

Parts and Operating Manual

PRELIMINARY

Bally
MIDWAY

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U.S.A.

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WARNING

THIS GAME MUST BE GROUNDED. FAILURE TO DO SO MAY RESULT IN DESTRUCTION TO ELECTRONIC COMPONENTS.

WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction 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 in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

ELECTRICAL BULLETIN: FOR ALL APPARATUS COVERED BY THE CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD C22.2 NO. 1, WHICH EMPLOYS A SUPPLY CORD TERMINATED WITH A POLARIZED 2-PRONG ATTACHMENT PLUG

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

PUBLISHED BY:

Bally
MIDWAY

TECHNICAL INFORMATION DEPARTMENT

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SECTION 1
SYSTEM INFORMATION

SAFETY

The following safety hints apply to all game operators and service personnel. Specific warnings and cautions will be found throughout this manual where they apply. *Bally-Midway* recommends that you read this page, and also, all of Section 1, before preparing the game for play.

WARNINGS

AC POWER CONNECTION - Before connecting the game to the AC power source, verify that the "Line Voltage Selection Chart" jumper wires are installed correctly for the line voltage in the area. For additional information, refer to the Cabinet Wiring Diagram in Section 3.

PROPERLY GROUND THE GAME - Service technicians and players *can* receive an electrical shock if this game is not properly grounded! To avoid shocks, DO NOT plug in the game until it has been inspected and properly grounded. *Bally-Midway* games should only be plugged into a grounded 3-wire outlet.

The games control panel *must* also be properly grounded to protect the service technician and player from electrical shock. After servicing the control panel, check and ensure that the ground wires are connected before locking up the game.

DISCONNECT POWER DURING REPAIRS - To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any component in the game.

When removing or repairing the TV Monitor, extra precautions *must* be taken to avoid electrical shock. When the Monitor is initially turned off, high voltage still exist within the Monitor circuitry and CRT (cathode-ray-tube). DO NOT touch internal components of the Monitor with your hands or metal objects! Always discharge the second anode from the CRT before servicing this area of the game.

To discharge the CRT, attach one (1) end of a large, well insulated, 20KV jumper to ground. Momentarily touch the free end of the grounded jumper to the anode by sliding it under the anode cap. *Wait* two (2) minutes and discharge the anode again.

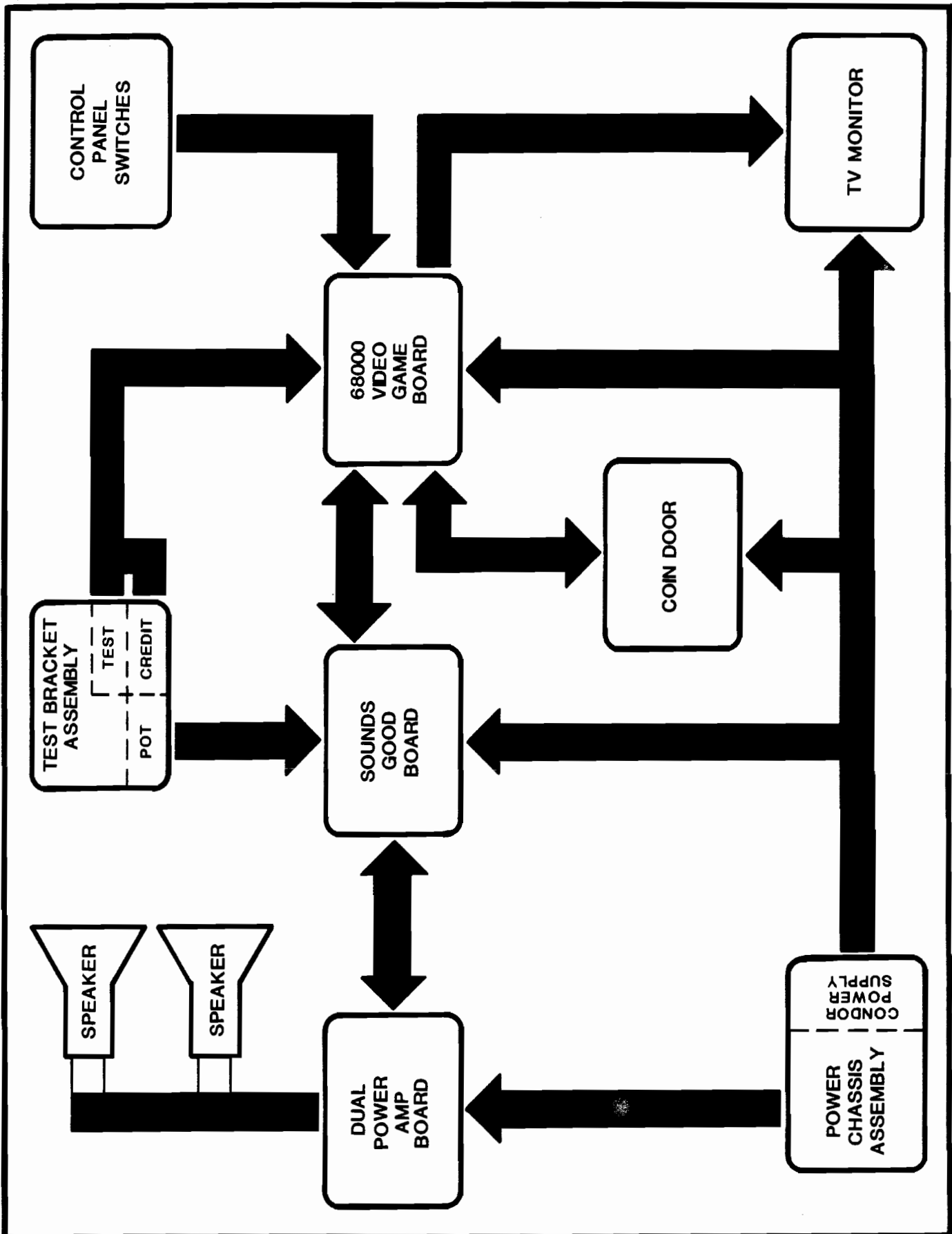
USE THE PROPER FUSE - To avoid electrical shock, use the replacement fuse which is specified in the parts list for this game. The replacement fuse(s) *must* match the original fuse(s) replaced in type, voltage rating and current rating.

HANDLE FLUORESCENT TUBE & CRT WITH CARE - When a fluorescent tube or CRT is dropped, it will break and may implode! Shattered glass can fly eight (8) feet or more from the implosion.

CAUTION

PROPERLY ATTACH ALL CONNECTORS - Ensure that the connectors on each printed circuit board (PCB) are properly connected. If they do not slip on easily, do not force them. A reversed connector *can* damage the game and void the warranty. All connectors are keyed to fit specific pins on each printed circuit board.

FIGURE 1 - ELECTRONIC GAME BLOCK DIAGRAM



GAME DESCRIPTION

"ROBOTS REVOLT... City Held Hostage"

The above headline, splashed across the front page of 'The Daily Pop', lets the player know at a glance just exactly WHAT he's getting into! Below the headline a photograph of one of the "Killer Cyborgs" stares menacingly at the player.

The player's mission:

To "Destroy All Cyborgs
...before they destroy YOU!"

The player assumes the role of an 'Urban Guerilla' sworn to rid Scrapheap City of the 'Mechanical Menace' that is terrorizing the townsfolk.

Unfortunately, the local population is 'caught in the middle', since all of the explosive battles in this classic confrontation take place in the very offices, factories and apartment buildings in which the townsfolk live and work!

Using the telephoto scope on his Hi-Intensity Laser Rifle the player quickly scans the opposite side of the street for any sign of the 'Technological Threat'; blasting into oblivion anything that moves. (... often to the dismay of the building's human occupants... Still, major property damage is a small price to pay for a world free of 'Tin Terrorists'!)

IMPORTANT FEATURES TO NOTE (In no particular order)

- I. One or Two player simultaneous play:

Players can "TEAM UP" to destroy
the common enemy & progress faster...
OR
Players can compete to see who can
Destroy the most Cyborgs!

- II. Each player has BOTH a wide-angle view AND a telephoto
(gunsight) view of the opposite side of the street.
Enables the Player to 'see' the action thru the eyes
of his character.

- III. Players can earn additional energy by blasting any "Power
Sources" (Table lamps, TV sets, wall clocks, etc.) they
happen to stumble across! This additional bit of mayhem
produces some delightfully nasty results... some players
find shooting up the town just as entertaining as trying
to save it!

- IV. Separate coin chutes enables players to "JOIN THE ACTION"
at any time as well as allowing players to 'build up'
their reserves with multiple coins.

POWER-UP TEST MODE

This test sequence is designed to effectively locate and identify any malfunction on the SOUNDS GOOD P.C. Board. Test results are indicated by an L.E.D. located on the sound board.

On power-up, under normal operation, the sound board runs through its self-diagnostic checks, flashing its L.E.D. to indicate each successful test. At the end of the diagnostic test, the attract mode begins and the game is ready to accept coins.

If one of the tests fails however, the L.E.D. will not flash for the failed test nor for any remaining tests in the sequential run. At this point, "SOUND BOARD INTERFACE ERROR" appears on the screen.

The following is the Self-Test routine for the SOUNDS GOOD P.C. Board

- 1st FLASH - Determines if the ROM (U7) is good.
- 2nd FLASH - Determines if the ROM (U8) is good.
- 3rd FLASH - Determines if the ROM (U17) is good.
- 4th FLASH - Determines if the ROM (U18) is good.
- 5th FLASH - *Determines if the RAMs (U6, U16) are good.*
- 6th FLASH - Determines if the PIA (6821) (U9) is good.

IMPORTANT NOTE: There is **NO** battery back up provided for this game. All logic & memory functions will be retained through dip switch settings.

SELF-TEST MODE

The Self-Test mode is a special mode for checking the game switches and computer functions. It is the most complete way of checking the proper game operation and is quite easy to use.

The Self-Test mode may be entered at any time and from any mode of operation. Simply locate the black slide switch on the test bracket inside the coin door, slide it to the Self-Test position? The game will enter the Self-Test mode immediately and display the following test menu....

*and operate the coin door's
Tilt (Slam) switch*

1. SELF - TEST
2. SWITCHES & SOUNDS
3. GAME STATS
4. CONVERGENCE GRID
5. DIP SWITCHES
6. GAME STATS RESET

*USE PLAYER 1'S CONTROLS. MOVE THE CURSOR ("POW")
USING THE JOY STICK. PRESS THE FIRE BUTTON &/OR THE
CREDIT/SERVICE PUSHBUTTON SWITCH TO CONTINUE.*

1. **SELF (DIAGNOSTIC) TEST:** This test is designed to effectively locate and identify any malfunction of the on-board computer. When selected, the game enters this mode immediately and begins scanning the memory stored in ROM (Read Only Memory) and RAM (Random Access Memory). If the test is successful, at the end of the scan *the test menu* is displayed on the screen. If a defective component is found during the scan, that component and its location will be displayed on the screen. The entire test is *initial* performed in approximately 15 seconds. To exit this test, *after the foreground and background (power-up) test portion is completed, operate the Tilt switch.*

(the Self-Test is exited) and the cursor is positioned at the SWITCH TEST.
2. **SWITCH AND SOUNDS TEST:** The SWITCH portion of this test is designed to confirm the operation of player input switches and device switches in the game. When you enter the test, the screen displays *nothing which indicates all switches are open. When any switch is activated (the switch is closed), the name of that switch will appear on the screen.*

The SOUNDS portion of this test will cause a unique sound to be emitted for every switch that is manually activated in the game except for:

1. TILT (Slam) Switch
2. Option DIP-Switches (Dual-In-Line Package)

To exit this test, operate the Tilt switch.

3. **GAME STATS TEST:** *These game statistics are available for your use in conducting time studies. To exit this test, operate the Tilt switch.*
4. **CONVERGENCE GRID DISPLAY:** This test is designed to display a crosshatch pattern used in adjusting the color monitor. This pattern may be used to adjust convergence, color balance, vertical linearity, and vertical/horizontal size. To exit this test, *operate the Tilt switch.*
5. **OPTIONS SETTINGS TEST:** All game options are adjusted through the use of DIP-switches located on the 68000 VIDEO BOARD. When this test is selected, a full display of the current DIP-switch settings will appear on the screen (see Figure 2 on page 1-7). To exit this test, *operate the Tilt switch.*
6. **GAME STATS RESET TEST:** *The game statistics available for your use in the GAME STATS TEST can be reset by entering this test. After the Game Stat Reset message is displayed on the screen, the test menu is displayed with the cursor position at SELF TEST.*

FIGURE 2.

