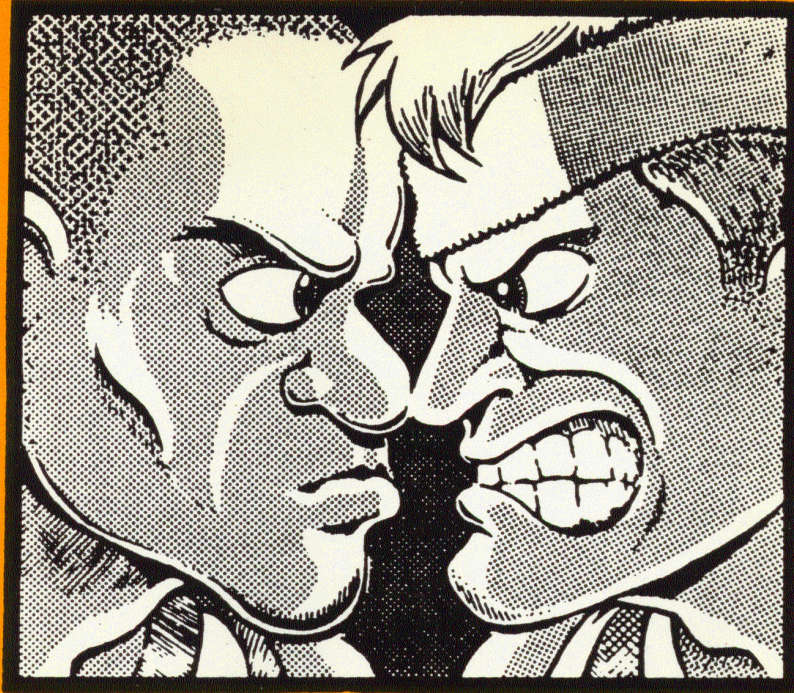


16-4001-K-101
May 1989

*Bally/MIDWAY*TM



ARCH RIVALRY

kit installation
and
operation
manual

HOMETOWN HEROES OPTION - HOW TO CUSTOMIZE YOUR GAME

1. PUT GAME IN TEST MODE:
 - a. Pull out diagnostic switch inside coin door.
 - b. Activate TILT switch.

2. SELECT "HOMETOWN HEROES" OPTION:
 - a. Use left player control button.
 - b. Move cursor (ball) to "HOMETOWN HEROES".
 - c. Press 1 or 2 PLAYER button.

3. Turn on switch 6 on game board.

4. Select item to update:
 - a. Use left player control button.
 - b. Move cursor (ball) to item to update.
 - c. Press 1/2 PLAYER or ANY left player buttons.

5. Team Updates (SELECT "NEW COLORS/NEW NAMES"):
 - a. 1 player button for "NEW COLORS".
 - b. 2 player button for "NEW NAME".

6. NEW COLORS:
 - a. Move left player joystick to change colors.
 - b. Press any left player button to save.
 - c. TILT to abort.

7. NEW TEAM NAME:
 - a. Move left player joystick to change LETTER.
 - b. Press any left player button to save LETTER.
 - c. Use (<-----) to ERASE.
 - d. Clear out all unwanted letters.
 - e. Move to "DONE" and press button to save.
 - f. TILT to abort.

8. TO CHANGE "PRESENTS" SCREEN:
 - a. ENTER NAME AS YOU WOULD LIKE IT TO APPEAR
 1. CENTER NAME OVER "PRESENTS"
USE SPACE or (<----->).
 - b. Move left player joystick to change LETTER.
 - c. Press any left player button to save LETTER.
 - d. Use (<-----) to ERASE.
 - e. Clear out all unwanted letters.
 - f. Move to "DONE" and press button to save.
 - g. TILT to abort.

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Notices and Warnings

Notice

Parts salvaged from an old game are required to complete your kit. These salvaged parts *must* operate perfectly or the converted game cannot perform properly or safely. Always repair circuit board malfunctions and cabinet damage before conversion is attempted.

These parts are:

1. A Power Supply capable of +5V DC at a minimum of 7A; -5V DC at a minimum of 1A and +12V DC at a minimum of 1A. These operating voltages are necessary for your kit. Your Power Supply must be FCC approved.
2. A Monitor with a horizontally mounted CRT that is capable of 16KHZ and Raster electronics with inputs for red, green, and blue video, as well as composite sync.

Warning

Use of Non-*Bally Midway* Parts or Circuit Modifications May Cause Serious Injury or Equipment Damage. Use Only *Bally Midway* Authorized Parts.

1. For safety and reliability, substitute parts or modifications are not recommended.
2. Substitute parts or modifications may void FCC type acceptance.
3. This game is protected by federal copyright, trademark and patent laws. Unauthorized software or hardware modifications may be illegal under Federal law. This law also applies to *Bally Midway* logos, designs, publications, and assemblies. Moreover, facsimiles of *Bally Midway* equipment (or any other feature thereof) may be illegal under Federal law, regardless of whether or not such facsimiles are manufactured with *Bally Midway* components.

Warning

Prevent Shock Hazard and assure proper operation. Only plug this game into a properly grounded outlet. Do not use a cheater plug to defeat the powers cord's ground pin. Do not cut off the ground pin.

Important

Check the Arch Rivals kit for an FCC sticker and apply it over the existing sticker on the cabinet. When *Bally Midway* ships a game, it is in compliance with FCC regulations. Your sticker, is proof. If your sticker is missing or damaged, legal repercussions to the owner or distributor of the game may result. If your game doesn't contain a FCC sticker contact your *Bally Midway* distributor immediately.

Warning

This equipment generates, uses and can emit radio frequency and, if not installed properly and used according to the directions in this manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference to radio communications, in which case the user, at his or her own expense, will be required to take whatever measures may be needed to correct the interference.

Disconnect power during set-up and repairs. To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any part of this game.

Installation

Cabinet Modifications

1. First, inspect your old cabinet. Remove foreign objects and fill in gouges with a good quick-hardening wood putty. Sand cabinet and wipe it clean.
2. Repaint the cabinet with black semi-gloss paint, (for games with wood grain sides: remove the old decals and clean the glue residue from the old decal). Allow to dry and set.
3. Pencil a line roughly at the top of the old graphic. Lightly moisten the cabinet with soapy water or glass cleaner. Apply the decal starting at the top and working down. After the decal is in place, use a piece of the foam packaging as a squeegee and smooth the decal down, taking care to squeeze out the air bubbles. If you miss an air bubble, pop it with a razor blade or a pin and burnish it down. Allow 12 hours for the adhesive to set. Remove masking.
4. Position the FCC sticker near the power cord.
5. Apply the CRT overlay to the glass covering the CRT.
6. Apply the instruction decal.

Control Panel Modifications

1. Remove the control panel buttons, joysticks, and the old vinyl covering .
2. Place the panel template on the control panel, and use it to help you align your control panel.
3. Leave your 1 and 2-Player buttons where they are. Drill holes as needed for the joysticks and other buttons. Plug any old holes with wood blocks, putty, cardboard, or epoxy. File the new holes smooth.
4. Carefully remove the backing on the vinyl control panel overlay. Place the overlay on top of the control panel. Assure that no air bubbles get under the vinyl overlay.
5. After the overlay has been securely applied, use a razor knife to cut holes for the buttons and joysticks. Player-1 and Player-2 START stickers go next to the appropriate buttons. A joystick direction decal goes around the joystick opening. Position Pass/Punch/Steal, and Shoot/Block stickers according to the template.
6. To mount the joystick assembly to the control panel, first push the joystick shaft and handle through the control panel from the back. If you have a metal control panel, or if the joystick protrudes too far out of the hole, insert the wood spacer included with your kit between the joystick mounting bracket and the control panel.

Once you have positioned the joystick, attach it to the back of the control panel with the Phillips screws provided. Repeat the procedure for the remaining joystick.

7. To mount push buttons to the control panel, insert the buttons through the control panel from the top and secure into place with mounting nuts provided with your kit.
8. Next, attach the blade switches to the control panel. Start by positioning the switch so that the long blade just covers the round tab on the bottom of the push button. The short blade should be facing you, not the control panel. Secure into place with Phillips screws.
9. After all control panel components are installed, attach the protective cover. It may be necessary to cut holes to accommodate the control panel components.

Installing the Interboard Wiring

1. Disconnect the old wiring harness from the CPU board. Use the schematic drawing from your old game to carefully note the function of each wire. Label the wires, if it will help to do so.
2. Carefully remove the circuit boards and the metal circuit board panel. Leave the transformer chassis in the game.
3. Leaving several inches of wire at each connector, cut the wires near the coin door, monitor, player panel, power supply, and speaker. *Do not cut the other side of these wires. That is, the side that is connected to the CPU should not be cut.*
4. Following the Wiring Diagram Schematic or the Jamma/Joystick Cable chart, solder the coin door, monitor, player panel, power supply, and speaker wires to the Jamma/Joystick Cable. Using electrical tape, be sure to insulate all splices.
5. The cables for the joysticks plug into the PC boards that are part of the joystick assembly. The cable for the left joystick has orange wires. The cable for the right joystick has yellow wires.
6. If your game has a series-pass transistor for the power supply on a separate heatsink, remount the metal heatsink beside the power supply board.
7. Check and clean the input jack on the power supply board. Replace any burned or damaged pins.
8. Install diagnostic (test) and tilt switches according to the Wiring Diagram Schematic. You may find it convenient to install the tilt switch in the coin door and the diagnostic switch on top of the cash box.

Installing the FCC Cage

1. Use the screws supplied to mount the FCC cage inside the game either on the back door or on one of the walls. Do not open the FCC cage while installing it.
2. Remove one mounting screw from each of the following: the transformer, the power-supply board, the cage, and the mounting plate for the FCC cage. Attach the ground braid between each one of these and replace the screws. The cage and the mounting plate for the FCC cage must be grounded separately.
3. Plug the Main Harness into J1 of the Jamma Interface Board. Support the cable as necessary with plastic wire guides. Jack J5 on the Jamma Interface Board is the connection for Player-1 Joystick and has a cable with mostly orange wires plugged into it. The other end is plugged into the Player-1 Joystick PC Board. Jack J4 on the Jamma Interface Board is the connection for the Player-2 Joystick and has a cable with mostly yellow wires plugged into it. The other end is plugged into the Player-2 Joystick PC Board.

Game Play

Starting Up

Turn the game on. After the player inserts the required number of coins, the game exits the attract mode and enters the play mode. Play mode halts until the one-player or two-player CREDIT button has been hit. After the player selects the ARCH RIVAL character for the game, game play will commence.

Player Controls

Credit Buttons designate one-player or two-player modes.

Joystick allows the player to assume 49 positions and move in 4 directions.

White Buttons allow the player to Pass in offense and Punch or Steal in defense.

Red Buttons allow the player to Shoot in offense and Block in defense.

Scoring

The game basically follows the same rules as basketball. Two points are awarded for each completed basket shot. Three points are awarded for completed shot outside the three-point line. The game does not account for fouls, so players are encouraged to use the Punch feature to make the game more enjoyable.

