since the Analog Vector-Generator PCB must be connected to the Auxiliary PCB, you may take signatures while the PCBs are installed in the game.

The following is the procedure for signature analysis of the Math Box Circuitry of the Auxiliary PCB:

— NOTE —
Of two Kurz-Kasch Signature IIs we tried, different STOP, START and CLOCK settings were required. If you are using a Kurz-Kasch signal analyzer, make note of *your* settings of these switches while testing a known good board.

A. Equipment Required:

1. Signature Analyzer (one of the following):

Atari C•A•T Computer-Assisted Troubleshooter. This is a signature analyzer and a RAM/ROM tester combined. For more information contact Atari, Inc., Field Service/Coin-Op Division, P.O. Box 427, Sunnyvale, CA 94086.

OR

Kurz-Kasch Signature II signature analyzer. For more information contact Kurz-Kasch, 711 Hunter Drive, Wilmington, Ohio 45117.

OR

Hewlett-Packard Model 5004A signature analyzer. For more information contact Hewlett-Packard, Scientific Instruments Div., 1501 Page Mill Road, Palo Alto, CA 94304.

For local dealers, check the Yellow Pages under "Electronic Equipment and Supplies."

2. SA Harness Assembly:

Atari part number A036836-01. You can make one of these yourself. The following is an illustration of its construction.

S.A. Harness Assembly
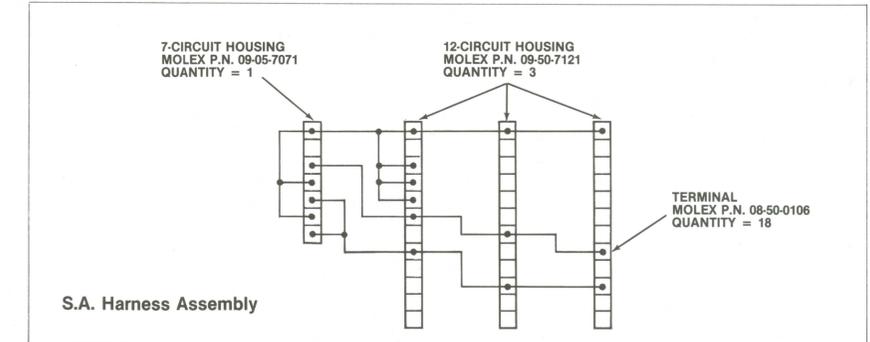
3. Three jumper wires with "hook" connectors on each end.

4. Pullup resistor as follows: 1K to 1.5K ohm, ¼ watt resistor.

B. Signature Analysis Setup Procedure

1. Connect Signature Analyzer to the SA connector of the SA Harness assembly as follows:

Signature Analyzer	SA Harness Assembly
GND	GND
START	STT
STOP	STP
CLOCK	CLK

2. Set Self-Test Switch of Battlezone™ game to ON. After approximately three seconds, the TM monitor should display the self-test pattern.

3. Jumper 1K-ohm resistor R129 (located immediately between and below C [center] and L [left] COIN test points) of Analog Vector-Generator PCB to ground five times, or until video display is blank. You will hear a short beep after the 5th grounding; also, the screen will display only a tiny dot in its center. **NOTE:** To avoid accidentally turning off the game by brushing against the interlock switch, we recommend putting tape over the switch.

Alternate: Jumper pin 5 of Analog Vector-Generator PCB edge-connector J20 to ground five times, or until video display is blank.

C. Signature Analysis Test #1 Procedure

1. Plug SA Harness Assembly Test #1 connector onto Signal Analyzer header on Auxiliary PCB (the black wire on the connector should be at the top).

2. Connect a jumper between pin 1 of IC B6 on the Analog Vector-Generator PCB and ground. This places a continuous RESET to the microprocessor on the Analog Vector-Generator PCB.

3. Set Signature Analyzer START to ⌐, STOP to ⌐, and CLOCK to ⌐.

4. Connect a jumper wire to each end of a 1K to 1.5K-ohm resistor. Connect one jumper wire to +5V test point on Auxiliary PCB. Connect other jumper wire to the tip of the Signature Analyzer probe.