B L A S T E D 2 P L A Y E R U P R I G H T

O P T I O N S W I T C H S E T T I N G S

PART NO. M051-00F09-A007

<u>DIP SWITCHES:</u>	<u>SW#1</u>	<u>SW#2</u>	<u>SW#3</u>	<u>SW#4</u>	<u>SW#5</u>	<u>SW#6</u>	<u>SW#7</u>	<u>SW#8</u>	<u>SW#9</u>	<u>SW#10</u>
					NOT USED				NOT USED	
<u>COIN OPTIONS</u> 1 COIN / 1 CREDIT 1 COIN / 2 CREDITS 2 COINS/ 1 CREDIT 2 COINS TO START / 1 COIN TO BUY-IN ¹	OFF OFF ON ON	OFF ON OFF ON								
<u>DIFFICULTY LEVEL:</u> HARD MEDIUM EASY			OFF OFF ON	ON OFF OFF						
<u>DOLLAR BILL:</u> REGULAR COIN DOOR COIN DOOR W/ \$ ACCEPTOR						OFF ON				
<u>ATTRACT SEQUENCE SOUNDS:</u> SOUNDS NO SOUNDS							OFF ON			
<u>RACK ADVANCE:</u> NO RACK ADVANCE RACK ADVANCE								OFF ON		
<u>VIDEO FREEZE MODE:</u> NORMAL VIDEO FREEZE VIDEO										OFF ON

NOTE:

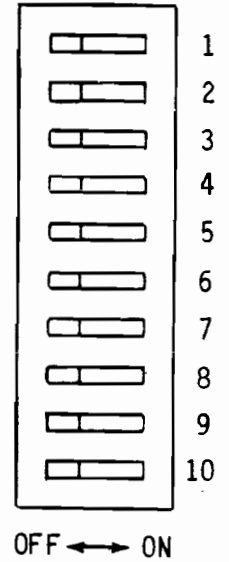
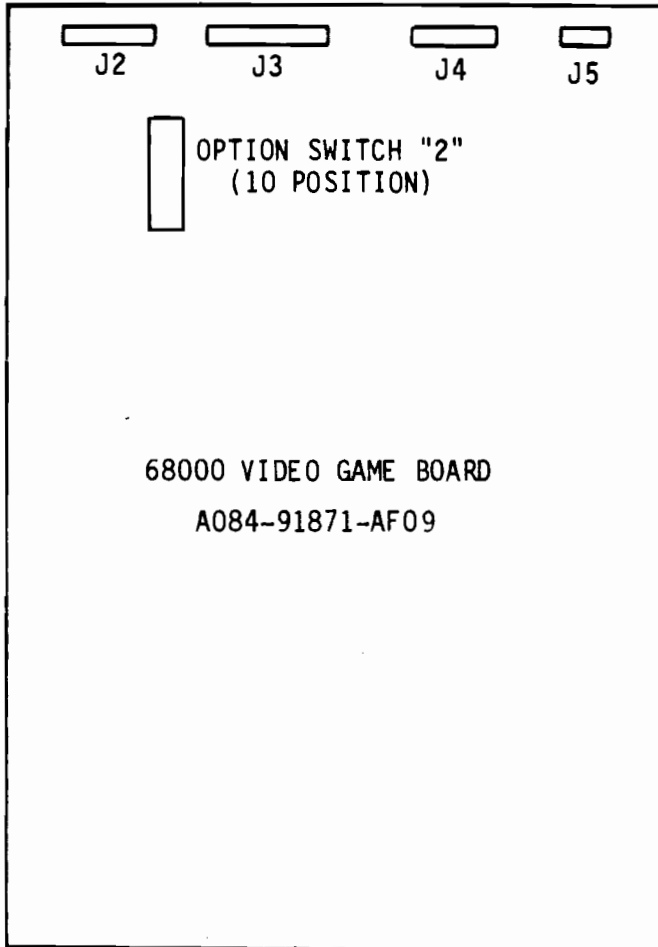
- BUY-IN FEATURE:** WHEN THE PLAYER IS DISABLED DURING GAME PLAY, WITH NO CREDITS REMAINING, HE OR SHE CAN CONTINUE GAME PLAY BY INSERTING ONE (1) COIN WITHIN A BRIEF, SET PERIOD OF TIME. IF THE PLAYER DOES NOT, THE GAME WILL END.

ADDITIONAL NOTES:

- FACTORY SETTING: ALL DIP SWITCHES SET IN THE "OFF" POSITION.
- THE DUAL-IN-LINE PACKAGE (DIP) OF SWITCHES "SW2" IS LOCATED ON THE 68000 VIDEO BOARD AT POSITION "A13".

FIGURE 3. VIDEO BOARD REFERENCE DRAWING

FOR 68000 SYSTEM



When the trapped coin is not returned when the wiper lever arm is actuated, you may have an acceptor that is (1) 'jammed' by a slug, (2) 'gummed' up with a liquid, (3) a 'jammed' coin, or (4), mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If a slug is found, simply remove it and test the acceptor. If the chute is blocked, remove the acceptor and remove the 'jammed' coins. If there is actual failure of the acceptor, remove the unit and repair it as indicated by the acceptor manufacturer's service procedures.

When the coin is making its way through the acceptor and falls into the coin box, yet there is still no credit game awarded, there is either a mechanical failure of the coin switch, or an electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are of the make/break type of micro switch. The micro switch should be checked for continuity between the "NO" (Normally Open), "NC" (Normally Closed) and "C" (Common) terminals.

When the coin switch is at its rest position, the "NC" and "C" terminals should be closed and the "NO" terminal should be open. When the coin switch is actuated, the "NO" and "C" terminals should be closed and the "NC" terminal should be open. If the coin switch checks good, inspect the solder connections to the coin switch terminals to be sure there is good contact at this point. If necessary, use a continuity tester or meter (VOM or DVM) to check from the terminal lug on the switch to the associated P.C. board trace. This will verify whether or not there is continuity to the credit circuit. However, if the coin switch wires check good, the problem is in one of the game logic printed circuit boards that contain the coin and credit circuitry.

When the player deposits a coin or token and it is accepted, but the game will not start when the Credit/Start button is pressed, there may be a problem in the Credit/Start button switch, the interconnecting wiring, or the game logic boards. First, check the switch. Most of these switches are of the make type of push-button switch. If the switch is OK, proceed to check the wiring. Again, make sure to go from the terminal lug on the switch to the P.C. board trace. This way, you will check the terminal contact as well as the P.C. board circuitry. If there is no continuity, check each section of the wiring, until the open or break is located. If the wiring is OK, the problem must lie in the game logic boards.

TRANSFORMER & LINE VOLTAGE PROBLEMS

This game *must* have the correct line voltage to operate properly. If the line voltage drops too low, one (1) of the game logic board circuits will disable the coin/credit circuit. The point at which the games' logic circuits will fail to function is approximately 100 VAC if the voltage supply is 120 VAC or approximately 190 VAC if the voltage supply is 220 - 240 VAC.

Low line voltage can have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies at the location. Peak usage times occur mainly at dawn and/or dusk. Therefore, if your game's problems seems to be related to the time of day, total usage may be a factor to be considered.

A large load connected to the same line (voltage supply) as the game, such as a large air conditioner or other device with an exceptionally large electric motor, *will* drop the line voltage significantly when starting up. This drop in supply voltage can result in an intermittent coin/credit problem. In addition, poor connections in the location's wiring, plug, or line cord can also cause a significant drop in power. Cold solder connections in the game's wiring, especially in an areas like the transformer connections, the interlock switch (if applicable), and the fuse block, can also produce the same results, although, probably, on a more permanent basis.

Some locations may have dimmer (rheostat) switch installed, and the game may be on the same line (supply voltage). Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned down.

The correct way to check for proper line voltage is with a meter (VOM or DVM). Set the meter to a scale higher than the location's voltage and (use caution to) check the voltage at the wall outlet that the game is connected to. If it is OK here, check the game transformer primary wiring connections and line filter. If the location's voltage is not present at the connections, examine the solder connections on the transformer, fuse block and interlock switch (if applicable). If the location's voltage is now present, the problem must either be in the transformer, cable connections, or in the printed circuit board power supply.

When you suspect the game's primary transformer, check the secondary voltages with a meter set to the 50 VAC range and correlate the meter readings with the Power Supply Chassis Assembly wiring diagram. This transformer *must* also be properly grounded. Check the ground potential at the transformer, especially if there is a 'hum bar' rolling up or down on the Monitor screen.

NO POWER, NO PICTURE - If the Monitor screen is completely dark, check the back of the Monitor to see if the CRT filament is glowing. If it is, try adjusting the brightness control. If this has no effect, listen near the Monitor for the high-pitched B+ hum produced by the isolation transformer. When you hear the hum but there is still no picture, and you have tried adjusting the brightness, major Monitor servicing is indicated.

When the Monitor appears to be completely dead, check the game to see if power is available. If there is no power, check the wall outlet. If the wall outlet is OK, check the game fuses, the interlock switch (if applicable) and cable connections. Sometimes it is difficult to determine if a Slo-Blo fuse has blown. If in doubt, check the fuse with a meter set to any resistance range. If there is no indication of resistance, the fuse is blown or open.

CABLE PROBLEMS - Cable problems include shorting to metal components and malfunctioning controls. The repetitive blown fuse problem can sometimes be quite exasperating to solve. (*Where is it? I've checked everywhere.*) Short circuits have the tendency to occur in areas almost impossible to find. The first thing to do in this instance is to install a known good fuse. Old fuses age and sometimes blow without *any* apparent cause. However, if the new fuse also blows, there is a short in the game and it is most likely to be a permanent type of short.

The best way to approach this problem is by disconnecting devices that may be causing the problem, such as the TV Monitor, the various printed circuit boards (one at a time), and the isolation transformer. Disconnect the devices by **FIRST** turning the game off and then disconnecting it from the wall outlet. Next, remove the blown fuse and connect a meter across the fuse block terminals (this will save blowing a fuse each time you check the circuit when the game is on).

Set the meter to any resistance range. The meter should indicate a shorted condition exist. If there is no meter indication, the probable suspect is a component that shorts out after it has heated up (we'll cover this in a minute). Therefore, assuming you are reading a short on the meter, disconnect the components from their cabling one at a time, checking the meter after each one is disconnected. When the short disappears, you have disconnected the bad component.

If all components are disconnected and the short still remains, the problem is in the cabling and only patient exploration will reveal its location. Carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting the connections, or burned cable insulation. If necessary, use the meter to check each suspected wire.

NOTE: Cable dressing is very important! The cable should be dressed away from sharp metal corners or components in the game.

It is assumed at this time that you have connected the meter across the fuse block terminals as stated above and you did not read a short. This most likely means that you have a component somewhere in the game that only goes bad after it heats up. The component *can* check good when its cold. In this case, turn the game off and disconnect all of its socketed components. Install a known good fuse in the fuse block and turn the game on. If the fuse does not blow after a few minutes, the cable is not the problem. (In this instance it shouldn't be, actually, but it never hurts to check.) Next, turn the game off again and reconnect one component. Turn the game back on and wait a few minutes to see if the fuse blows. If it does not, turn the game off again and reconnect another (single) component.

Turn the game back on and wait a few minutes to see if the fuse blows. When the fuse blows, the last component connected has the part on it that is going bad after it heats up.

MALFUNCTIONING CONTROLS - The most common problem here is a bad POT (potentiometer). Typically, a bad POT will cause the image on the screen to jump when it reaches a certain point. The only cure for this is to install a known good POT.

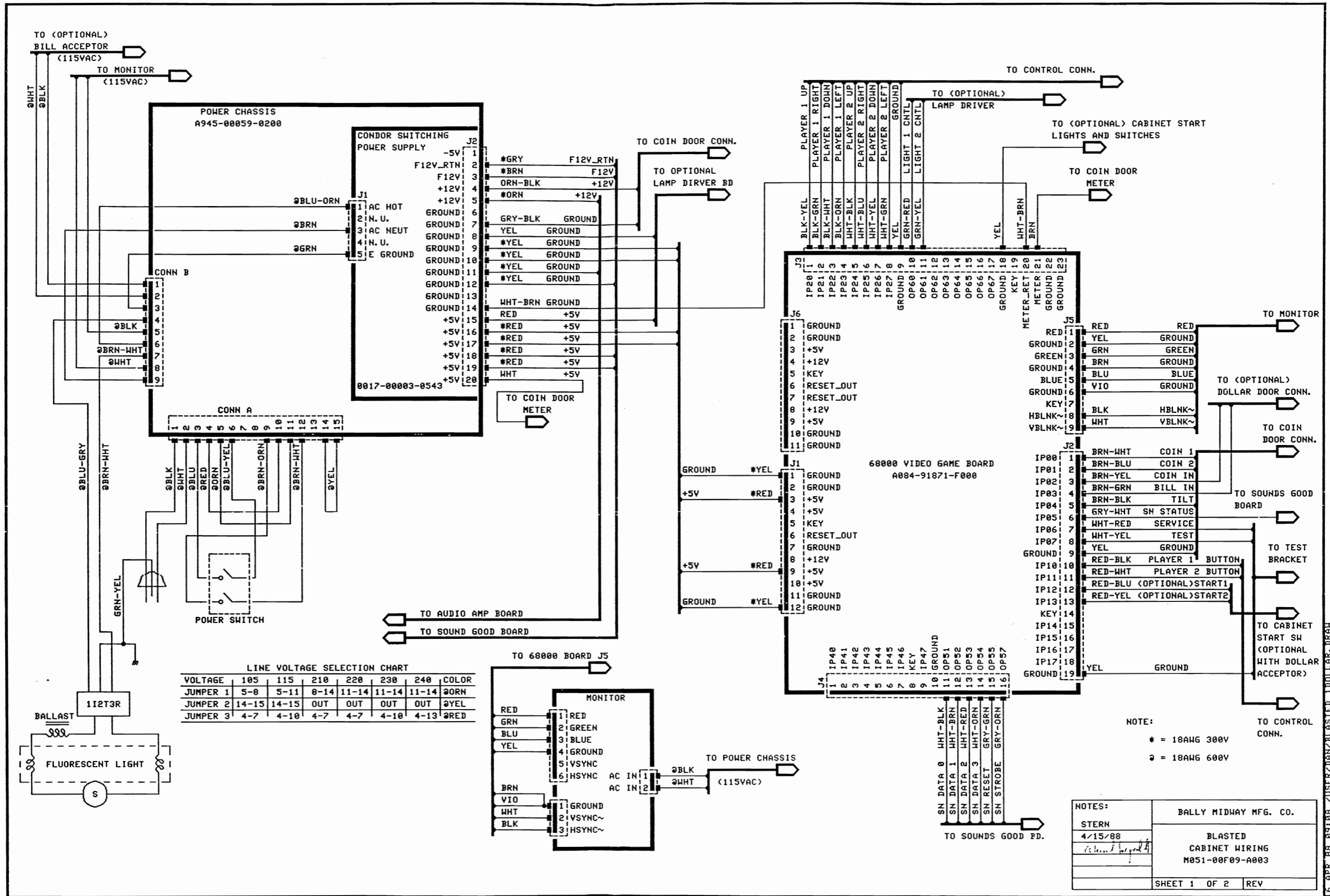
When a feature is operated by a switch (for example, joysticks and control panel push-buttons) does not operate at all, check the switch with a meter or continuity tester to verify its operation. If the switch does not check good, replace it. If the switch is OK, suspect the switch input from the printed circuit board. In this case, refer to the wiring diagrams and printed circuit board schematics and check to see what type of input is supposed to be at the switch. In many cases, the input will be +5 VDC. If so, use the meter to check for its presence with the game turned on. Normally, the switch is used to 'pull' the +5 VDC line low (near ground) or to 'pull' a low line high.