Ready-To-Play Mode

The Ready-To-Play mode begins when proper coinage has been accepted in the coin slot. During this mode the game will ask the player(s) to press the one-player or two-player Credit button. After the Credit button has been pressed, player will get a chance to pick a character to represent them in a game. After selecting a character press the Shoot or Pass button to proceed into game play. If a character is not selected the game will assign one automatically.

Play Mode

The Play Mode begins for each player when the Shoot or Pass buttons have been pressed. The Play Mode ends for each player when game time runs out. "Video Time Out-Insert Coin" appears on the screen, signaling the player to insert another coin to continue game play. The player has 15 seconds to insert another coin to continue the game that was already started. After 15 seconds, the Play Mode will start with a new game.

Offensive Play

To Shoot or Pass, press the appropriate button. To "fake out" an opponent, hold the button down longer. If your teammate is holding the ball, you can "tell him" to Shoot or Pass by pressing the appropriate button.

Defensive Play

To Block, press and release the shoot button. To Steal, aim your player at the ball, and press either Pass button.

Diagnostics and Adjustments

Diagnostic Mode

By pulling the white diagnostic switch and pressing the tilt switch, the operator can enter the Diagnostic Mode. The Diagnostic Mode can be entered at any time from any mode of operation.

Once in Diagnostics, the operator has access to several features and self-test operations. These are shown on the screen. Use Player Joystick the move cursor. Press 1 or 2 Player Button to start the test.

Self-Test

This test is designed to locate and identify any computer malfunctions. When selected, the game enters this mode immediately and begins scanning its memory. The phrases "PASSED TEST" or "FAILED TEST" will appear on the screen depending on whether the test was successful or not.

"Hometown Heroes"

The operator has the capability to program names and colors of his choice for four different teams which his game will feature. Having entered into "Hometown Heroes", select the team that is to have their name and/or colors updated using the left joystick. Press the Credit Button to proceed. The game requests the operator's choice between NEW COLORS and NEW NAME, (Press the two-player Credit Button for NEW NAME, or the one-player Credit Button for NEW COLORS). Both of these items may be changed, but only one at a time. Again, press the Credit Button to proceed. When programing the new information, use the joystick to select your choice, and press the Shoot Button to enter that choice.

Reset High Scores

The game automatically clears High Scores when either Credit Button is pressed.

Switches

The Switch and Sound Self-Test mode allow the operator to determine if all game switches, sound features, and the opto-board controlled joysticks are operating properly. The operator can activate switches one at a time and check the monitor screen to see if they are acknowledged.

Sounds

The two Credit Buttons activate the Sound-Test during the Switch-Test mode. Press the one-player Credit Button to run through the music features and the two-player Credit Button to test the speech functions.

Joysticks

To assure that the joysticks are operating properly, while in the Switch Test mode, check to see that they can be moved for three units in all of the appropriate (up, down, left, right) directions.

Grid

The Convergence Grid Display Test displays a crosshatch pattern to aid in adjusting the color monitor. This pattern is useful in adjusting the color balance, convergence, vertical linearity, and vertical/horizontal sizing. To exit this test, press the Tilt switch.

DIP Switch

All game options are adjustable by changing the bit switch settings on the DIP Switch unit (on the 68000 Video Board in location 12A). The DIP Switch unit combines ten bit switches, which are set to the On or Off position. When you enter this test mode, the screen shows a full display of current DIP Switch settings.

Arch Rivals OPTION (DIP) SWITCH SETTINGS TABLE

| | SW 1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9* | SW10 |
|--|------------------------|------------------------|--|--|---|-----------|-----------|-----------|------|-----------|
| GAME TIME: Preset Preset + 10 sec Preset + 20 sec Preset + 30 sec | OFF ON OFF ON | OFF OFF ON ON | | | | | | | | |
| COIN CHUTES: 1 Coin;1 Credit 2 Coins;1 Credit 3 Coins;1 Credit 2 Coins;3 Credit 1 Coin; 2 Credits 1 Coin; 3 Credits 1 Coin; 5 Credits 1 Coin; 6 Credits | | | OFF ON OFF ON OFF ON OFF ON | OFF OFF ON ON OFF OFF ON ON | OFF OFF OFF ON ON ON ON | | | | | |
| "HOMETOWN HEROES": Programmed Default Teams | | | | | | ON OFF | | | | |
| ATTRACT SEQUENCE SOUNDS: Sounds No Sounds | | | | | | | OFF ON | | | |
| Free Game No Free Game | | | | | | | | ON OFF | | |
| FREEZE SW: Freeze Mode Normal Operation | | | | | | | | | | ON OFF |

* Switch 9 : Not Used

Troubleshooting

General Operation

The following section gives a brief overview of the ARCH RIVALS computer system. A troubleshooting chart is located at the end of this section. The chart may help the operator locate a faulty component quickly.

68000 Microprocessor

The computer in your Arch Rivals game is controlled by a Motorola 68000 microprocessor. Microprocessor chip 4E is on the CPU Board. This chip has 32 address lines and 16 bidirectional data lines. As with other microprocessors, each of these lines corresponds to an address or data bit.

Local Memory Devices

Local ROM. The Game program is in Local ROM chips 2B, 2C, 3B, and 3C. Also stored in this ROM is staging data used in the game's Foreground Packet Section.

Local RAM. The microprocessor uses Local RAMs 4B and 4C, when it processes program or peripheral data. RAM chip 4B contains the eight "low" bits, while chip 4C holds eight "high data bits".

Image Storage

Your game stores image data in three places. Two of these control foreground graphics; a third furnishes background image.

Foreground Packet Section. The first section is a library of details about foreground (moving character) images. Because these details are packetized, this section is called Foreground Packet Section. The system computes such details or retrieves them from Local (program) ROM. These details may involve a character's position in the screen. They may also specify the group of colors for its display. However, digitized image description (called bit maps) are stored and manipulated elsewhere.

Foreground Bit Map Section. The second section is the Foreground Bit Map Section. This includes a Foreground Image ROM for game foregrounds including characters. The Foreground Image ROM is composed of chips 7J through 10J. This ROM stores the bit map of characters such as basketball players and cheerleaders.

Background Section. Game backgrounds (scenery) are in the background section. On command, Background Pixel PROM 11D/12D passes a scene to Background Pixel RAM 13E.

How They Produce Video. How do the three sections work together? The microprocessor loads an appropriate image pixel into Foreground or Background RAM. Packet RAM distributes additional foreground image details. Then, under microprocessor control, image pixels are combined at a switcher. (This switcher

appears on schematics as the "Color Arbiter"). Switcher 7A/8A/8B/9B determines whether a foreground or background pixel should fill an area of screen.

Color Ram

Between the Switcher and the screen, pixel data addresses a Color RAM. This mapping process substitutes color data for pixel data. Color RAM 4A produces three bits each of red, green, and blue data.

Discrete Video DAC

Resistors and Transistor. Color RAM output bits arrive at three PNP transistors Q5, Q7, and Q9. Between the buffer and each transistor, each bit is fed through a different value resistor. These resistors determine how intensely each transistor will turn on. The resistors form a discrete digital-to-analog converter (DAC). Three resistors join each transistor's base to Color RAM outputs. Because the Color RAM produces nine output bits, each resistor corresponds to one bit.

The high bit turns the color transistor on the hardest. The middle bit turns the transistor on half as hard. And the low bit turns the transistor on one quarter as hard.

The outputs of the three transistors become the red, green, and blue components of a pixel. The game feeds these outputs to a computer monitor for screen display.

Video Blanking. Driven by a clock signal and inverted by gate 1A. The blanking output of NPN transistor Q3 allows or disables current flow through the red, green and blue transistor outputs.

Sound Link

The Jamma Interface Board links the game computer to the Sound Board. The CPU Board specifies sounds that the Sound Board must produce. Sound specifications consist of 10-bit, TTL sound-selection and strobe data. An eleventh bit permits the CPU Board to reset the Sound Board.

PAL and PLA Devices

What they are. Your game produces many of its control functions in programmable logic arrays. Depending on the type, these chips are shown on schematics as PLAs or PALs. Although they contain certain programmable hardware, these devices are related to PROMS.

No Substitutes. Because PALs and PLAs must be programmed, part substitution isn't possible. If you need a part you must order in from *Bally Midway*.

Color Arbiter. The most important PAL is chip 9B, the "Color Arbiter" that presides over video switching. It select a foreground or background video pixel for screen display. This PAL is the only programmable logic array that's directly in the pixel data path. The other PALs and PLDs manipulate control signals.

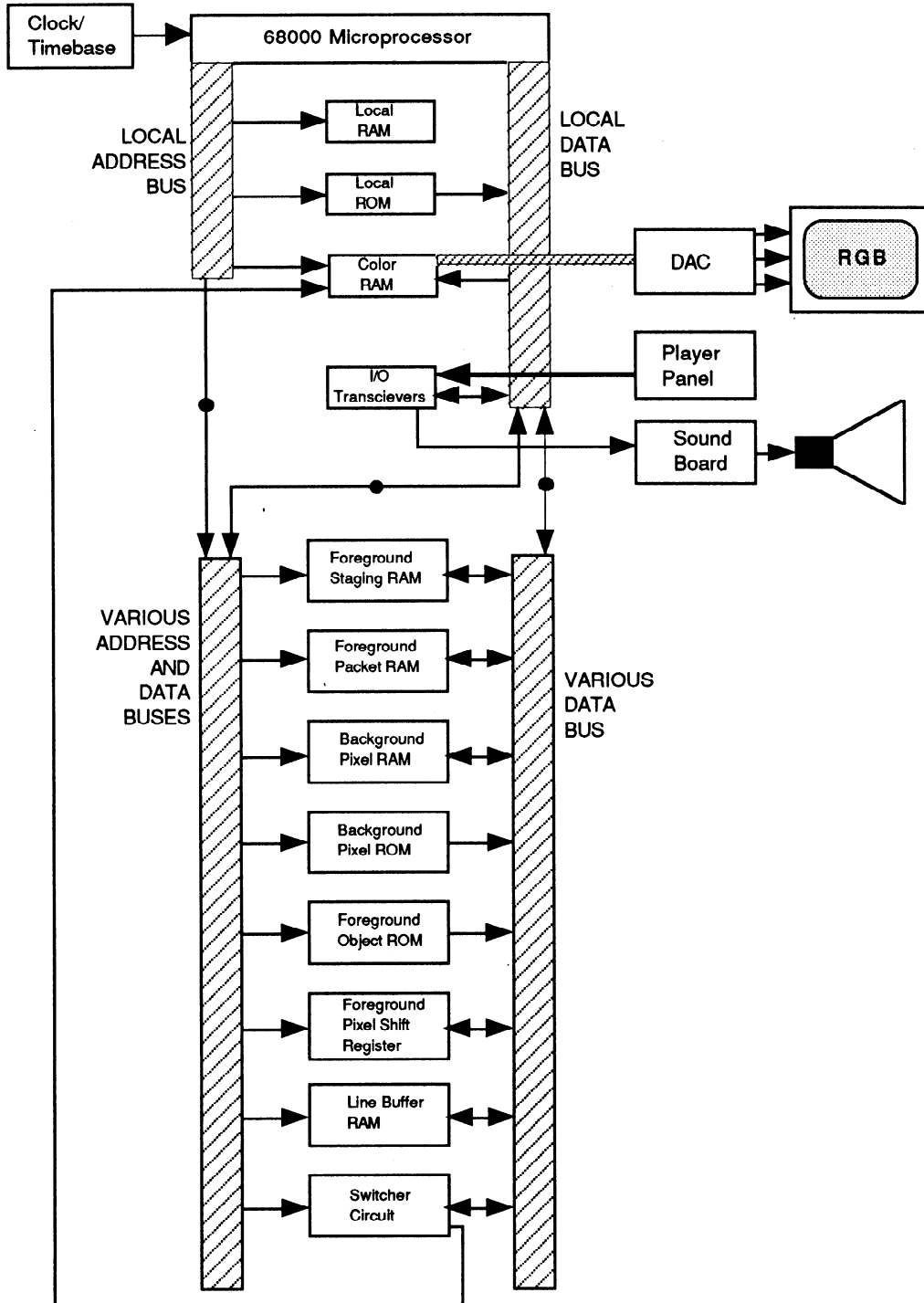
Foreground Packet Control. The Foreground Packet Control receives many control signals from Foreground Packet Control PLA 11J/12J. Outputs of these two chips feed through latch 11K/12K. Resultant signals control counter 4G/6G/6H, the origin of the Packet Address Bus. This bus addresses the Foreground Packet RAM and the Foreground Staging RAM. Other circuits receive signals from the Foreground Packet Control PLA. Other signals are affected by the Foreground Packet Control PLA.