5. Verify that setup procedure was correct by probing (touching probe to) the +5V test point. The Signature Analyzer should indicate **CC34**. If not **CC34**, remove the jumper from pin 6 of IC B6. Return to *B. Signature Analysis Setup Procedure* and once again do step 3.

6. Probe for signatures as shown in Figure 1 to the left. If all signatures are correct, continue with *D. Signature Analysis Test #2A Procedure*. If any signatures are incorrect, probe for signature of **CC34** on +5V test point. If not **CC34**, remove jumper from pin 1 of IC B6. Return to *B. Signature Analysis Setup Procedure* and once again do step 3. If +5V is **CC34**, refer to *G. Isolating a Failing Circuit*.

D. Signature Analysis Test #2A Procedure

1. Remove 1K to 1.5K-ohm jumper wire from Signature Analyzer probe.

2. Plug SA Harness Assembly Test #2 connector onto Signature Analyzer header on Auxiliary PCB.

3. Remove jumper from pin 1 of IC B6 on the Analog Vector-Generator PCB.

4. Set Signature Analyzer START to ⌐, STOP to ⌐, and CLOCK to ⌐.

5. Verify that setup procedure was correct by probing +5V for a signature of **3951**. If not **3951**, return to *B. Signature Analysis Setup Procedure* and once again do step 3, then return to this step.

6. Probe for signatures as shown in Figure 2A to the left. If all signatures are correct, continue with *E. Signature Analysis Test #2B Procedure*. If a signature is incorrect, refer to *G. Isolating a Failing Circuit*.

E. Signature Analysis Test #2B Procedure

1. Make sure the SA Harness Assembly Test #2 connector is plugged onto Signature Analyzer header on Auxiliary PCB.

2. Make sure jumper is removed from pin 6 of IC B6 on the Analog Vector-Generator PCB.

3. Set Signature Analyzer START to ⌐, STOP to ⌐, and CLOCK to ⌐.

4. Verify that setup procedure was correct by probing +5V for a signature of **72A2**. If not **72A2**, return to *B. Signature Analysis Setup Procedure* and once again do step 3, then return to this step.

5. Probe for signatures as shown in Figure #2B to the left. If all signatures are correct, continue with *F. Signature Analysis Test #3 Procedure*. If a signature is incorrect, refer to *G. Isolating a Failing Circuit*.

F. Signature Analysis Test #3 Procedure

1. Plug SA Harness Assembly Test #3 connector onto Signature Analyzer header on Auxiliary PCB.

2. Make sure jumper is removed from pin 6 of IC B6 on the Analog Vector-Generator PCB.

3. Set Signature Analyzer START to ⌐, STOP to ⌐, and CLOCK to ⌐.

4. Verify that setup procedure was correct by probing +5V for **3951**. If not **3951**, return to *B. Signature Analysis Setup Procedure* and once again do step 3, then return to this step.

5. Probe for signatures as shown in Figure #3 to the left. If all signatures are correct, then Math Box Circuitry of Analog Vector-Generator PCB is OK.

G. Isolating a Failing Circuit

If you find an incorrect signature, find the signature test point of the Math Box Circuitry on Sheet 3, Side B. Locate the IC from which the signature is being output. Check all inputs of that IC.

If all input signatures are correct: Remove the Auxiliary PCB from the circuit. Check the circuit traces common to the failing IC pin on both the top and bottom of the PCB for shorts to another circuit trace. If the circuit traces are not shorted, then replace the failing IC.