If the printed circuit board output is missing, check the wiring from the printed circuit board to the output device. If the signal is at the printed circuit board trace, the wiring or connection is at fault. If there is no signal at the printed circuit board trace, begin exploring the printed circuit board using the logic schematics.

SECTION 2
ILLUSTRATED PARTS BREAKDOWN

THIS INFORMATION IS NOT AVAILABLE AT THIS TIME.

SECTION 3
COMPONENT LAYOUTS, SCHEMATICS
& CABINET WIRING DIAGRAM

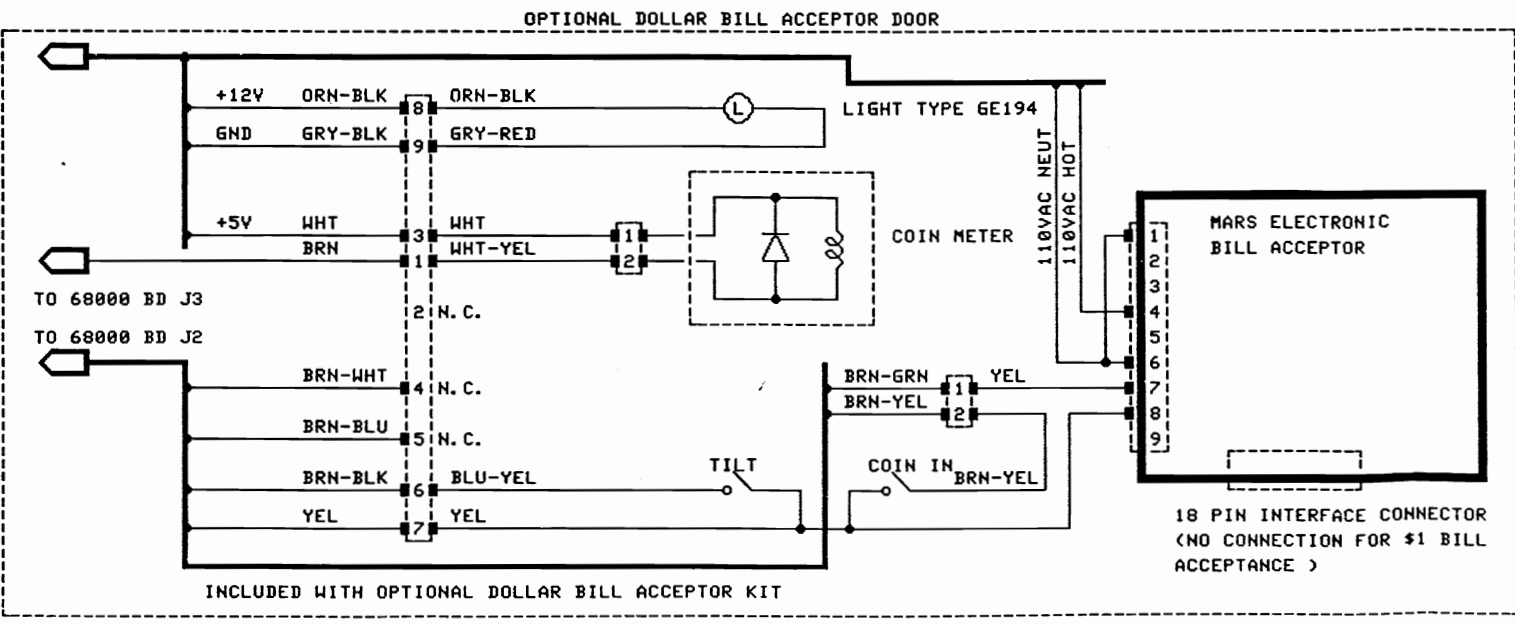
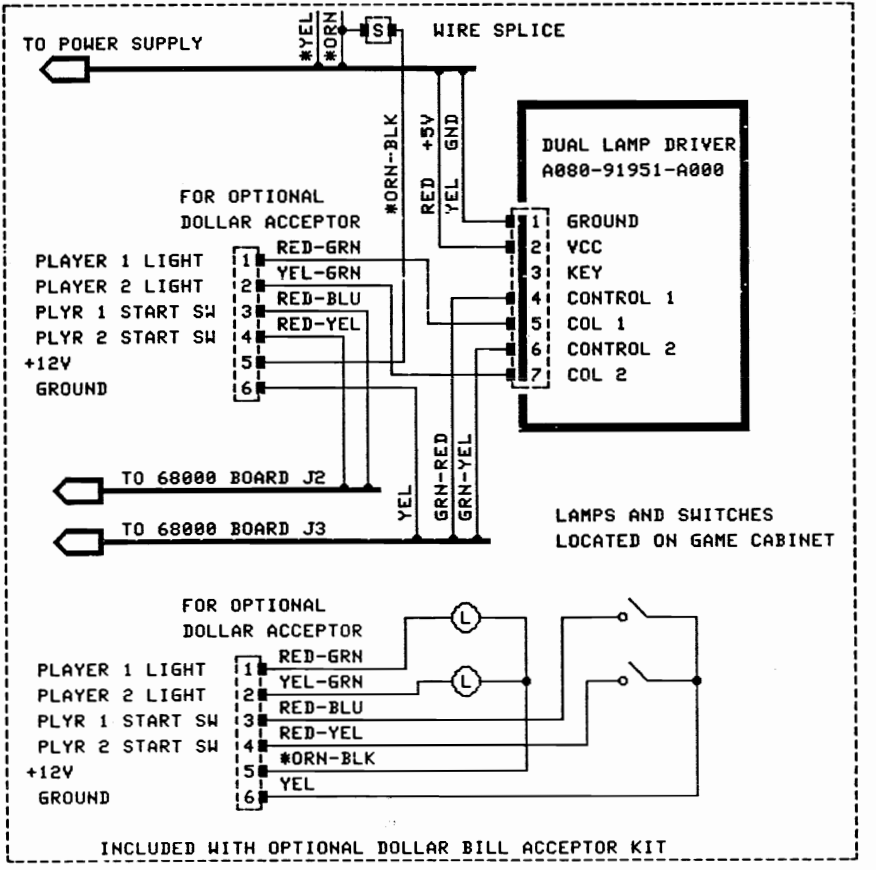
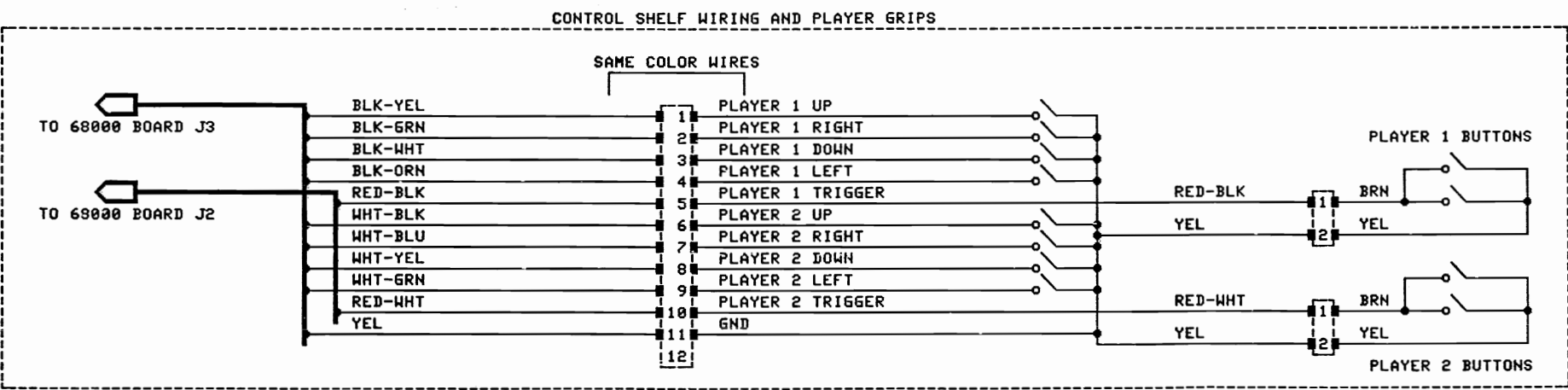
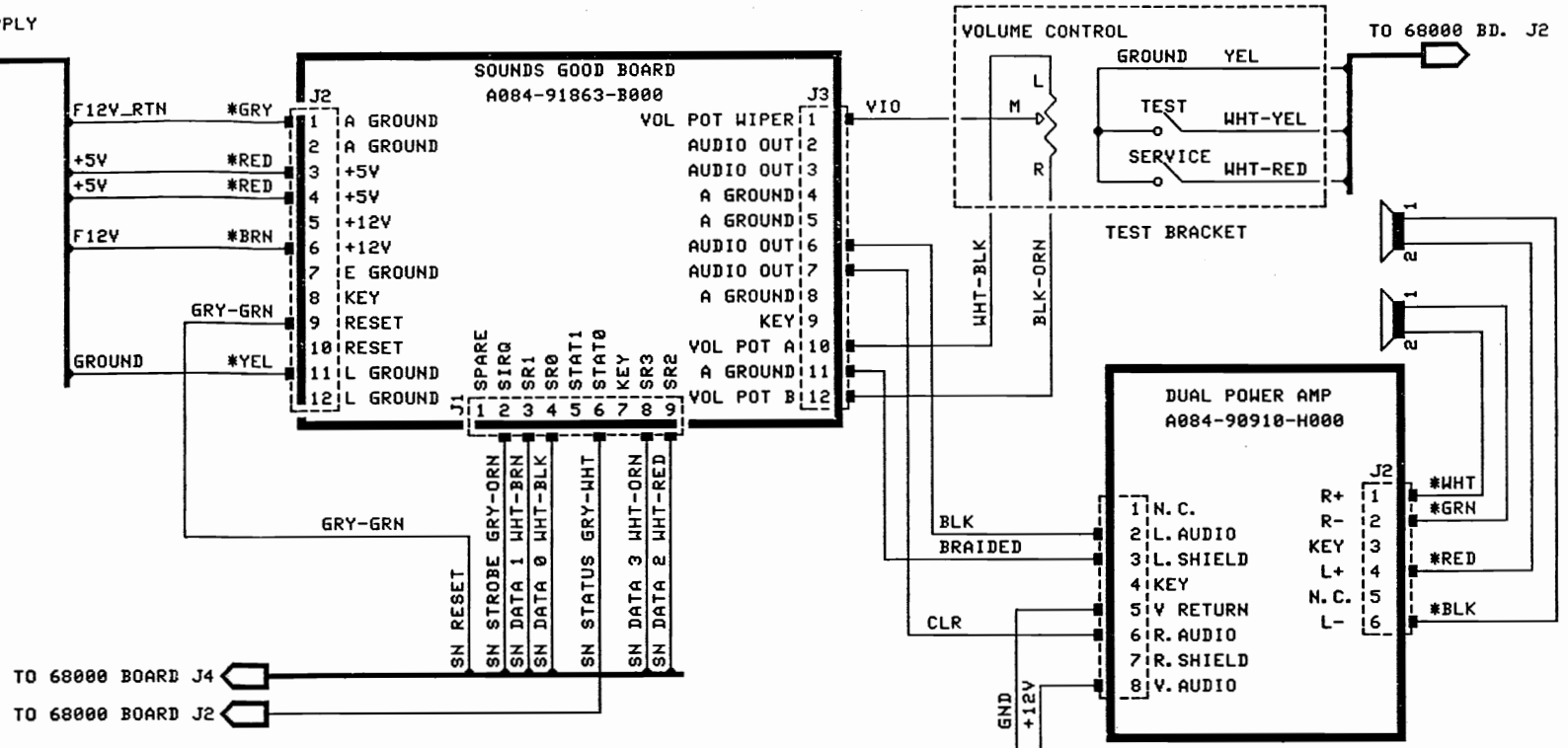
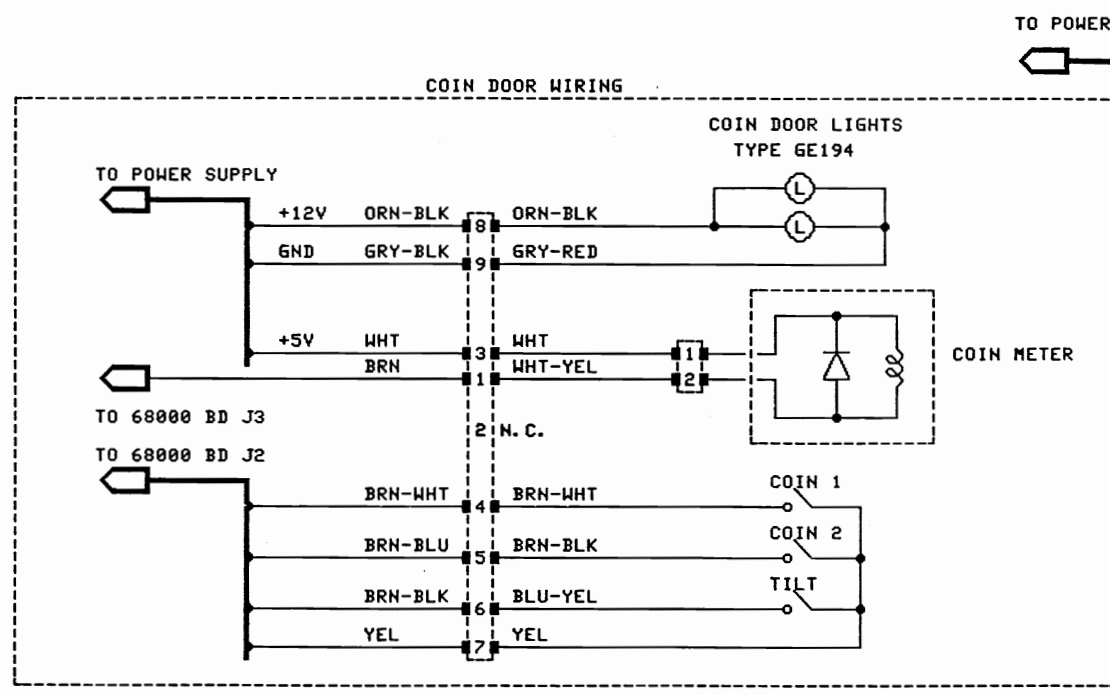