- >Foreground Rom Control PLA 14H
- >Foreground Object ROM Resistor 6K
- >Latch 5F
- >Line Buffer RAM Multiplexer 4K
- >Line Buffer RAM 5D/6D/7D/8D/ and related gates

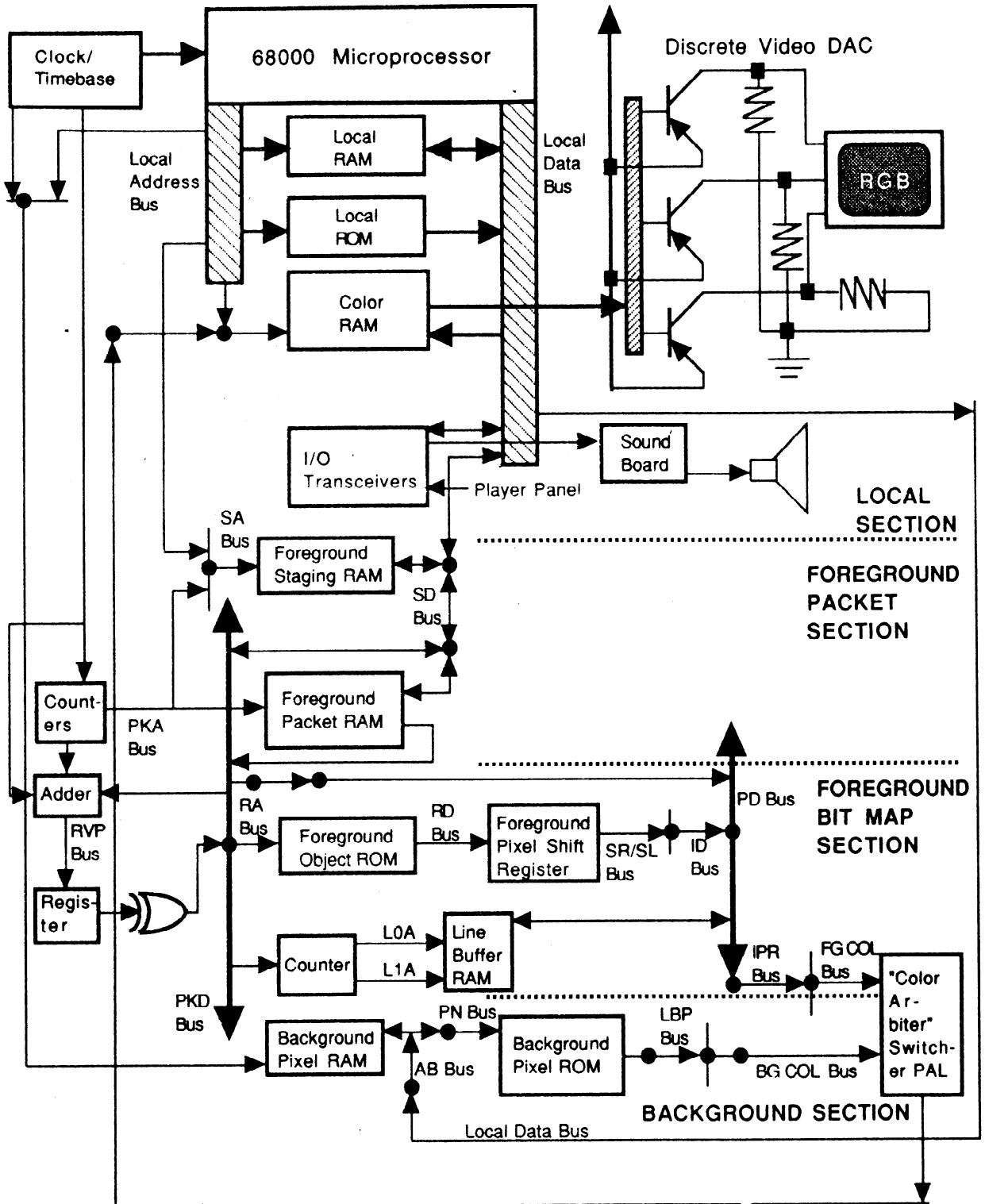
Foreground ROM Control. Chip 14H is another PLA device. The system latches this PLA's output at chips 13H, 15H, and 15J. Functions output from the latches address the the Foreground Object ROM . Other signals from PLA 14H affect operation in the following circuits...

- >Multiplexer 9D/9E
- >NAND 13J and PD Bus Latch 5E/6E/7E/8E
- >Foreground Pixel Shift Register
7G/7H/8G/8H/9H/10G/10H
- >Line Buffer RAM 5D/6D/7D/8D and related gates

SIMPLIFIED BLOCK DIAGRAM



DETAILED BLOCK DIAGRAM



- NOTES: ● = latch, buffer or transceiver.
 Left side of memory chips indicates address pins; right side, data pins.
 ⊙ = multiplexer.
 Not shown: Control Bus, part of Timebase Bus.

Troubleshooting: From Block to Problem

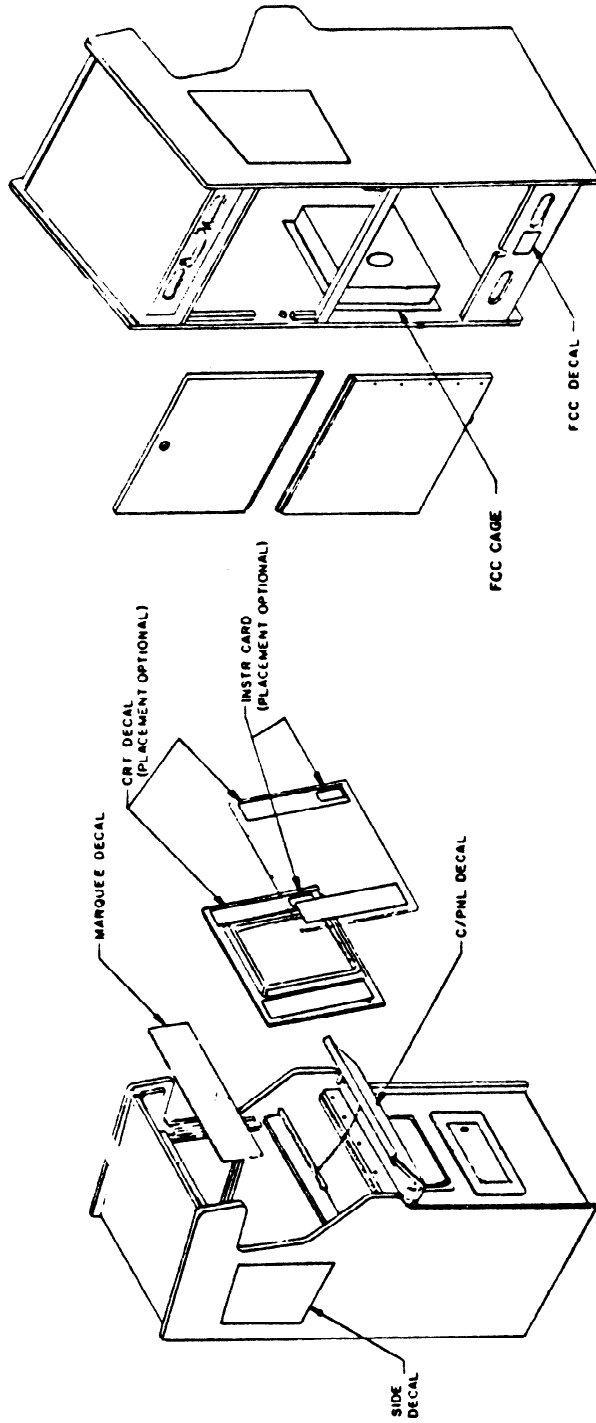
| Symptom | Area to Check |
|---|--|
| Dead system | 1. Fuses; 2. Switching Power Supply; 3. clock chip; 4. monitor; 5. local bus components: MPU 4E, Local RAM 4B/4C, Local ROM 1B/ 1C, 2B/2C, 3B/3C, etc.; 6. capacitor C1; 7. transistor Q3. |
| Missing or improper background video | Background Section: 1. mux 13F/13G/ 14G; 2. Background Pixel RAM 12F/13E; 3. transceiver 12F; 4. latch 11E/12E; 5. Background Pixel PROM 11D/12D; latch 11C/12C; mux 11B/12B; latch 10B; PAL 9B. |
| Characters in the wrong place; wrong foreground colors | Foreground Packet Section: 1. PLA 11J/12J; 2. Mux 2H/3H/4H; 3. Foreground Staging RAM 3J/4J; 4. data buffer 5H; 5. counter 4G/6G/6H; 6. Foreground Packet RAM 5G. |
| Missing or improper foreground video | Foreground Bit Map Section: 1. Adder 11G/12G; 2. register 6K; 3. OR 7K/13K; 4. latch 5J/6J; 5. PLA 14H; 6. Foreground Object ROM 7J/8J/9J/10J; 7. register 7G/7H/8G/8H/9G/9H/10G/10H; 8. mux 9D/9E; 9. latch 5F; 9. latch 5E/6E/7E/8E; 10. counter 6F/7F/8F/9F; 11. Line Buffer RAM 5D/6D/7D/8D; 12. latch 5C/6C/7C/8C; 13. mux 6B/7B. |
| Ghost images; confused foreground/background separation | 1. PAL 9B; 2. mux 6B/7B; 3. latch 10B. |
| Black, vertical lines through image | 1. Flip-flop 8B; 2. latch 7A/8A; 3. Color RAM 4A. |
| One missing hue | Red: Q8/Q9; green: Q4/Q5; blue: Q6/Q7. |