If an input signature is incorrect: Locate on the schematic the IC source of the failing signature. Check the input signatures of that IC. If all input signatures are correct, then that is the failing IC. If this IC has a failing input signature, then continue "upstream" in the circuit flow until the failing IC is isolated.
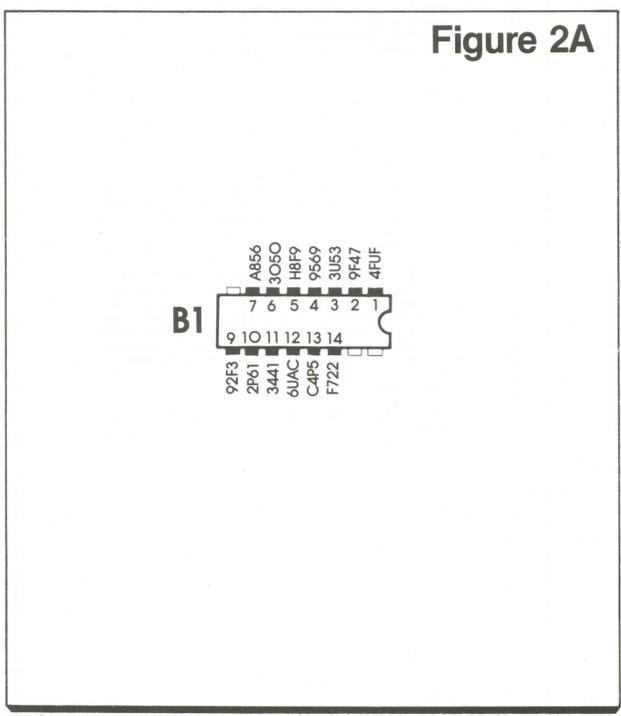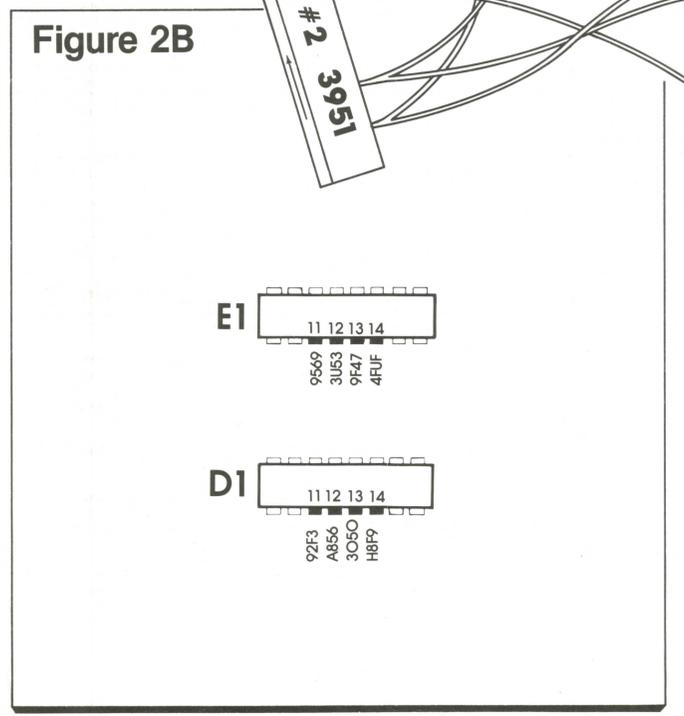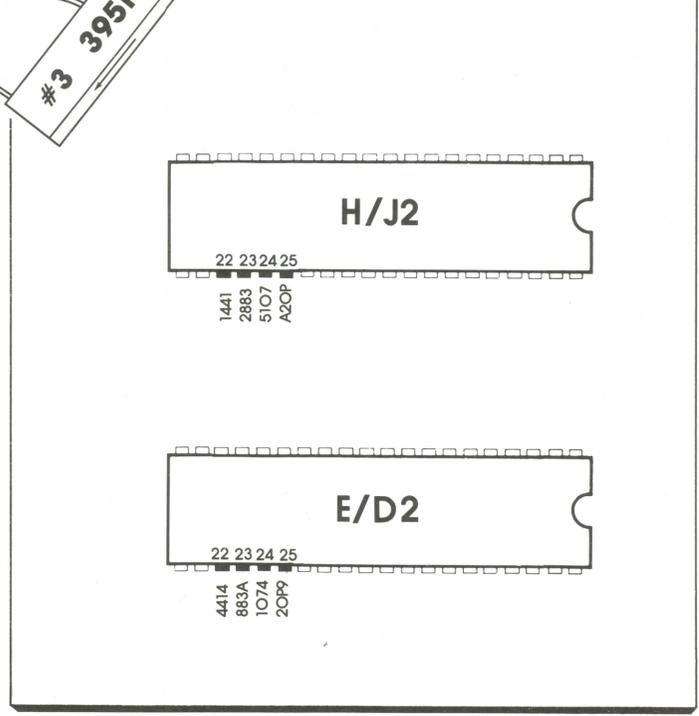
Figure 3

Figure 2A

Figure 2B