LINE VOLTAGE SELECTION CHART

VOLTAGE	105	115	210	220	230	240	COLOR
JUMPER 1	5-8	5-11	8-14	11-14	11-14	11-14	ORN
JUMPER 2	14-15	14-15	OUT	OUT	OUT	OUT	YEL
JUMPER 3	4-7	4-10	4-7	4-7	4-10	4-13	RED

NOTE:
 * = 18AWG 300V
 @ = 18AWG 600V

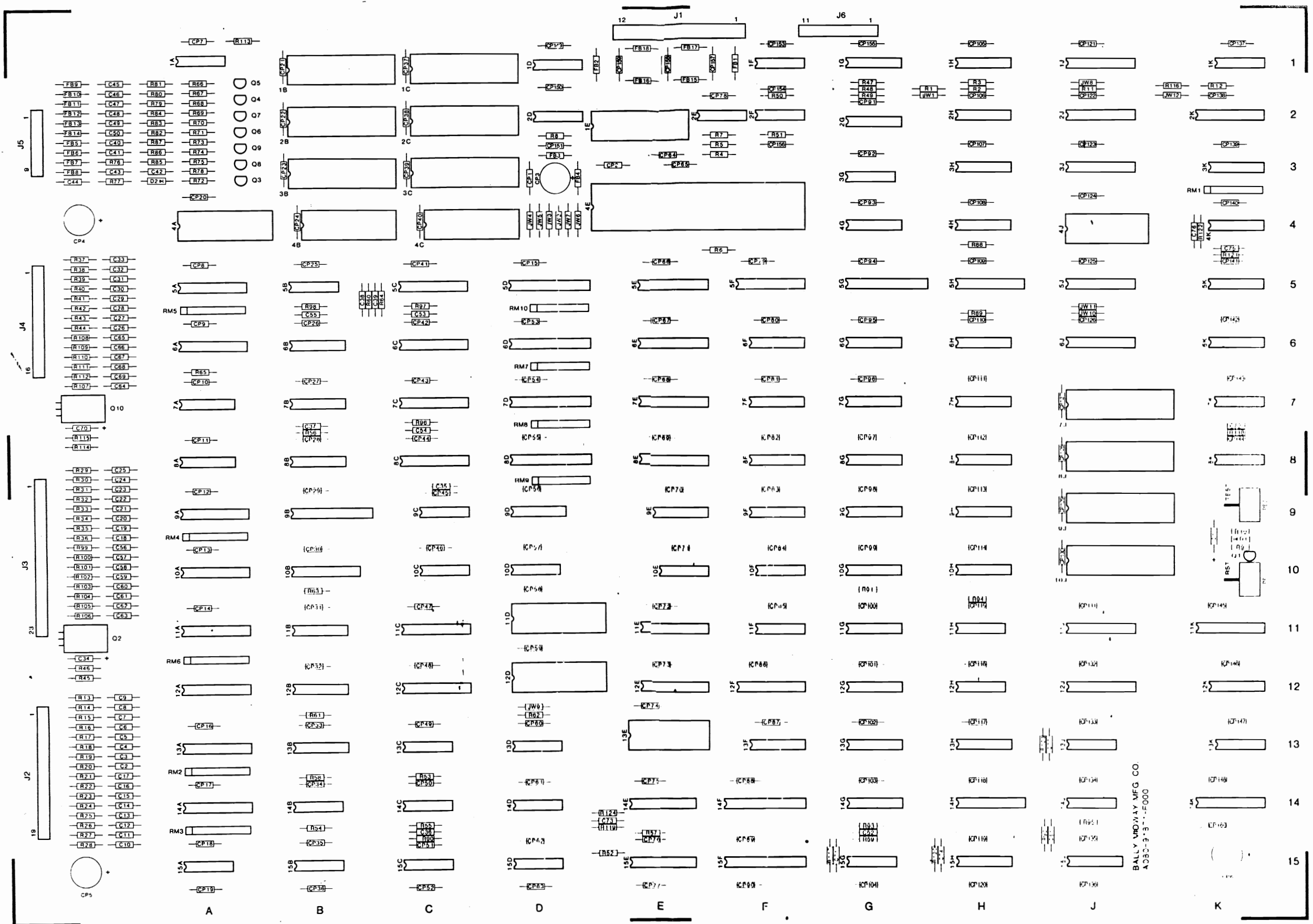
NOTES:	BALLY MIDWAY MFG. CO.
STERN	BLASTED
4/15/88	CABINET WIRING
<i>Richard Berglund</i>	M051-00F09-A003
	SHEET 1 OF 2 REV



NOTES:
* = 18 AWG 300V

NOTES:	BALLY MIDWAY MFG. CO.
D. STERN	BLASTED
4/15/88	CABINET WIRING
	M051-00F09-A003
	SHEET 2 OF 2 REV

16 APR 88 09105 7USER/DAN/BLASTED 2DOLLAR.DRAW



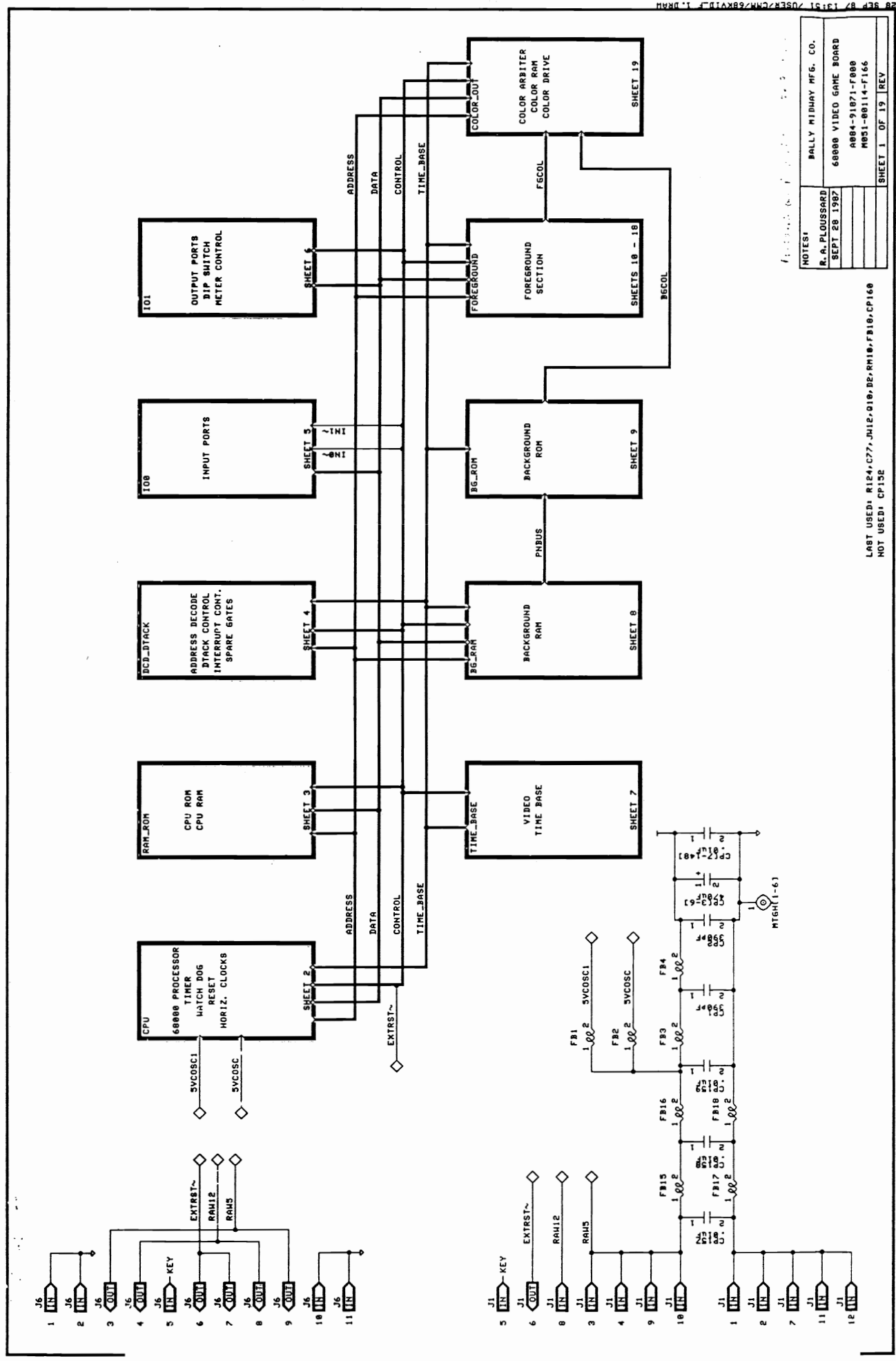
BALLY MIDWAY MFG. CO.
A084-91871-F000

PROJECT ENG: C. MEDNICK		USED ON: OE85		REVISIONS	
DO NOT SCALE DWG.		SCALE: FULL		NO. REQ'D: 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED		FRAC. 1/16		DEC. 0.001	
CONCENTRICITY TYP. 0.001		HOLE DIA. ±0.002-0.005		DATE: 9/25/87	
ASSEMBLY DRAWING				PART NO. M051-00114-F164	
68000 VIDEO GAME BOARD				A084-91871-F000	
BALLY MIDWAY MFG. CO.				FRANKLIN PK. ILL.	