Troubleshooting: From Block to Problem (continued)

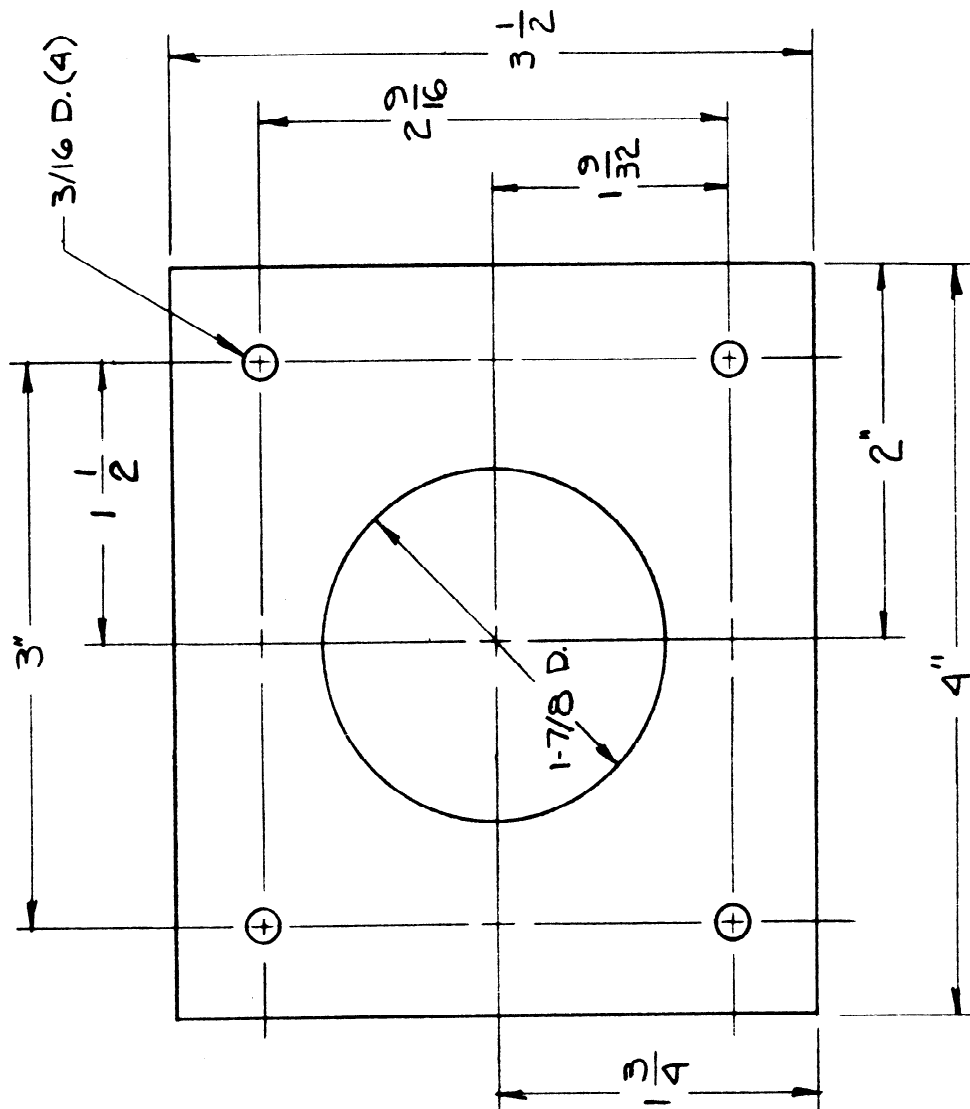
| Symptom | Area to Check |
|---|--|
| Some player panel switches don't work | 1. Switches under panel; 2. Connectors 1J2, 1J3, 1J4; 3. Buffers 5A, 9A, 13A, 14A; 4. resistor packs RM2, RM3, RM4, RM5; 5. associated capacitors. |
| Missing sounds | 1. Connectors 1J3, 1J4; 2. buffers 6A, 10A; 3. resistors R99 through R106; 4. resistors R107 to R112; 5. associated capacitors. |
| Characters with lines through them or boxes around them | Foreground Object ROM chips 7J, 8J, 9J, 10J. |
| Wrong or mixed-up character images | 1. register 6K; 2. XOR gate 7K/13K; 3. latch 5J/6J; 4. Foreground Object ROM 7J/8J/9J/10J; 5. PLA 14H; 6. latch 13H; 7. PLA 11J; latch 11K. |
| Rough or "sketchy" looking background video | Background Pixel ROM chips 11D and 12D. |
| Wrong or mixed-up background images | 1. Multiplexer 13F/13G/14G; 2. Background Pixel RAM 13E; 3. transceiver 12F; 4. latch 11E/12E. |
| | |

JAMMA/JOYSTICK CABLE

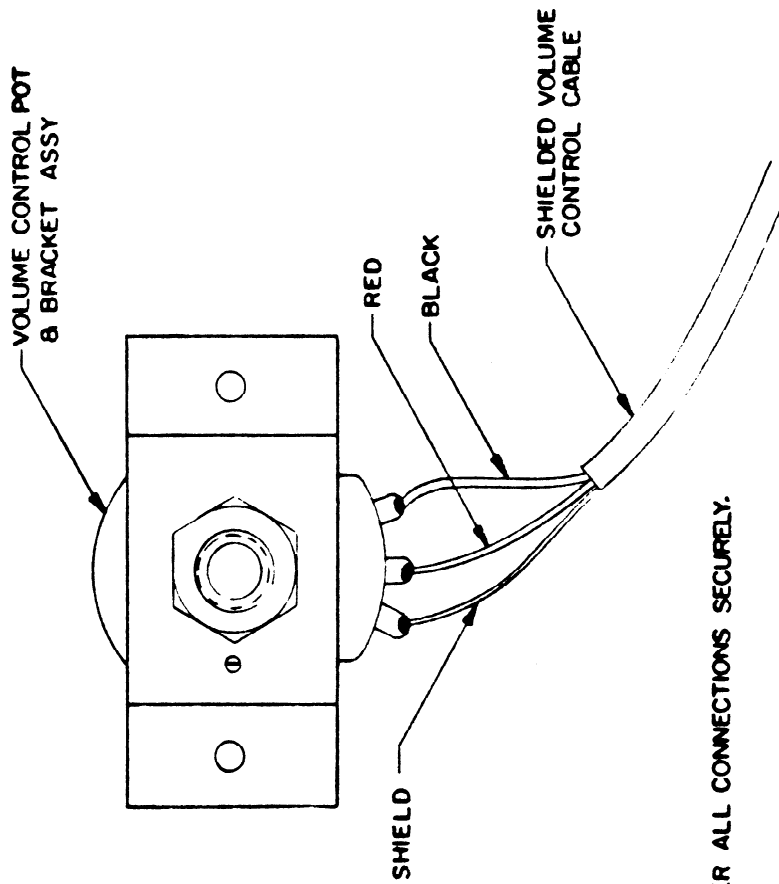
| FUNCTION | WIRE COLOR | PIN | PIN | WIRE COLOR | FUNCTION |
|--------------------|------------|-----|-----|------------|---------------------|
| GND | BLK | 1 | A | BLK | GND |
| GND | BLK | 2 | B | BLK | GND |
| +5V | RED | 3 | C | RED | +5V |
| +5V | RED | 4 | D | RED | +5V |
| -5V | YEL/GREEN | 5 | E | YEL/GREEN | -5V |
| +12V | ORN/BLK | 6 | F | ORN/BLK | +12V |
| KEY | ----- | 7 | H | ----- | KEY |
| NC | NC | 8 | J | NC | NC |
| NC | NC | 9 | K | NC | NC |
| SPEAKER - | VIO/RED | 10 | L | VIO/YEL | SPEAKER + |
| NC | NC | 11 | M | NC | NC |
| VIDEO RED | RED | 12 | N | GREEN | VID. GREEN |
| VIDEO BLUE | BROWN | 13 | P | WHT | VIDEO SYNC |
| VIDEO GND | SHIELD | 14 | R | NC | NC |
| NC | NC | 15 | S | NC | NC |
| COIN 1 LEFT | GRAY/BLUE | 16 | T | GRAY/YEL | COIN 2 RIGHT |
| PLAYER 1 START | WHT/GRAY | 17 | U | GRAY/RED | PLAYER 2 START |
| TEST SWITCH | WHT/GREEN | 18 | V | NC | NC |
| TILT | WHT/BLUE | 19 | W | NC | NC |
| NC | NC | 20 | X | NC | NC |
| NC | NC | 21 | Y | NC | NC |
| PLAYER 1 PASS | YEL/BLK | 22 | Z | RED/GRAY | PLAYER 2 PASS |
| PLAYER 1 SHOOT | BLUE/BLK | 23 | a | RED/WHT | PLAYER 2 SHOOT |
| NC | NC | 24 | b | NC | NC |
| NC | NC | 25 | c | NC | NC |
| NC | NC | 26 | d | NC | NC |
| GND | BLK | 27 | e | BLK | GND |
| GND | BLK | 28 | f | BLK | GND |