68000 VIDEO GAME BOARD
A084-91871-F000
M051-00114-F165

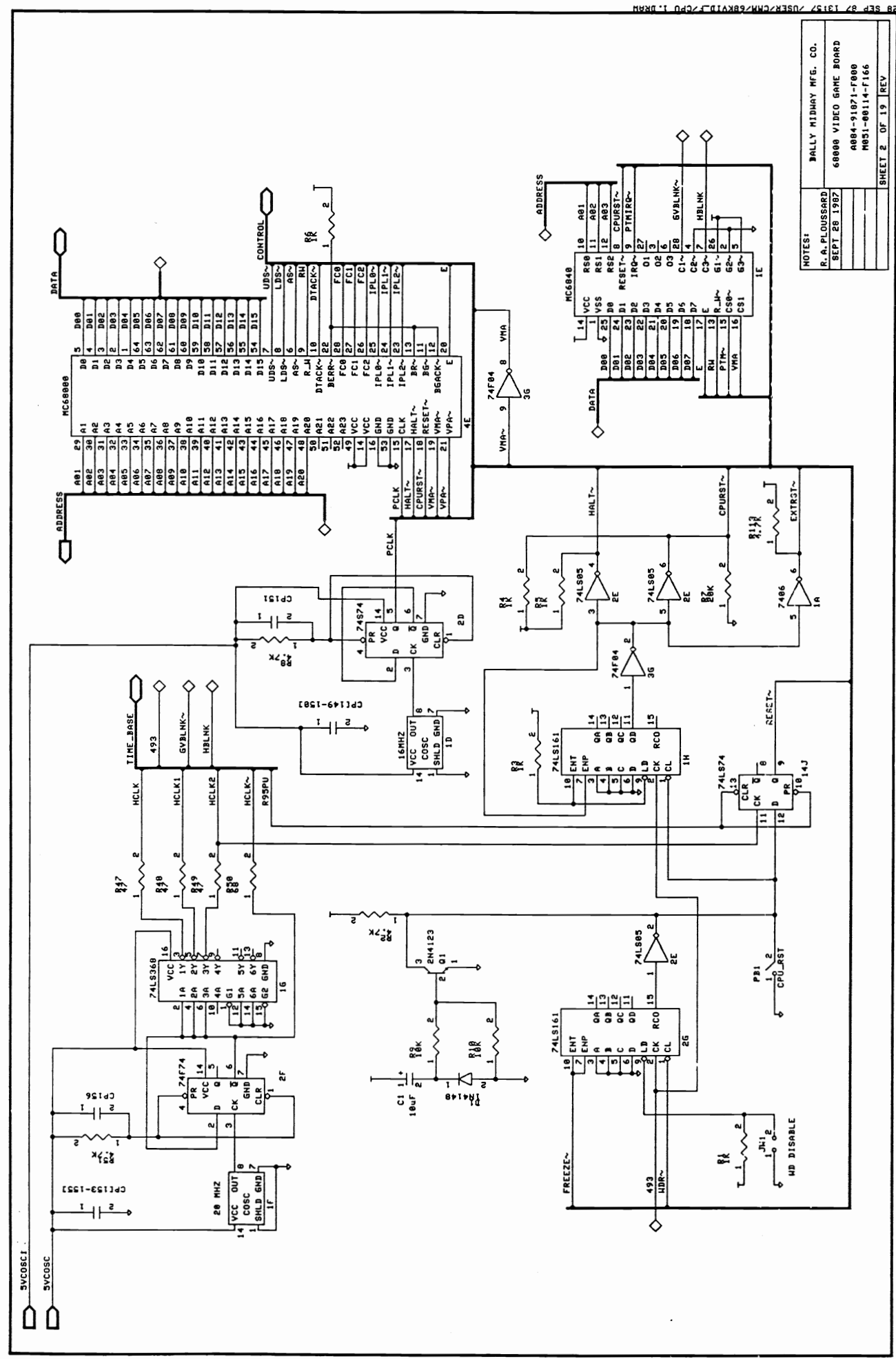
DESCRIPTION	QTY	DESIGNATION	PART NUMBER
10 pF AX CR	3	C71 C55 C72	0360-00800-0038
18pF AX CR	4	C37 C38 C73 C75	0365-00800-0026
33pF AX CR	2	C51 C74	0986-00800-0300
47pF AX CR	6	C45-C50	0986-00800-2800
68pF AX CR	5	C39 C53 C54 C76 C77	0360-00800-0028
100pF AX CR	32	C2-C33	0360-00800-0046
390pF AX CR	4	CP1 CP2 C35 C42	0986-00800-3000
820pF AX CR	18	C40 C41 C43 C44 C56-C69	0945-00816-0400
.01uF AX CR	155	C36 C52 CP[7-151,153-160]	0986-00800-2000
10uF AX TANT	3	C1 C34 C70	0986-00800-0700
470uF RD ELEC	4	CP3-CP6	0875-00803-0001
10 OHM 1/4W 5% RES	6	R79 R80 R82 R83 R85 R86	100E-00005-0011
22 OHM 1/4W 5% RES	3	R52 R57 R124(PART OF MOD.)	100E-00005-0016
47 OHM 1/4W 5% RES	3	R47 R48 R49	100E-00005-0025
60 OHM 1/4W 5% RES	3	R50 R53 R90	100E-00005-0029
82 OHM 1/4W 5% RES	6	R60 R96 R97 R120 R121 R123	100E-00005-0031
100 OHM 1/4W 5% RES	15	R92 R99-R112	100E-00005-0033
200 OHM 1/4W 5% RES	7	R56 R64 R98 R117-R119 R122	100E-00005-0040
470 OHM 1/4W 5% RES	3	R81 R84 R87	100E-00005-0051
510 OHM 1/4W 5% RES	3	R68 R71 R75	100E-00005-0053
560 OHM 1/4W 5% RES	3	R76 R77 R78	100E-00005-0054
680 OHM 1/4W 5% RES	1	R58	100E-00005-0056
1K OHM 1/4W 5% RES	10	R1 R3-R6 R12 R67 R70 R72 R74	100E-00005-0061
2K OHM 1/4W 5% RES	3	R66 R69 R73	100E-00005-0068
2.7K OHM 1/4W 5% RES	4	R45 R46 R114 R115	100E-00005-0071
4.7K OHM 1/4W 5% RES	19	R2 R8 R11 R51 R54 R55 R59 R61 R62 R63 R65 R88 R89 R91 R93 R94 R95 R113 R116 R9 R10 R13-R44	100E-00005-0079 100E-00005-0088 100E-00005-0095 102E-00004-0011 102E-00004-0024 102E-00004-0026 102E-00004-0045 103E-00002-0005 104E-00001-0007 104E-00002-0012 104E-00009-0001 109E-00002-0001 0304-00804-0007 0986-00803-7600 0A59-00803-0015 0A59-00803-0001 0A59-00803-0034 0A59-00803-0030 0304-00803-0059 0A59-00803-0003 0A59-00803-0031 0A59-00803-0004 0A59-00803-0005 0875-00803-0001 0906-00000-C600 0A15-00803-0023 0304-00803-0010 0986-00803-7400 0A15-00803-0011 0986-00803-7300 0986-00803-1004 0986-00803-6100 0986-00803-1005 0986-00803-9900 0A15-00803-0067 0A59-00803-0006 0304-00803-0021 0986-00803-1003 0A59-00803-0008 0304-00803-0023 0A59-00803-0009 0304-00803-0024 0304-00803-0025 0304-00803-0026 0986-00803-4000 0986-00803-6400 0304-00803-0028 0986-00803-4700 0304-00803-0030 0A59-00803-0010 0A59-00803-0011 0986-00803-4600
10K OHM 1/4W 5% RES	34	R7	100E-00005-0088
20K OHM 1/4W 5% RES	1	R7	100E-00005-0095
1K 9 PIN SIP	4	RM7 RM8 RM9 RM10	102E-00004-0011
4.7K 9 PIN SIP	1	RM1	102E-00004-0024
4.7K 10 PIN SIP	1	RM6	102E-00004-0026
100K 10 PIN SIP	4	RM2 RM3 RM4 RM5	102E-00004-0045
1N4148 DIODE	2	D1 D2	103E-00002-0005
2N4123 NPN XSTR	2	Q1 Q3	104E-00001-0007
MPSA70 PNP XSTR	6	Q4 Q5 Q6 Q7 Q8 Q9	104E-00002-0012
TIP110 NPN XSTR	2	Q2 Q10	104E-00009-0001
COSC 16MHZ	1	10	109E-00002-0001
COSC 20MHZ	1	1F	0304-00804-0007
7406	1	1A	0986-00803-7600
74ALS20	1	12H	0A59-00803-0015
74F00	2	11F 8K	0A59-00803-0001
74F04	1	3G	0A59-00803-0034
74F08	1	10D	0A59-00803-0030
74F32	1	1K	0304-00803-0059
74F74	2	2F 11H	0A59-00803-0003
74F86	2	13C 13K	0A59-00803-0031
74F157	4	14G 13F 13G 5K	0A59-00803-0004
74F174	1	12K	0A59-00803-0005
74HCT244	4	14A 9A 5A 13A	0875-00803-0001
74S04	2	15B 15C	0906-00000-C600
74S74	1	2D	0A15-00803-0023
74LS00	1	5B	0304-00803-0010
74LS02	1	9C	0986-00803-7400
74LS05	1	2E	0A15-00803-0011
74LS08	1	15D	0986-00803-7300
74LS20	3	13D 10E 15A	0986-00803-1004
74LS32	2	14D 13J	0986-00803-6100
74LS74	5	15G 14J 10F 14B 14C	0986-00803-1005
74LS86	2	10C 7K	0986-00803-9900
74LS148	1	3K	0A15-00803-0067
74LS153	2	11B 12B	0A59-00803-0006
74LS157	6	8A 7A 4K 4H 3H 2H	0304-00803-0021
74LS161	2	1H 2G	0986-00803-1003
74LS163	3	4G 6G 6H	0A59-00803-0008
74LS169	4	9F 8F 6F 7F	0304-00803-0023
74LS173	1	6K	0A59-00803-0009
74LS174	4	13B 8B 15H 13H	0304-00803-0024
74LS175	1	15J	0304-00803-0025
74LS194	8	8G 9H 7H 10G 9G 7G 8H 10H	0304-00803-0026
74LS244	2	5H 11A	0986-00803-4000
74LS245	2	12F 3J	0986-00803-6400
74LS258	2	9E 9D	0304-00803-0028
74LS273	6	10B 12C 11C 11K 10A 6A	0986-00803-4700
74LS283	2	11G 12G	0304-00803-0030
74LS298	2	7B 6B	0A59-00803-0010
74LS368	1	1G	0A59-00803-0011
74LS374	8	5E 6E 7E 8E 6C 7C 8C 5C	0986-00803-4600

DESCRIPTION	QTY	DESIGNATION	PART NUMBER
74LS377	5	12E 11E 5J 6J 5F	0A59-00803-0012
PACOUT REV 1 PLA	1	11J	A59A-26AXL-AXHD
PACNS REV 1 PLA	1	12J	A59A-26AXL-BXHD
ROMCTRL REV 1 PLA	1	14H	A59A-26AXL-CXHD
MMC02B HAL	1	14F	0986-00803-9000
MMC01A HAL	1	15F	0986-00803-8900
MMC06 HAL	1	14E	0986-00803-9200
MMC03B HAL	1	15E	0986-00803-9100
COLARB PAL20L8	1	9B	0E61-00803-0001
IODCD PAL16L8	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
93419 64x9 RAM	1	4A	0986-00803-9600
2018 2Kx8 RAM 45nS	4	8D 7D 5D 6D	0A59-00803-0028
2018 2Kx8 RAM 55nS	1	5G	0A59-00803-0029
2064 8Kx8 RAM 150nS	2	4B 4C	0A15-00803-0079
6116 2Kx8 RAM 150nS	1	4J	0A59-00803-0027
6116 2Kx8 RAM 120nS	1	13E	0A59-00803-0014
MC68000	1	4E	0304-00803-0051
MC6840	1	1E	0A15-00803-0068
ROM/EPROMS	12	1B-3B 1C-3C 7J-10J 11D 12D	SEE ROM/EPROM CHART
16 PIN IC SOCKET(.3)	1	1G 4K	110E-00001-0003
20 PIN IC SOCKET(.3)	9	1J 2J 2K 14K 14E 15E 11J	110E-00001-0005
		12J 14H	
24 PIN IC SOCKET(.3)	8	14F 15F 5G 5D 6D 7D 8D 9B	110E-00001-0009
24 PIN IC SOCKET(.6)	2	13E 4J	110E-00001-0007
28 PIN IC SOCKET(.6)	12	1B-4B 1C-4C 11D 12D 1E 4A	110E-00001-0010
32 PIN IC SOCKET(.6)	4	7J-10J	110E-00001-0024
64 PIN IC SOCKET(.9)	1	4E	110E-00001-0015
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 10 POS	1	12A	113E-00001-0004
SNAP	2	Q2 Q10	0017-00007-0134
PC BOARD	1		A080-91871-E000