DECAL LOCATIONS

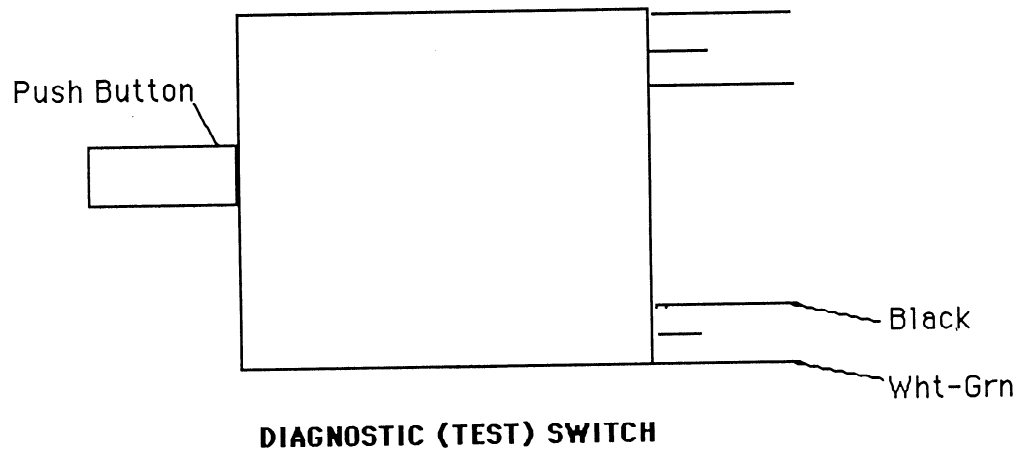


JOYSTICK WOOD SPACER DIAGRAM

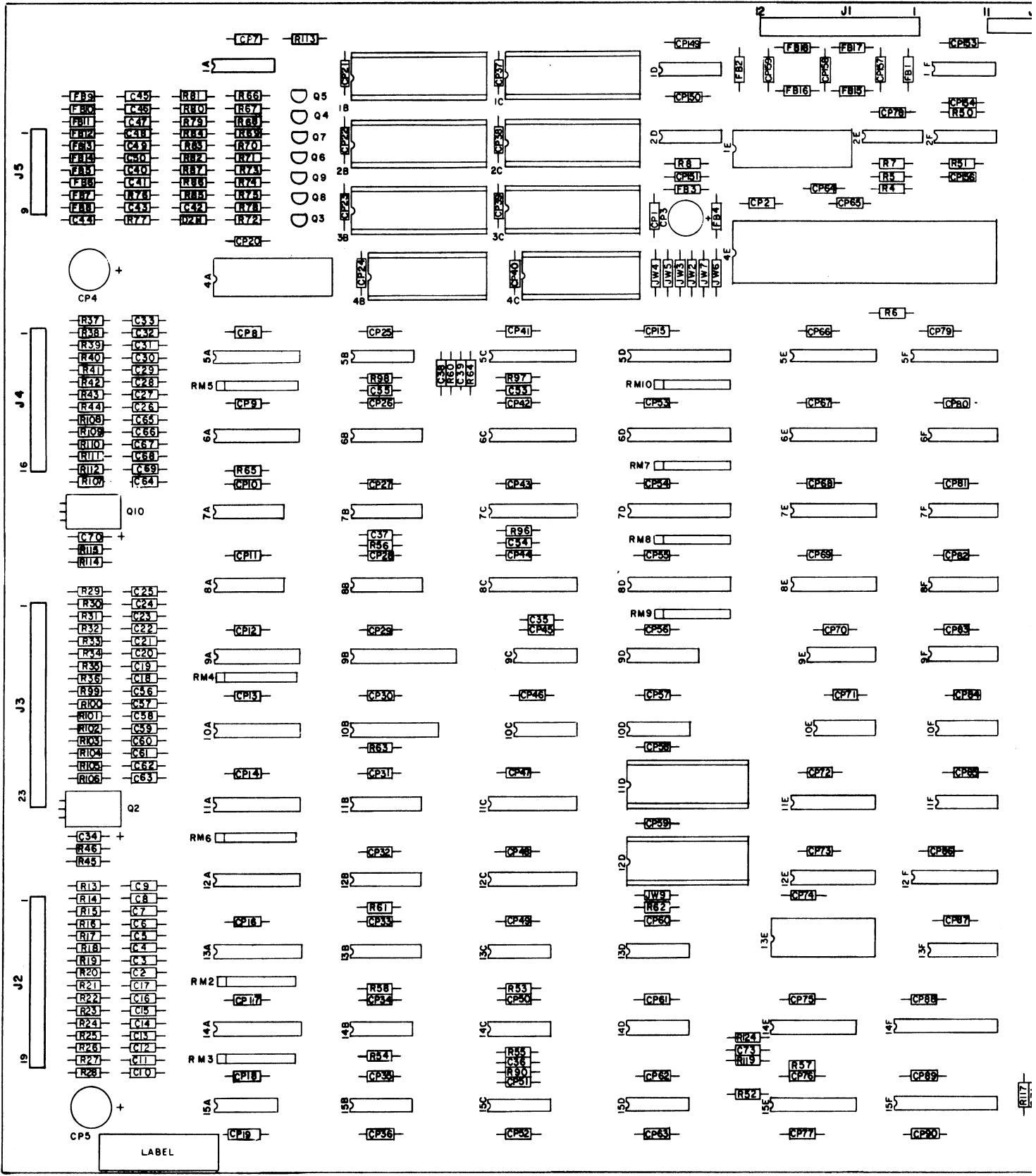


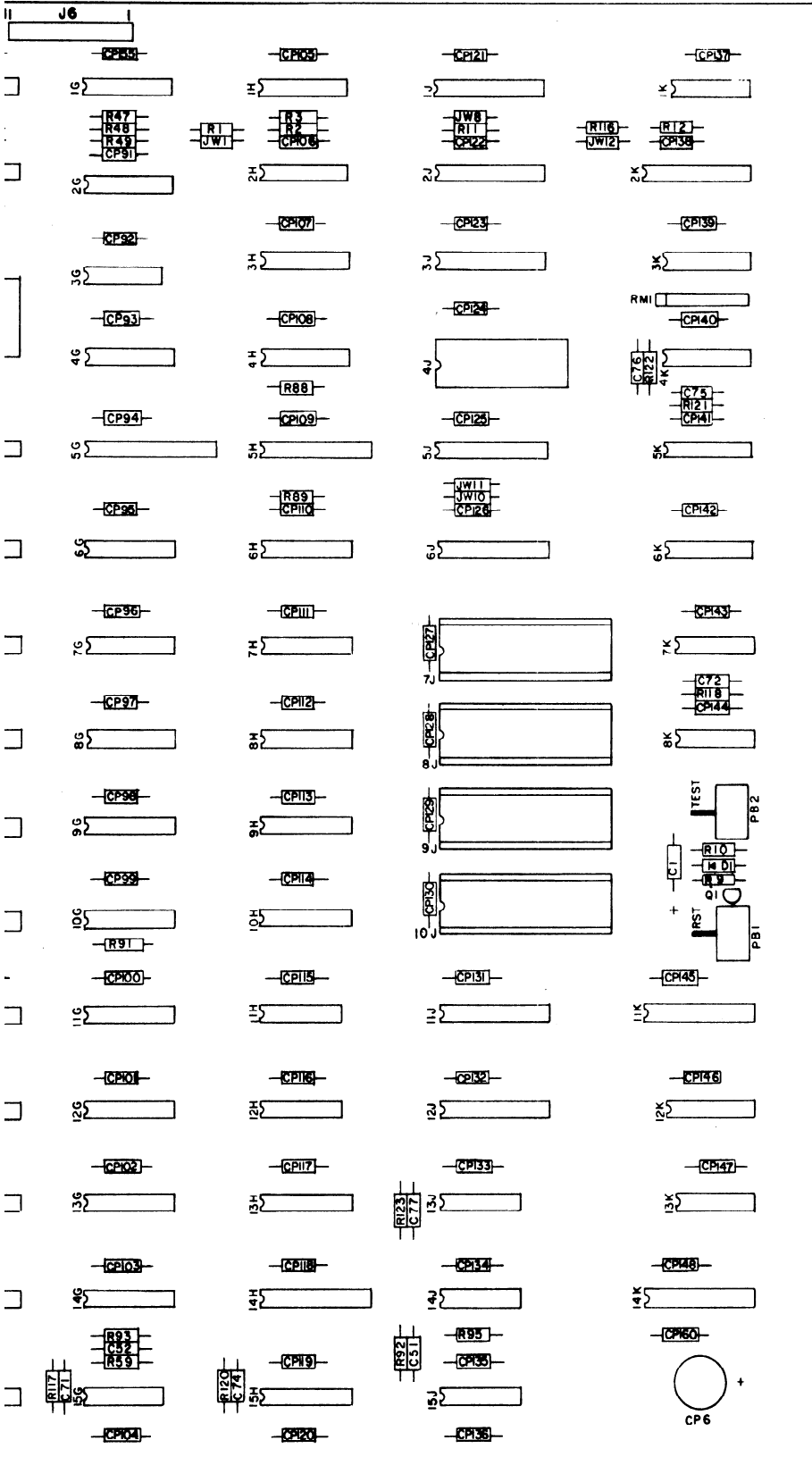
NOTE:
SOLDER ALL CONNECTIONS SECURELY.

VOLUME CONTROL WIRING



Note: Double Sided Tape is Provided to Aid in Mounting Diagnostic (Test) Switch.





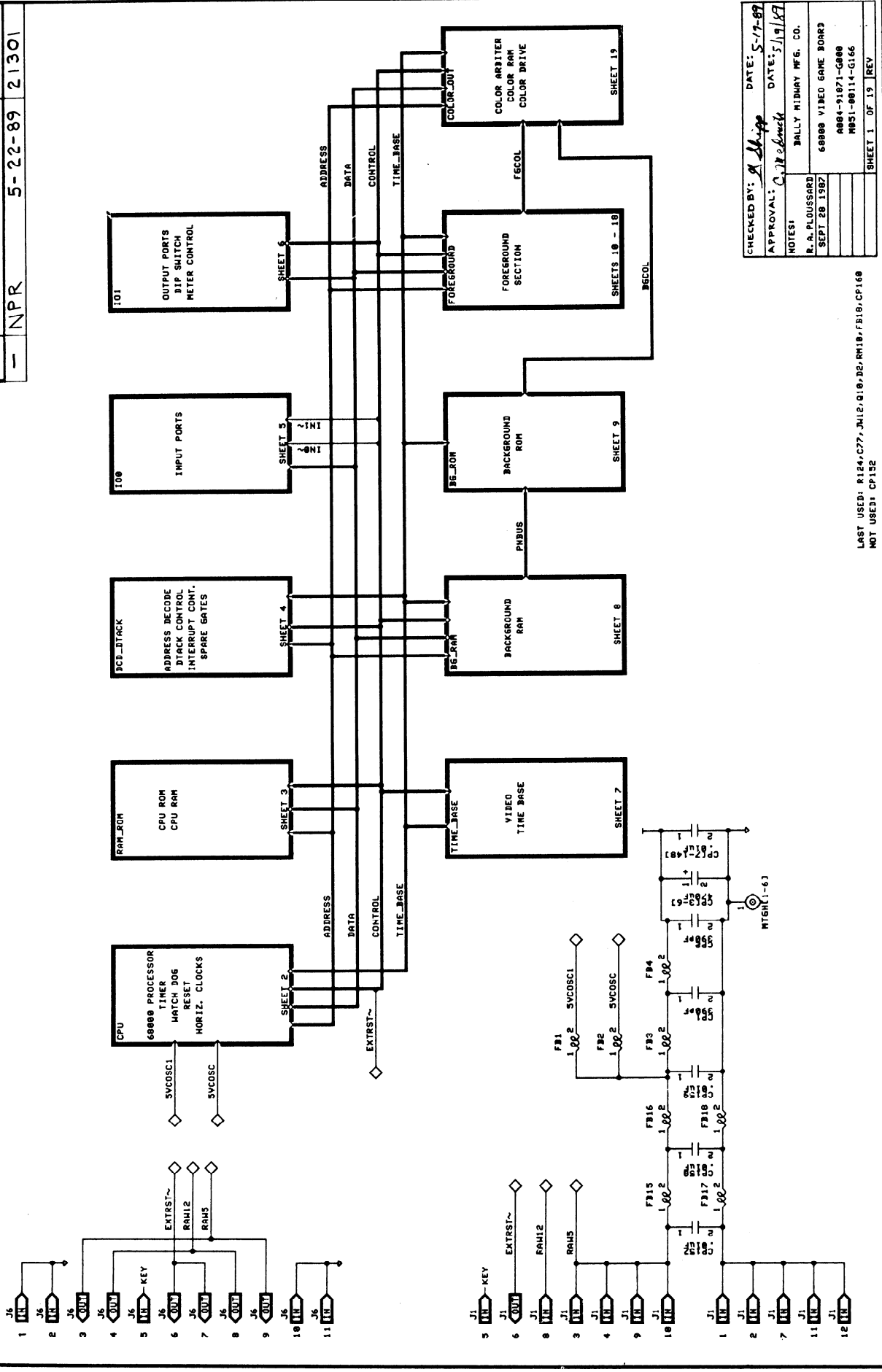
C-12610
68000 CPU ASSY

| DESCRIPTION | QTY | DESIGNATION | PART NUMBER |
|----------------------|-----|---|-----------------|
| CAP 10pF AXIAL CER | 3 | C71, C55, C72 | 0360-00800-0038 |
| CAP 18pF AXIAL CER | 4 | C37, C38, C73, C75 | 0365-00800-0026 |
| CAP 33pF AXIAL CER | 2 | C51, C74 | 0986-00800-0300 |
| CAP 47pF AXIAL CER | 6 | C45-C50 | 0986-00800-2800 |
| CAP 68pF AXIAL CER | 5 | C39, C53, C54, C76, C77 | 0360-00800-0028 |
| CAP 100pF AXIAL CER | 32 | C2-C33 | 0360-00800-0046 |
| CAP 390pF AXIAL CER | 4 | CP1, CP2, C35, C42 | 0986-00800-3000 |
| CAP 820pF AXIAL CER | 18 | C40, C41, C43, C44, C56-C69 | 0945-00816-0400 |
| CAP .01uF AXIAL CER | 155 | C36, C52, CP7-151, 153-160) | 0986-00800-2000 |
| CAP 10uF AXIAL TANT | 3 | C1, C34, C70 | 0986-00800-0700 |
| CAP 470uF RAD ELEC | 4 | CP3-CP6 | 0B75-00803-0001 |
| RES 10 OHM 1/4W 5% | 6 | R79, R80, R82, R83, R85, R86 | 100E-00005-0011 |
| RES 22 OHM 1/4W 5% | 3 | R52, R57, R124 | 100E-00005-0016 |
| RES 47 OHM 1/4W 5% | 3 | R47, R48, R49 | 100E-00005-0025 |
| RES 68 OHM 1/4W 5% | 3 | R50, R53, R90 | 100E-00005-0029 |
| RES 82 OHM 1/4W 5% | 6 | R60, R96, R97, R120, R121, R123 | 100E-00005-0031 |
| RES 100 OHM 1/4W 5% | 15 | R92, R99-R112 | 100E-00005-0033 |
| RES 200 OHM 1/4W 5% | 7 | R56, R64, R98, R117-R119, R122 | 100E-00005-0040 |
| RES 470 OHM 1/4W 5% | 3 | R81, R84, R87 | 100E-00005-0051 |
| RES 510 OHM 1/4W 5% | 3 | R68, R71, R75 | 100E-00005-0053 |
| RES 560 OHM 1/4W 5% | 3 | R76, R77, R78 | 100E-00005-0054 |
| RES 680 OHM 1/4W 5% | 1 | R58 | 100E-00005-0056 |
| RES 1K OHM 1/4W 5% | 10 | R1, R3-R6, R12, R67, R70, R72, R74 | 100E-00005-0061 |
| RES 2K OHM 1/4W 5% | 3 | R66, R69, R73 | 100E-00005-0068 |
| RES 2.7K OHM 1/4W 5% | 4 | R45, R46, R114, R115 | 100E-00005-0071 |
| RES 4.7K OHM 1/4W 5% | 19 | R2, R8, R11, R51, R54, R55, R59, R61, R62, R63, R65, R88, R89 | 100E-00005-0079 |
| RES 10K OHM 1/4W 5% | 34 | R9, R10, R13-R44 | 100E-00005-0088 |
| RES 20K OHM 1/4W 5% | 1 | R7 | 100E-00005-0095 |
| SIP 1K 9 PIN | 4 | RM7, RM8, RM9, RM10 | 102E-00004-0011 |
| SIP 4.7K 9 PIN | 1 | RM1 | 102E-00004-0024 |
| SIP 4.7K 10 PIN | 1 | RM6 | 102E-00004-0026 |
| SIP 100K 10 PIN | 4 | RM2, RM3, RM4, RM5 | 102E-00004-0045 |
| DIODE 1N4148 | 2 | D1, D2 | 103E-00002-0005 |
| XSTR 2N4123 NPN | 2 | Q1, Q3 | 104E-00001-0007 |
| XSTR MPSA70 PNP | 6 | Q4, Q5, Q6, Q7, Q8, Q9 | 104E-00002-0012 |
| XSTR TIP110 NPN | 2 | Q2, Q10 | 104E-00009-0001 |
| COSC 16MHz | 1 | 1D | 109E-00002-0001 |
| COSC 20MHz | 1 | 1F | 0304-00804-0007 |
| IC 7406 | 1 | 1A | 0986-00803-7600 |
| IC 74ALS20 | 1 | 12H | 0A59-00803-0015 |
| IC 74F00 | 2 | 11F, 8K | 0A59-00803-0001 |
| IC 74F04 | 1 | 3G | 0A59-00803-0034 |
| IC 74F08 | 1 | 10D | 0A59-00803-0030 |
| IC 74F32 | 1 | 1K | 0304-00803-0059 |
| IC 74F74 | 2 | 2F, 11H | 0A59-00803-0003 |
| IC 74F86 | 2 | 13C, 13K | 0A59-00803-0031 |
| IC 74F157 | 4 | 14G, 13F, 13G, 5K | 0A59-00803-0004 |
| IC 74F174 | 1 | 12K | 0A59-00803-0005 |
| IC 74HCT244 | 4 | 14A, 9A, 5A, 13A | 0B75-00803-0001 |
| IC 74S04 | 2 | 15B, 15C | 0986-00803-6600 |
| IC 74S74 | 1 | 2D | 0A15-00803-0023 |
| IC 74LS00 | 1 | 5B | 0304-00803-0010 |
| IC 74LS02 | 1 | 9C | 0986-00803-7400 |
| IC 74LS05 | 1 | 2E | 0A15-00803-0011 |
| IC 74LS08 | 1 | 15D | 0986-00803-7300 |
| IC 74LS20 | 3 | 13D, 10E, 15A | 0986-00803-1004 |
| IC 74LS32 | 2 | 14D, 13J | 0986-00803-6100 |
| IC 74LS74 | 5 | 15G, 14J, 10F, 14B, 14C | 0986-00803-1005 |
| IC 74LS86 | 2 | 10C, 7K | 0986-00803-9900 |
| IC 74LS148 | 1 | 3K | 0A15-00803-0067 |
| IC 74LS153 | 2 | 11B, 12B | 0A59-00803-0006 |
| IC 74LS157 | 6 | 8A, 7A, 4K, 4H, 3H, 2H | 0304-00803-0021 |
| IC 74LS161 | 2 | 1H, 2G | 0986-00803-1003 |