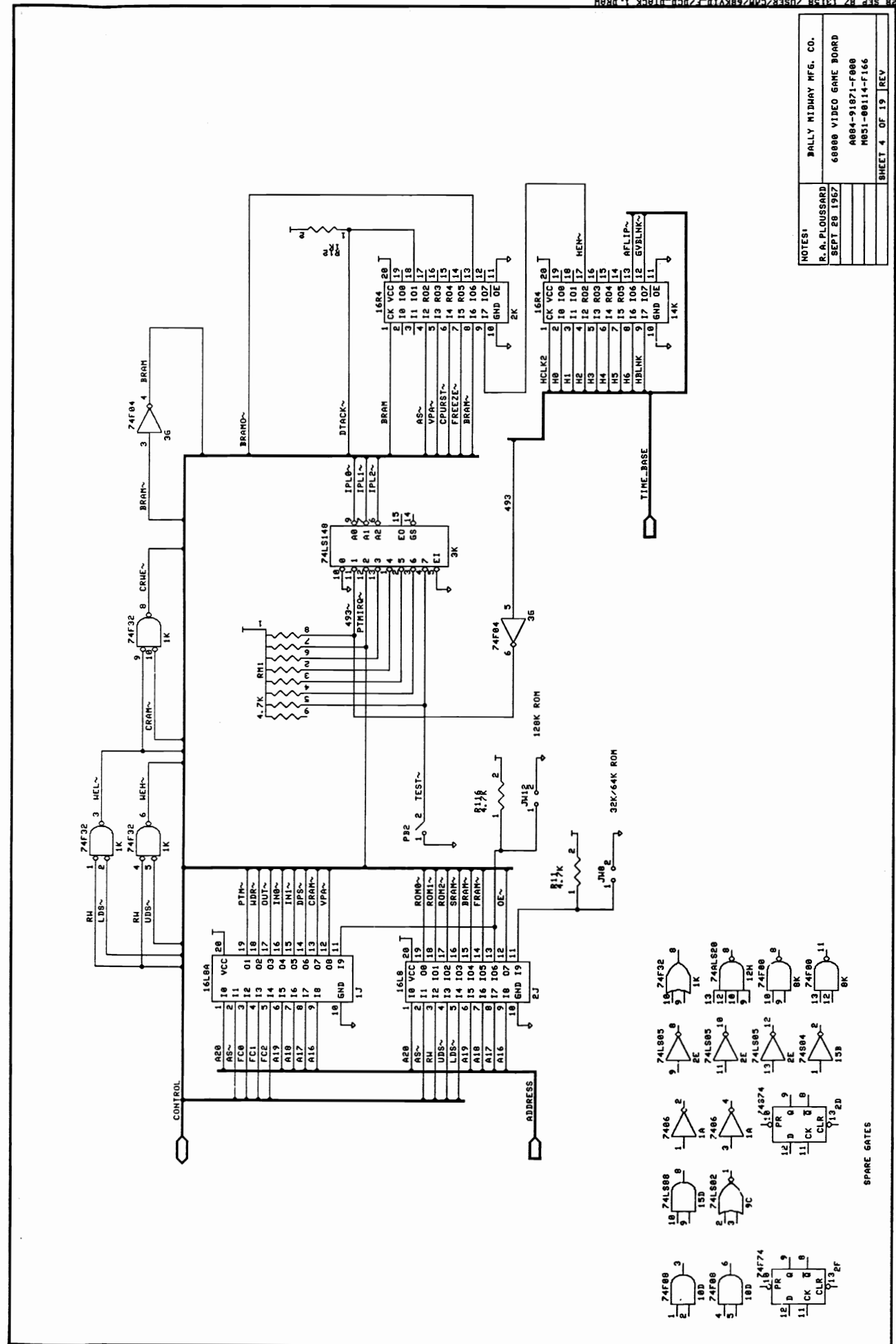
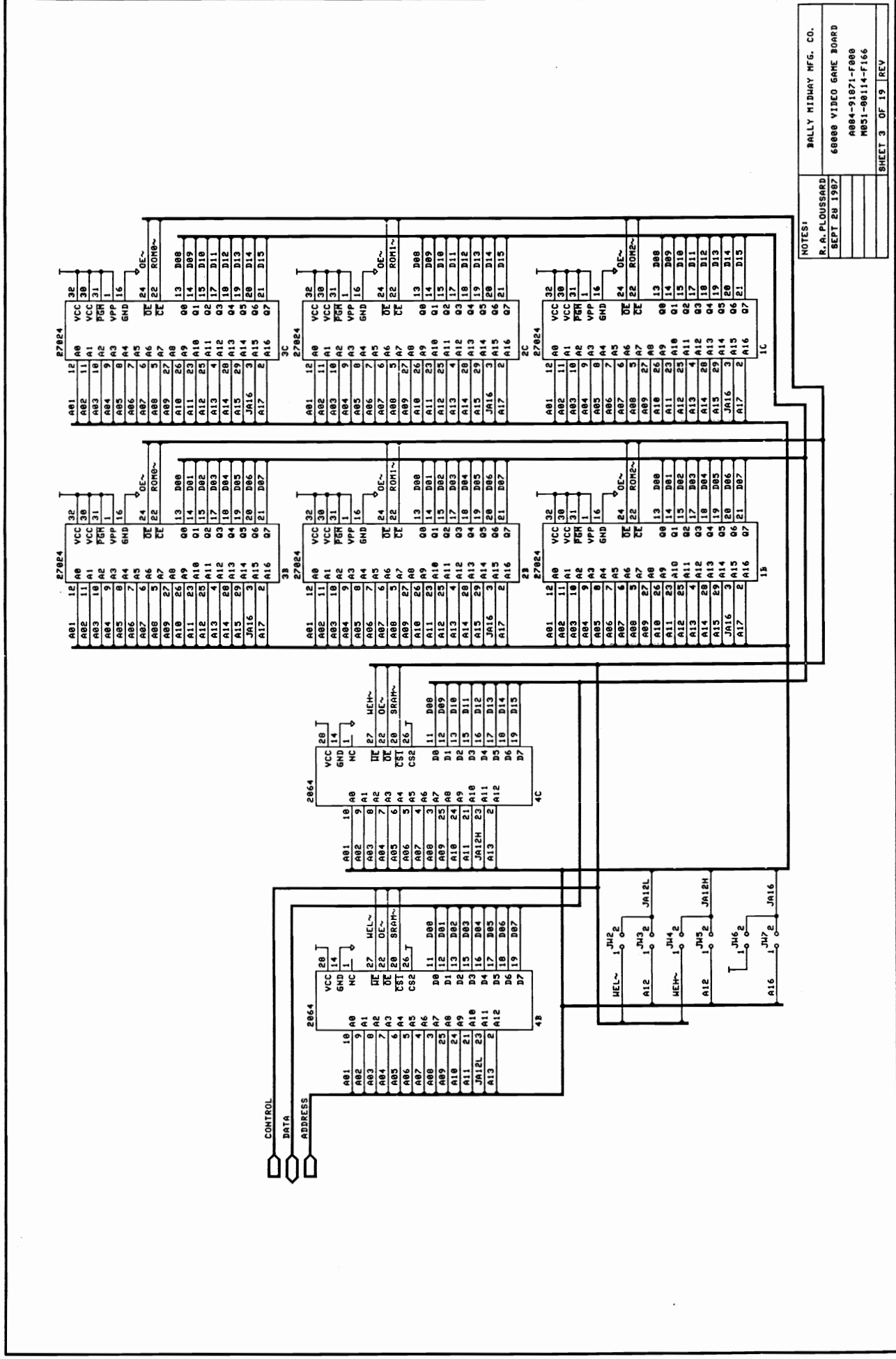


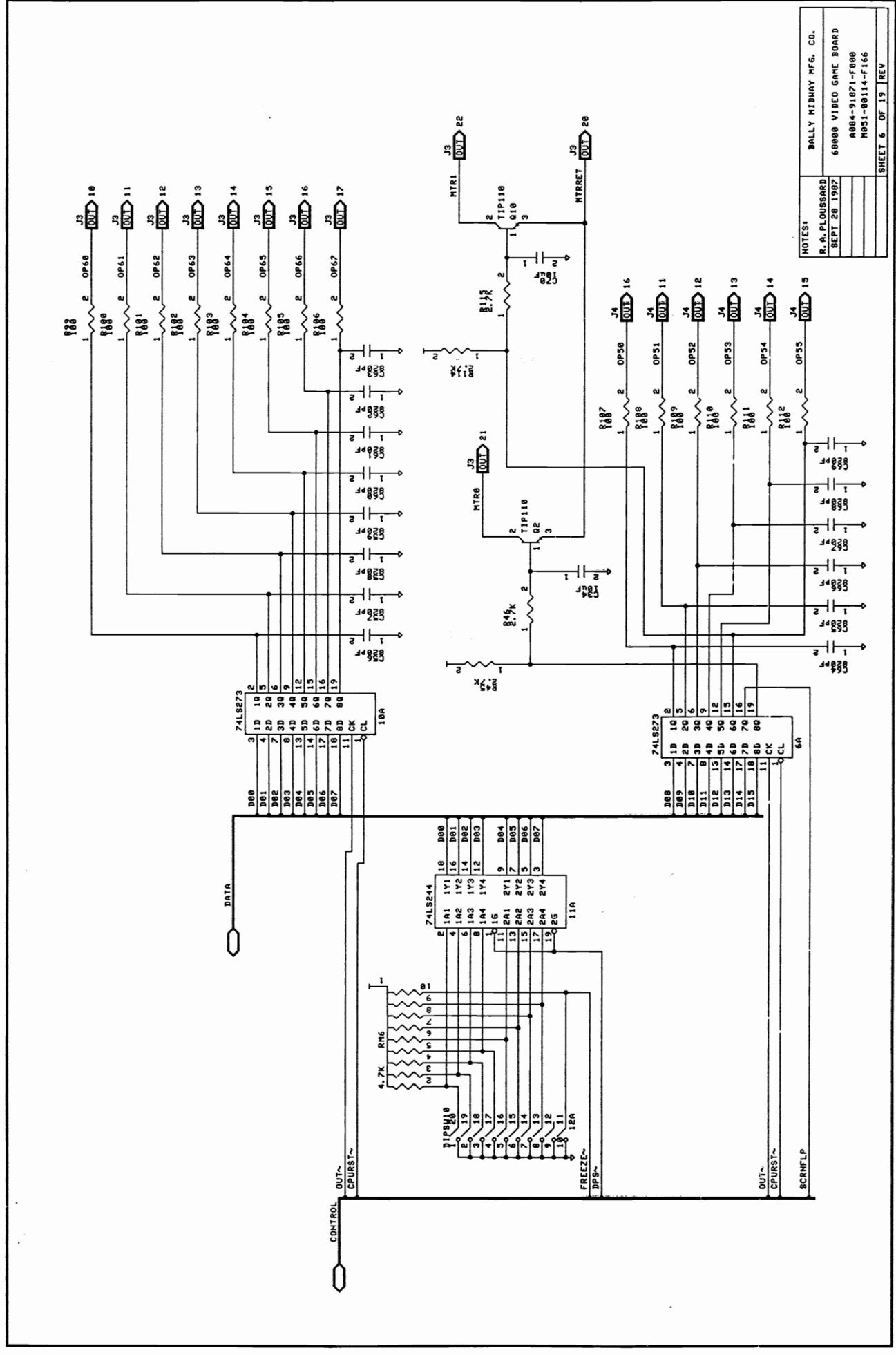
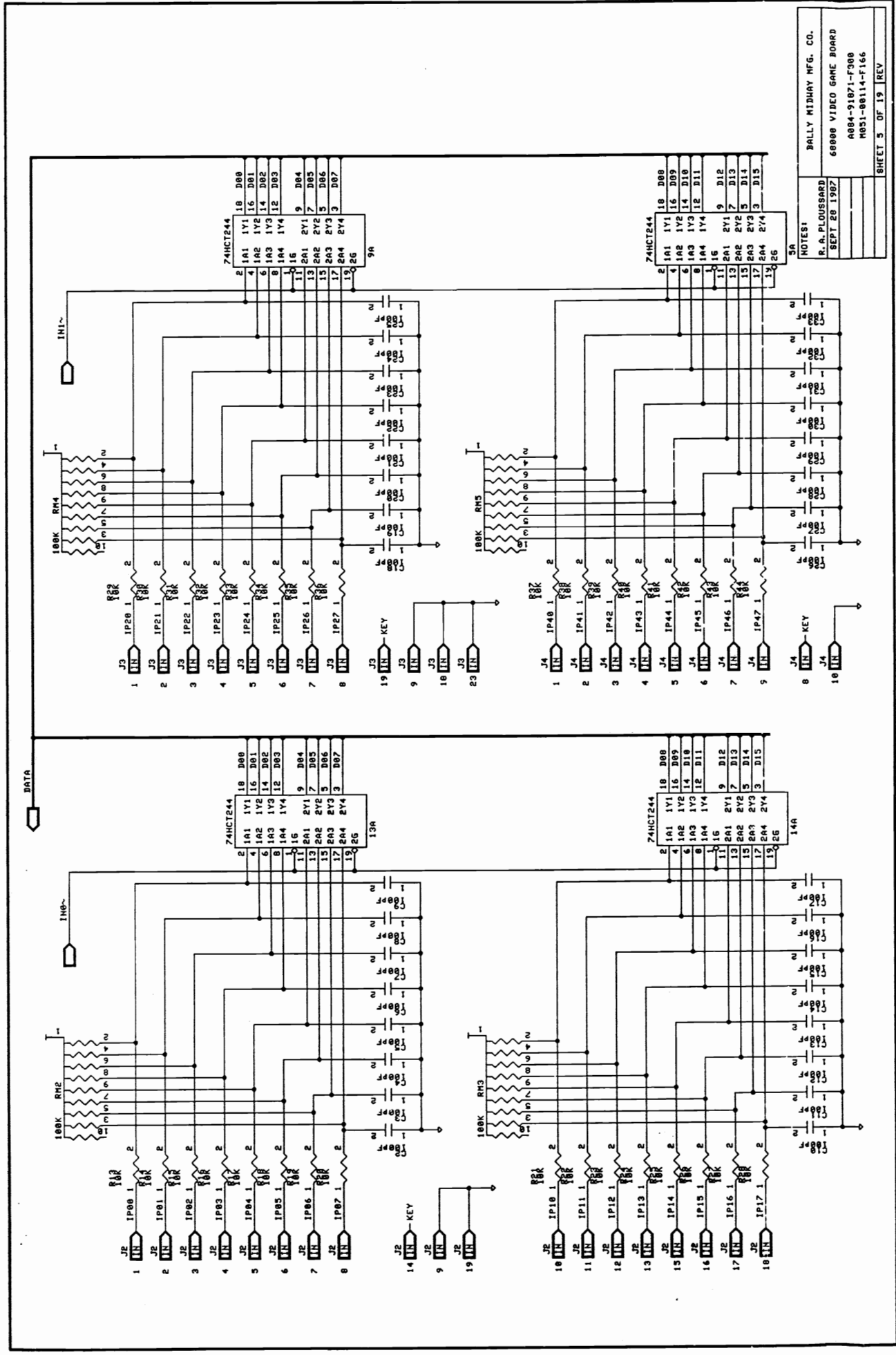
NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 AB84-91871-F080
 M051-00114-F166
 SHEET 1 OF 19 REV