C-12610 (Cont'd)
68000 CPU ASSY

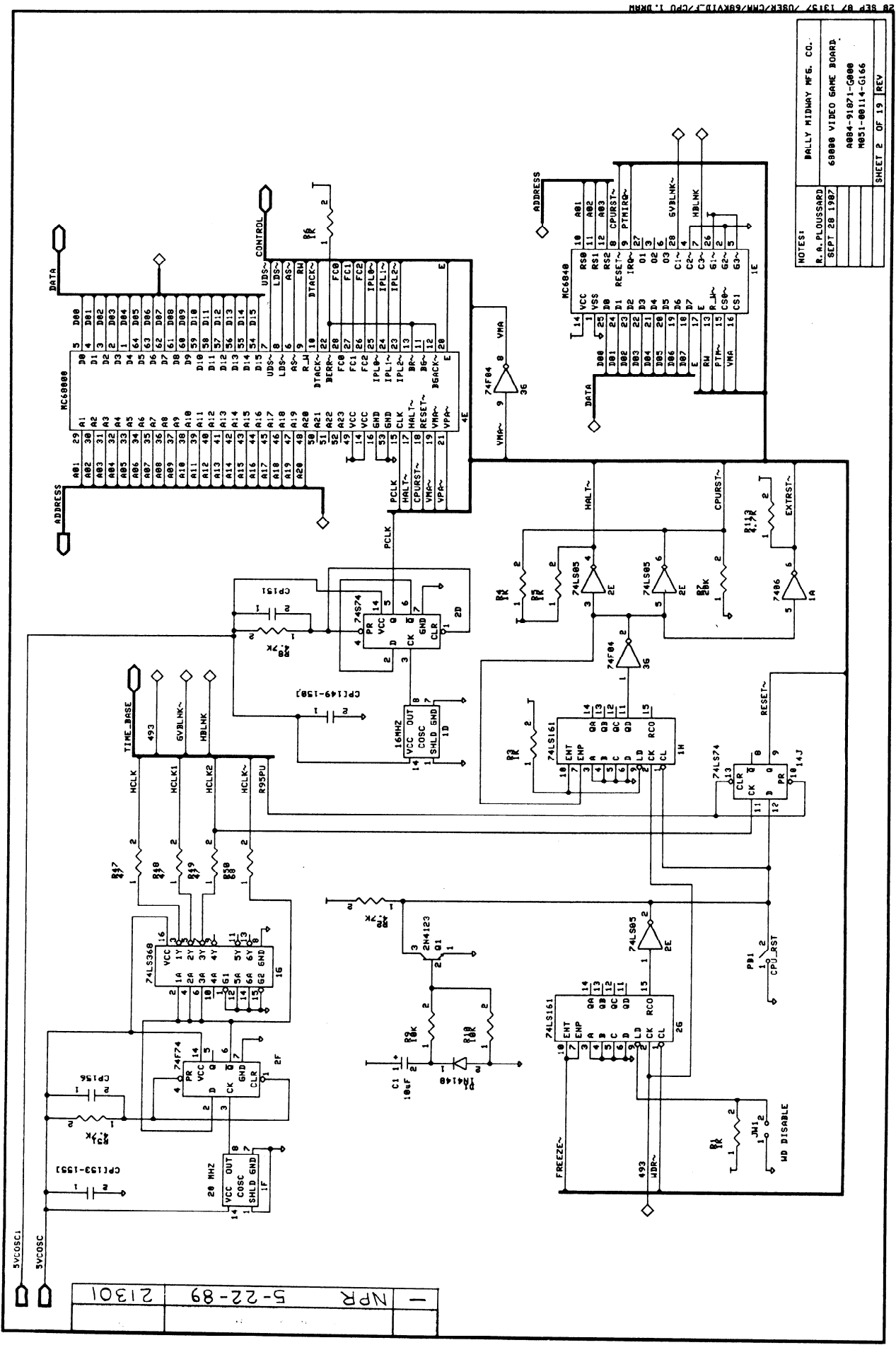
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| IC 74LS163 | 3 | 4C,6G,6H | 0A59-00803-0008 |
| IC 74LS169 | 4 | 9F,8F,6F,7F | 0304-00803-0023 |
| IC 74LS173 | 1 | 6K | 0A59-00803-0009 |
| IC 74LS174 | 4 | 13B,8B,15H,13H | 0304-00803-0024 |
| IC 74LS175 | 1 | 15J | 0304-00803-0025 |
| IC 74LS194 | 8 | 8G,9H,7H,10G,9G,7G,8H,10H | 0304-00803-0026 |
| IC 74LS244 | 2 | 5H,11A | 0986-00803-4800 |
| IC 74LS245 | 2 | 12F,3J | 0986-00803-6400 |
| IC 74LS258 | 2 | 9E,9D | 0304-00803-0028 |
| IC 74LS273 | 6 | 10B,12C,11C,11K,10A,6A | 0986-00803-4700 |
| IC 74LS283 | 2 | 11G,12G | 0304-00803-0030 |
| IC 74LS298 | 2 | 7B,6B | 0A59-00803-0010 |
| IC 74LS368 | 1 | 1G | 0A59-00803-0011 |
| IC 74LS374 | 8 | 5E,6E,7E,8E,6C,7C,8C,5C | 0986-00803-4600 |
| IC 74LS377 | 5 | 12E,11E,5J,6J,5F | 0A59-00803-0012 |
| PACOUT REV 4 PLA | 1 | 11J | A59A-26AXL-AXHD |
| PACNS REV 4 PLA | 1 | 12J | A59A-26AXL-BXHD |
| ROMCTRL REV 1 PLA | 1 | 14H | A59A-26AXL-CXHD |
| MMCO2B HAL | 1 | 14F | 0986-00803-9000 |
| MMCO1A HAL | 1 | 15F | 0986-00803-8900 |
| MMCO6 HAL | 1 | 14E | 0986-00803-9200 |
| MMCO3B HAL | 1 | 15E | 0986-00803-9100 |
| COLARB PAL20L8 | 1 | 9B | 0E61-00803-0001 |
| IODCD PAL16LB | 1 | 1J | 0B75-00803-0003 |
| MEMDCD PAL16L8 | 1 | 2J | 0B75-00803-0004 |
| DTACK PAL16R4 | 1 | 2K | 0B75-00803-0005 |
| HSYNC PAL16R4 | 1 | 14K | 0B75-00803-0006 |
| RAM 93419 64X9 | 1 | 4A | 0986-00803-9600 |
| RAM 2018 2KX8 45nS | 4 | 8D,7D,5D,6D | 0A59-00803-0028 |
| RAM 2018 2KX8 55nS | 1 | 5G | 0A59-00803-0029 |
| RAM 6116 2KX8 150nS | 1 | 4J | 0A59-00803-0027 |
| RAM 6116 2KX8 120nS | 1 | 13E | 0A59-00803-0014 |
| RAM STATIC 8KX8 150nS | 1 | 4C | 5340-12278-00 |
| RAM NON-VOL 8KX8 250nS | 1 | 4B | 5347-12394-00 |
| MC68000 | 1 | 4E | 0304-00803-0051 |
| MC6840 | 1 | 1E | 0A15-00803-0068 |
| SOCKET IC 16 PIN (.3) | 2 | 1G,14K | 110E-00001-0003 |
| SOCKET IC 20 PIN (.3) | 9 | 1J,2J,2K,14K,14E,15E,11J | 110E-00001-0005 |
| SOCKET IC 24 PIN (.3) | 8 | 14F,15F,5G,5D,6D,7D,8D,9B | 110E-00001-0009 |
| SOCKET IC 24 PIN (.6) | 2 | 13E,4J | 110E-00001-0007 |
| SOCKET IC 28 PIN (.6) | 12 | 1B-4B,1C-4C,11D,12D,1E,4A | 110E-00001-0010 |
| SOCKET IC 32 PIN (.6) | 4 | 7J-10J | 110E-00001-0024 |
| SOCKET IC 64 PIN (.9) | 1 | 4E | 110E-00001-0016 |
| AUTO INSERT PIN .025 | 73 | J2,J3,J4,J5,J6 | 0304-00804-0009 |
| AUTO INSERT PIN .045 | 11 | J1 | 0304-00804-0010 |
| FERRITE BEADS | 18 | FB1-FB18 | 0316-00804-0002 |
| JUMPERS | 12 | JW1-JW12 | 117E-00001-0003 |
| SWITCH PC MTG | 2 | PB1,PB2 | 0986-00804-3100 |
| DIP SWITCH | 1 | 12A | 113E-00001-0004 |
| SNAP | 2 | Q2,Q10 | 0017-00007-0134 |
| PC BOARD | 1 | | A080-91871-E000 |
| LABEL-PCB ASSY ID | 1 | | 16-8850-240 |
| GAME ROM | 1 | 2B | A-5343-4001-4 |
| GAME ROM | 1 | 3B | A-5343-4001-5 |
| GAME ROM | 1 | 2C | A-5343-4001-6 |
| GAME ROM | 1 | 3C | A-5343-4001-7 |
| GAME ROM | 1 | 11D | A-5343-4001-8 |
| GAME ROM | 1 | 12D | A-5343-4001-9 |
| GAME ROM | 1 | 7J | A-5343-4001-10 |
| GAME ROM | 1 | 8J | A-5343-4001-11 |
| GAME ROM | 1 | 9J | A-5343-4001-12 |
| GAME ROM | 1 | 10J | A-5343-4001-13 |

DESCRIPTION OF CHANGE
 -E-
 -NPR
 5-22-89
 21301
 ECHNO DATE



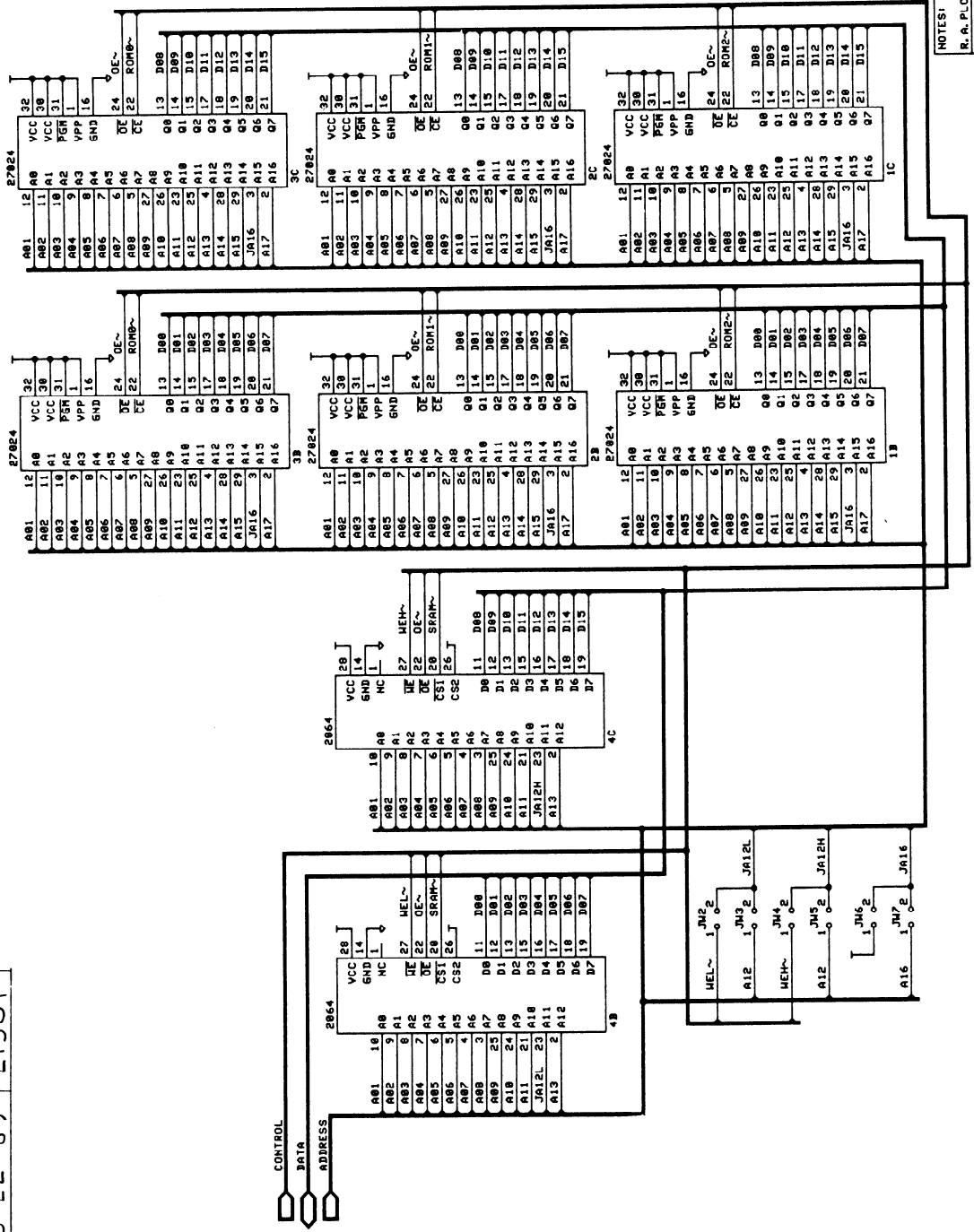
CHECKED BY: *A. Skapp* DATE: 5-17-89
 APPROVAL: *C. J. Schmidt* DATE: 5/19/89
 NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 A884-91871-G880
 M051-80114-G166
 SHEET 1 OF 19 REV