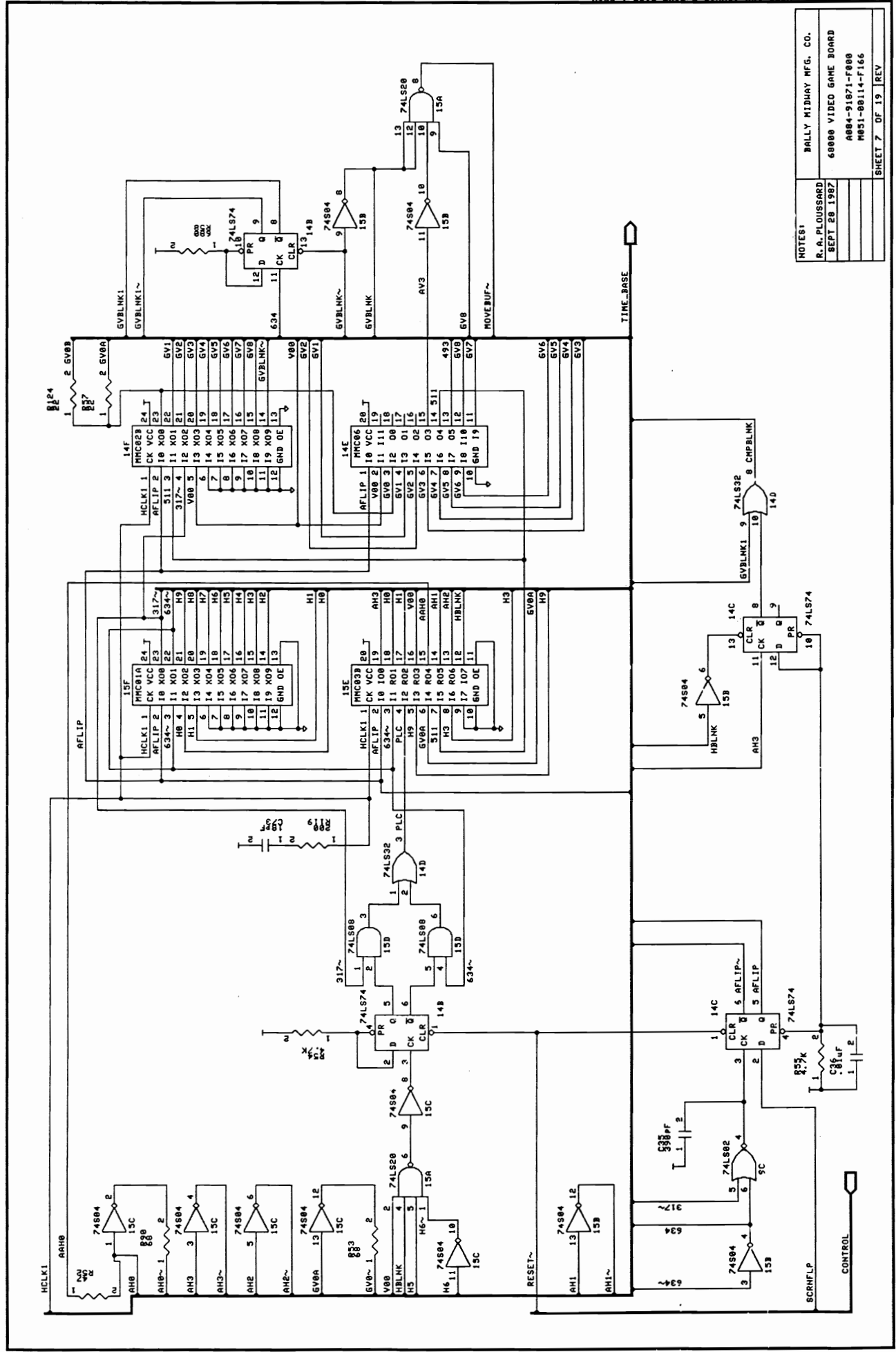
LAST USED: R124, C77, J412, D19, D2, RM19, FB18, CP18
 NOT USED: CP152



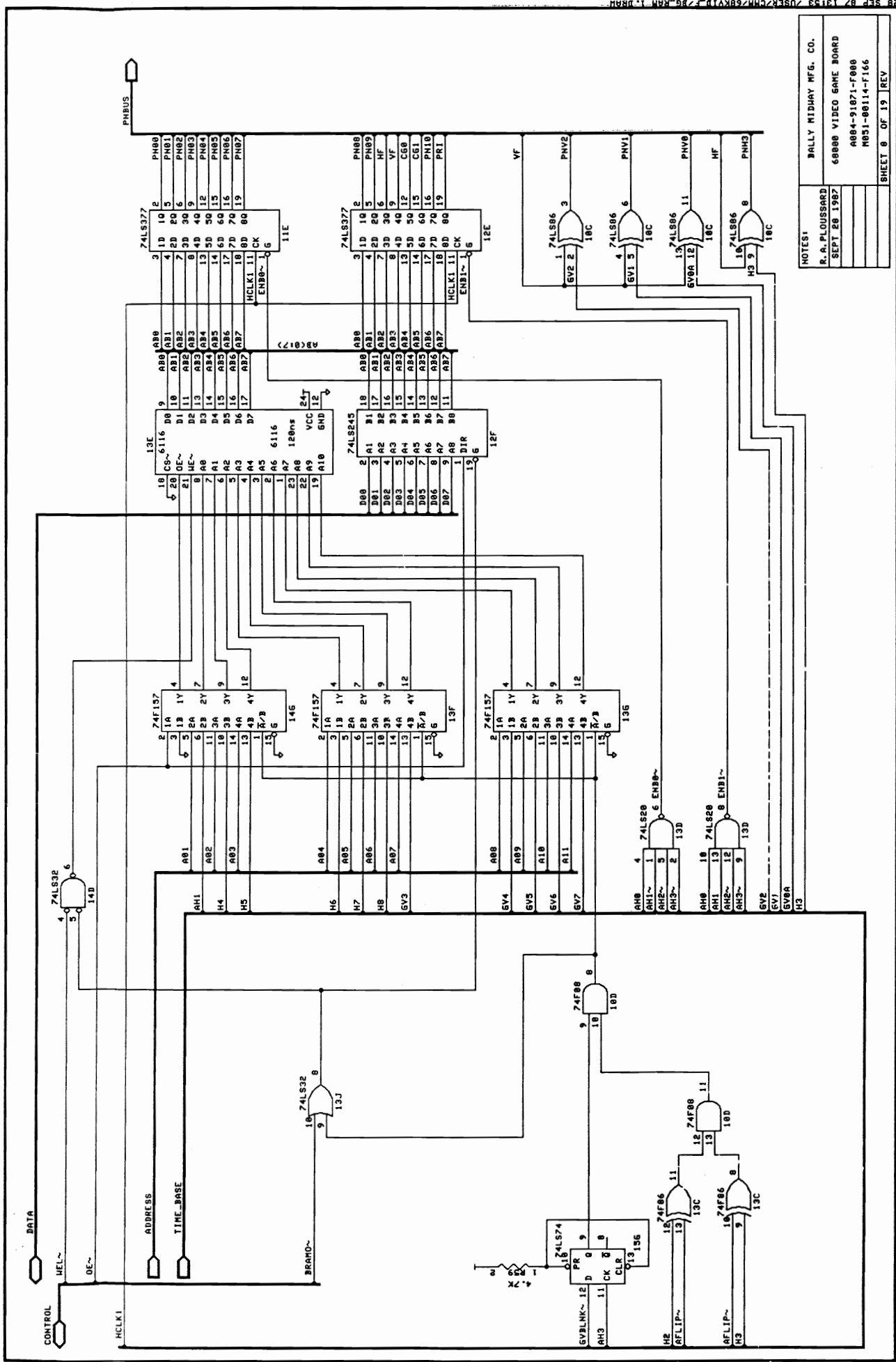
NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 AB84-91871-F080
 M051-00114-F166
 SHEET 2 OF 19 REV



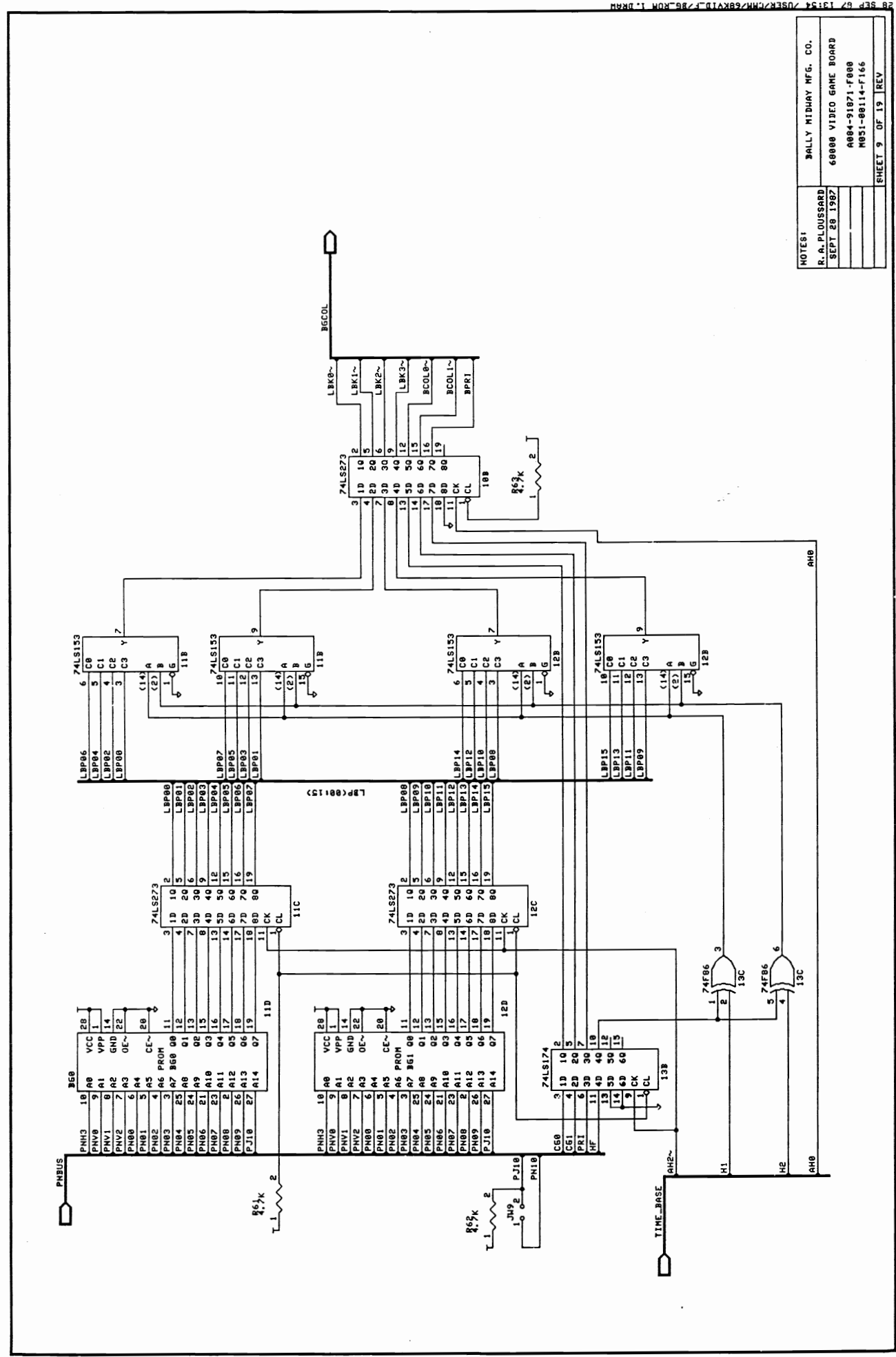




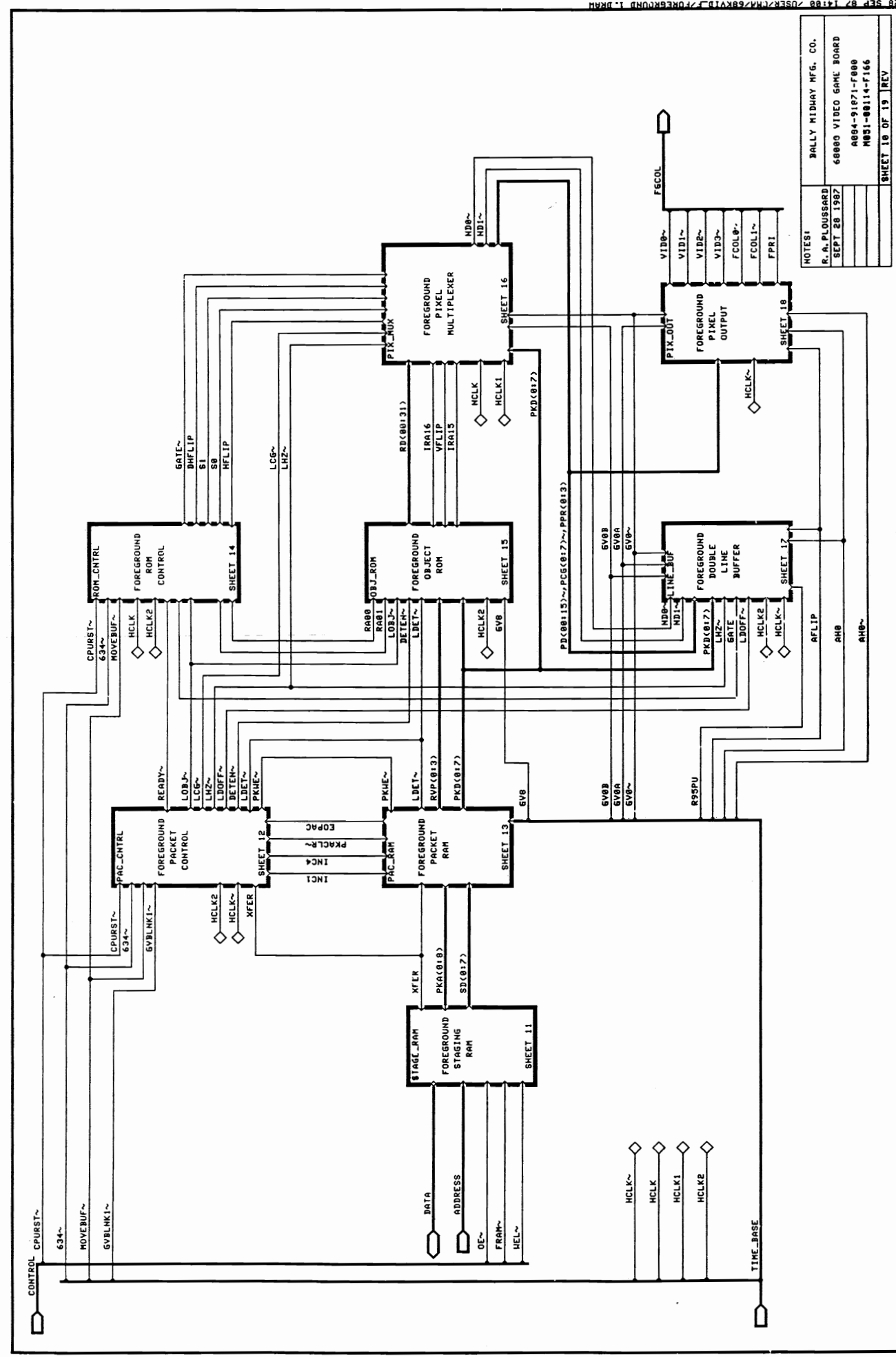
NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 A884-91871-F000
 M051-00114-F166
 SHEET 7 OF 19 REV