LAST USED: R124,C77, JH12,Q10,D2,RM10,FB10,FB18,CP160
 NOT USED: CP152

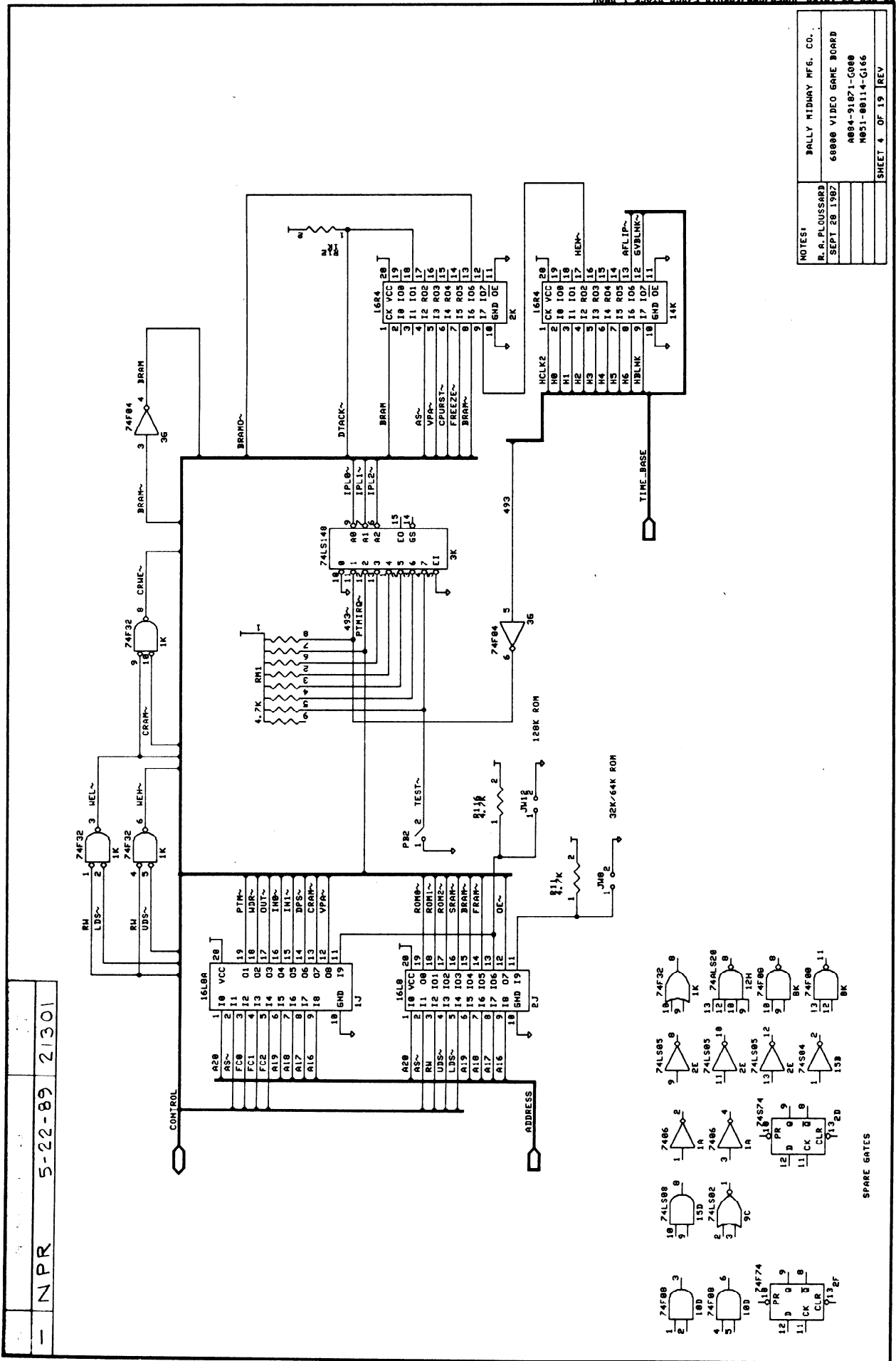


NOTES:
 R. R. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 4084-91871-G000
 4051-00114-G166
 SHEET 2 OF 19 REV

DESCRIPTION OF CHANGE
 — NPR 5-22-89 21301



NOTES:
 R. A. PLOUSSARD
 68888 VIDEO GAME BOARD
 SEPT 28 1987
 8804-91871-G088
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 SHEET 3 OF 19 REV

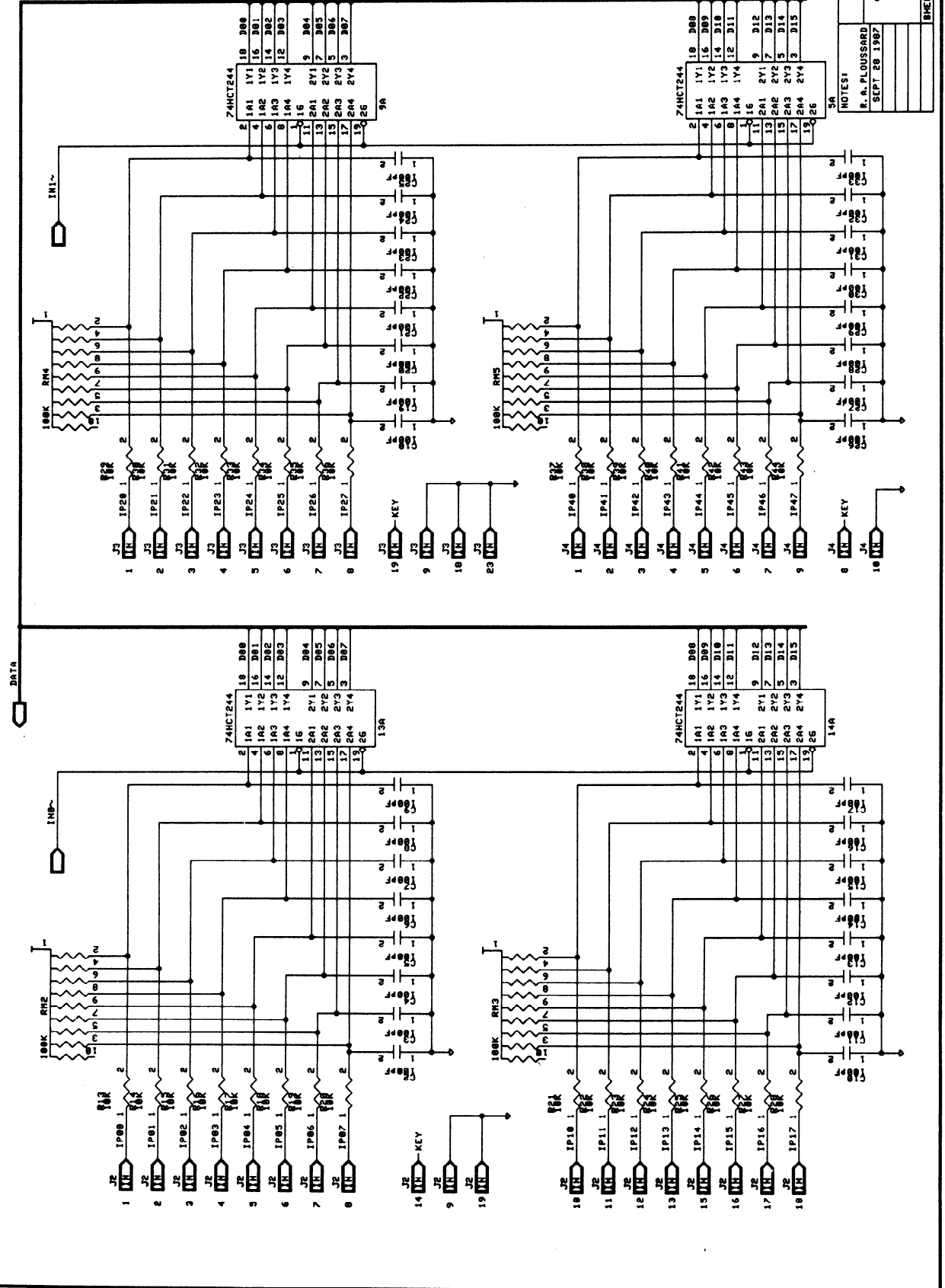


NPR 5-22-89 21301

| | | |
|--------|-----------------|------------------------|
| NOTES: | R. A. PLOUSSARD | BALLY MIDWAY MFG. CO., |
| | SEPT 28 1987 | 68000 VIDEO GAME BOARD |
| | | 8884-91871-C088 |
| | | M051-88114-C166 |
| | | SHEET 4 OF 19 REV |

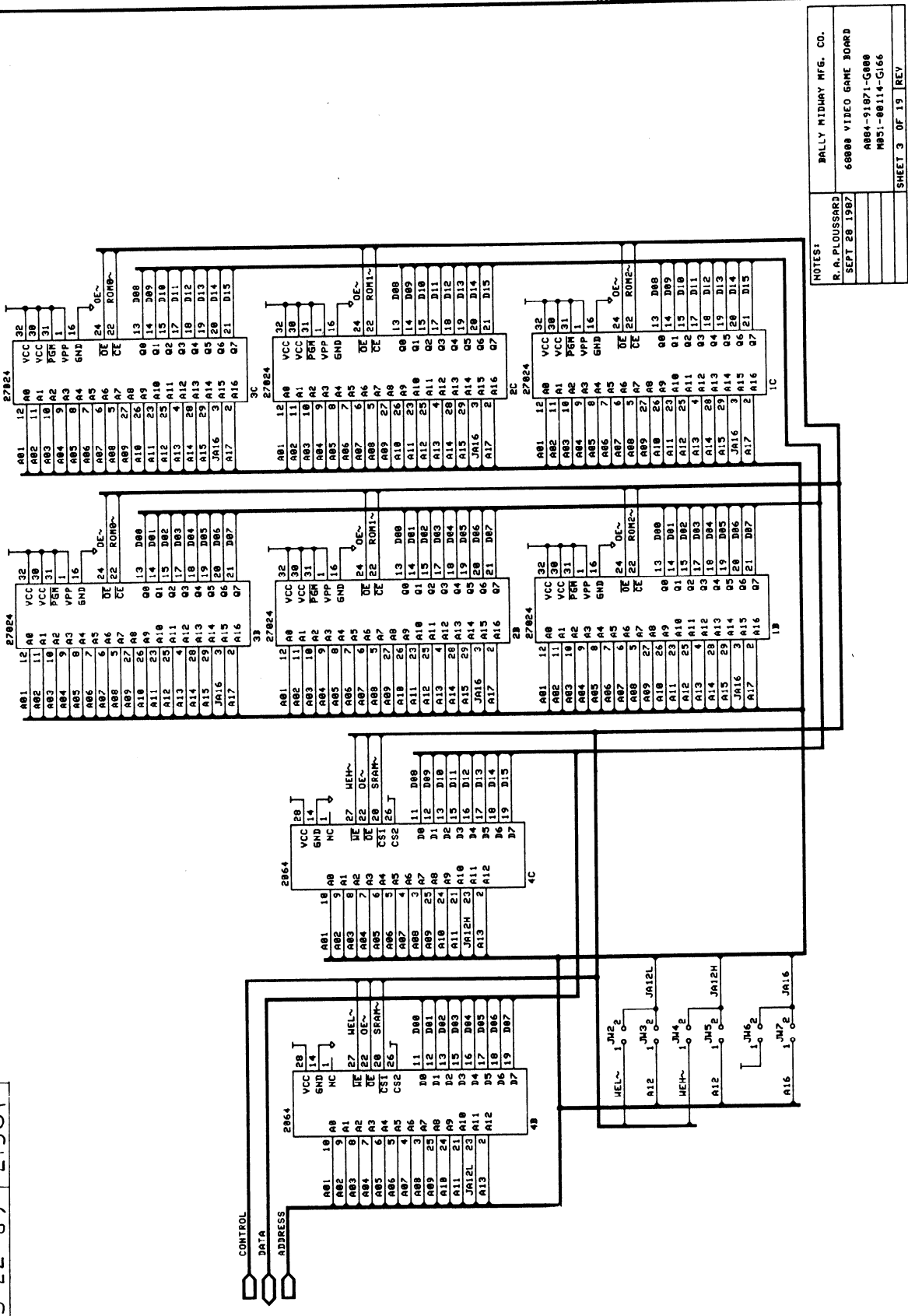
SPARE GATES

| REV | DESCRIPTION OF CHANGE | DATE | BY |
|-----|-----------------------|---------|-------|
| 1 | NPR | 5-22-89 | 21301 |



| | |
|-----------------|------------------------|
| NOTES: | BALLY MIDWAY MFG. CO. |
| R. A. PLOUSSARD | 68888 VIDEO GAME BOARD |
| SEPT 29 1987 | MSI-80114-G000 |
| | MSI-80114-G156 |
| | SHEET 5 OF 15 REV |

DESCRIPTION OF CHANGE
 5-22-89 21301



NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68888 VIDEO GAME BOARD
 AB84-91871-G888
 MB51-88114-C166
 BALLY MIDWAY MFG. CO.
 SHEET 3 OF 19 REV

28 SEP 87 1413 OVER/CMM/SBK/VID/JRM/KOM L-DRM