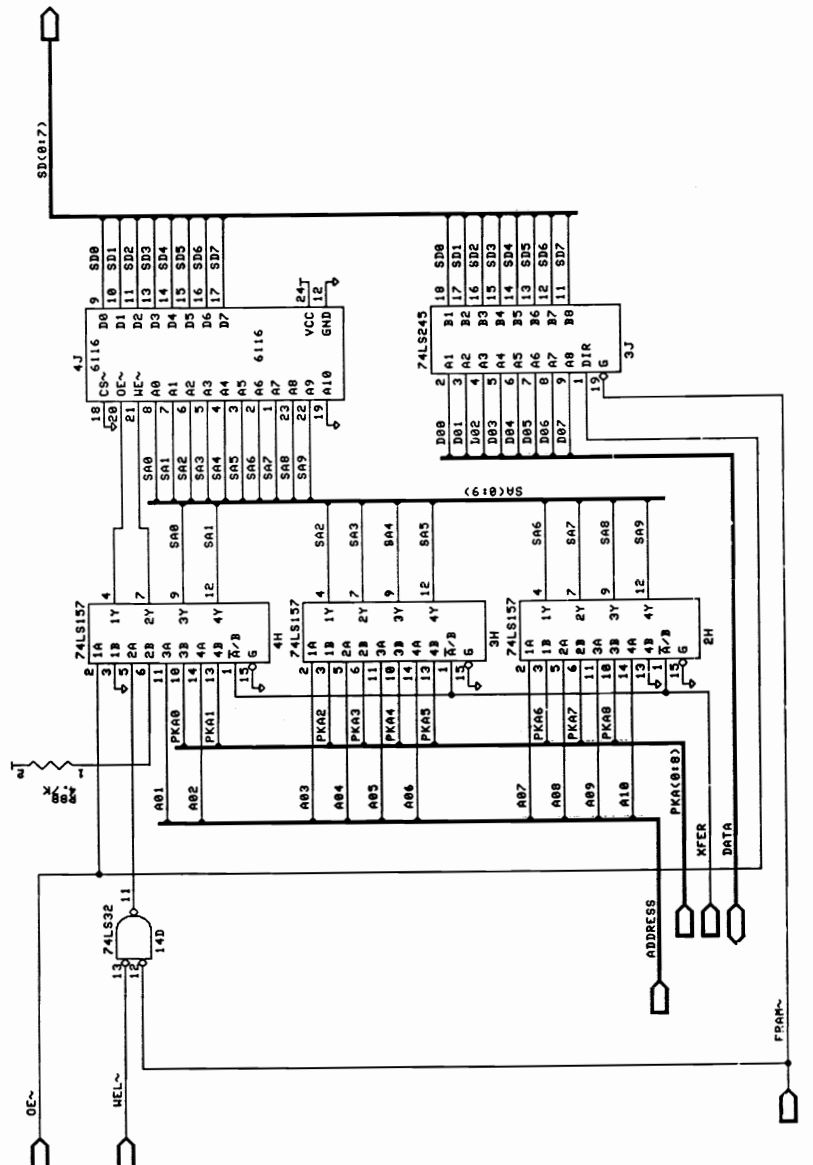
NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987
 68000 VIDEO GAME BOARD
 A884-91871-F000
 M051-00114-F166
 SHEET 8 OF 19 REV



NOTES:
 R. A. PLOUSSARD
 SEPT 28 1982
 BALLY MIDWAY MFG. CO.
 68000 VIDEO GAME BOARD
 A884-91871-F888
 M851-88114-F166
 SHEET 9 OF 19 REV

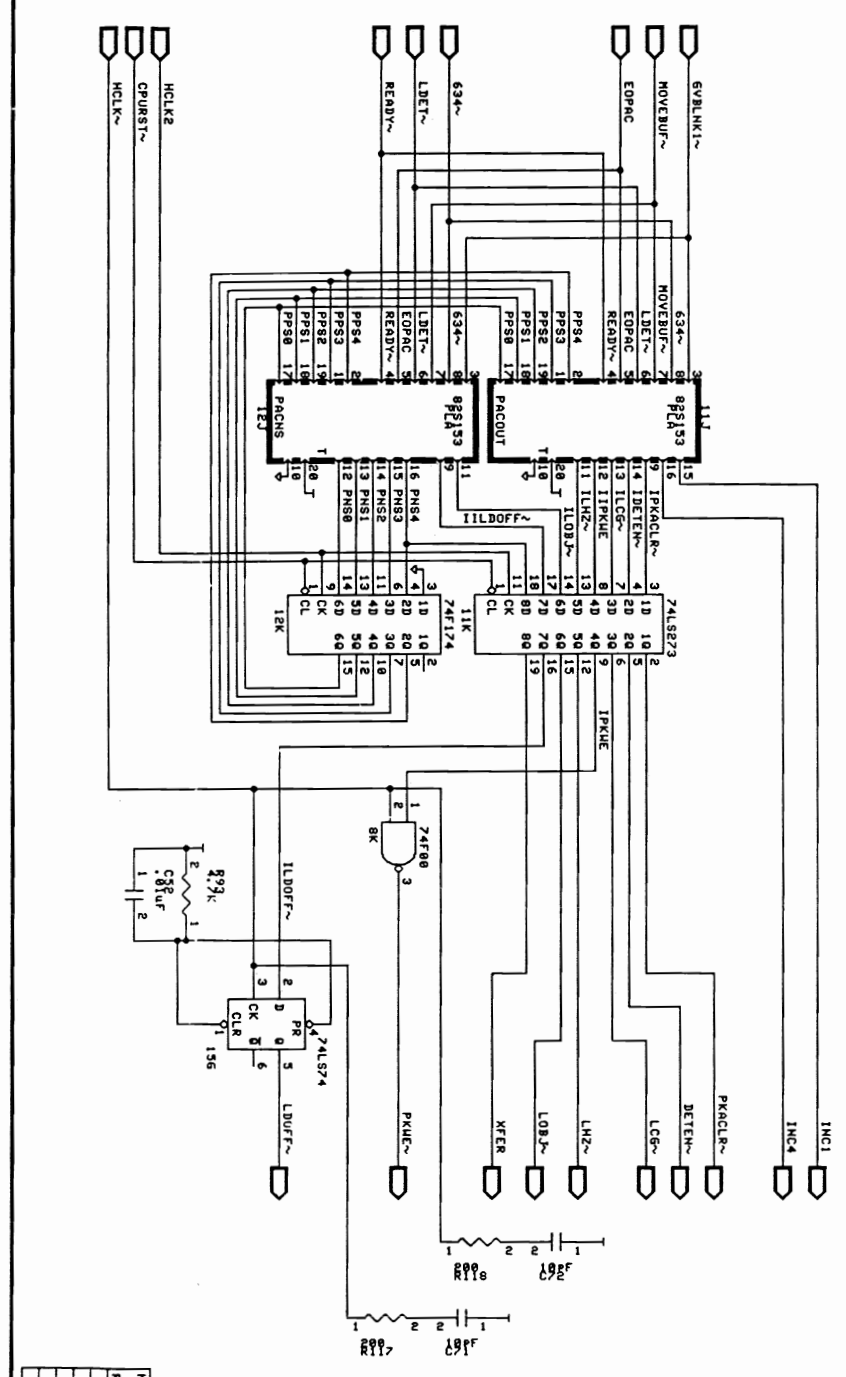


NOTES:
 R. A. PLOUSSARD
 SEPT 28 1982
 BALLY MIDWAY MFG. CO.
 68000 VIDEO GAME BOARD
 A884-91871-F888
 M851-88114-F166
 SHEET 18 OF 19 REV



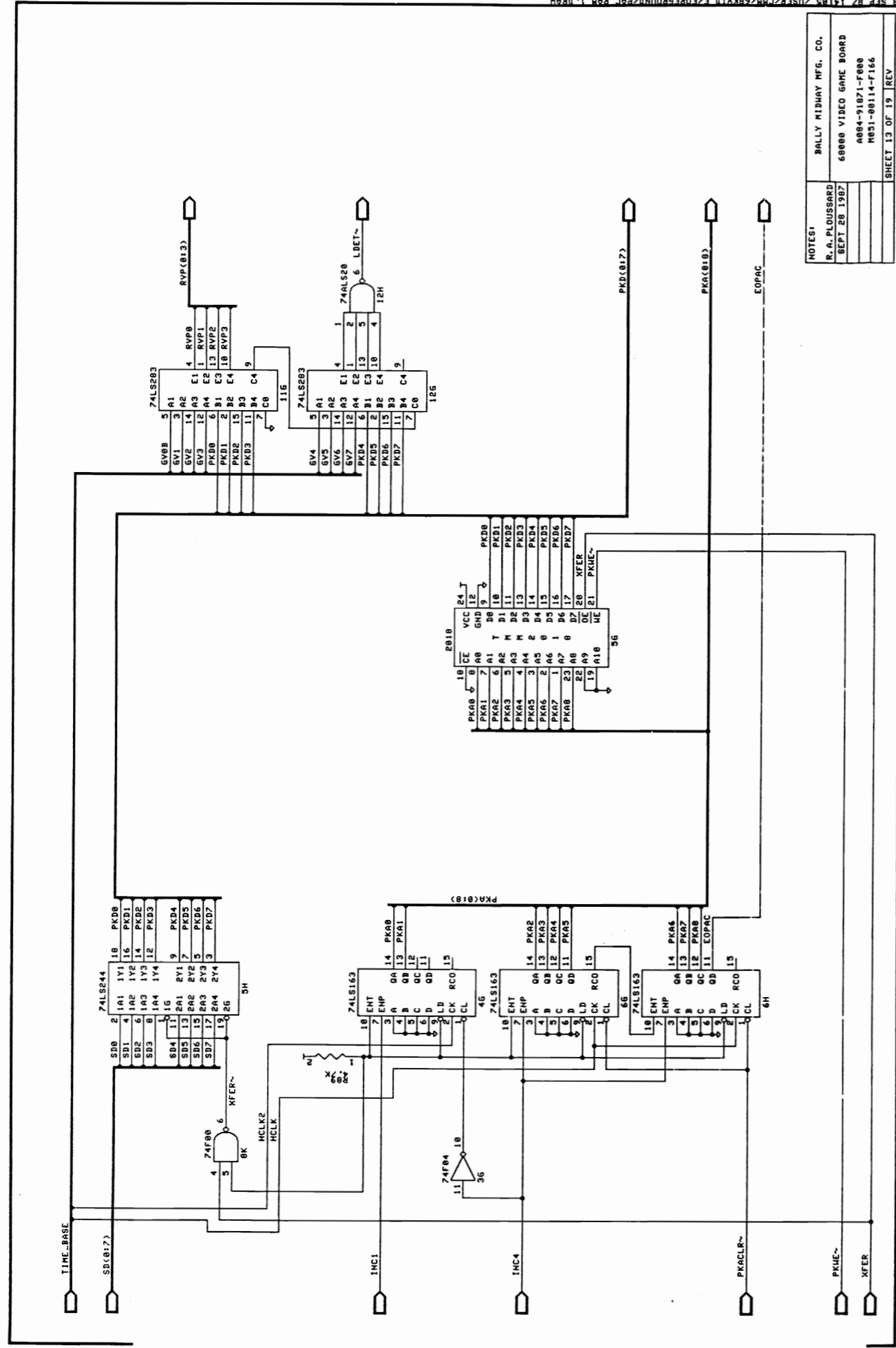
NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987

BALLY MIDWAY MFG. CO.
 68008 VIDEO GAME BOARD
 0884-91871-F088
 0851-80114-F166
 SHEET 11 OF 19 REV

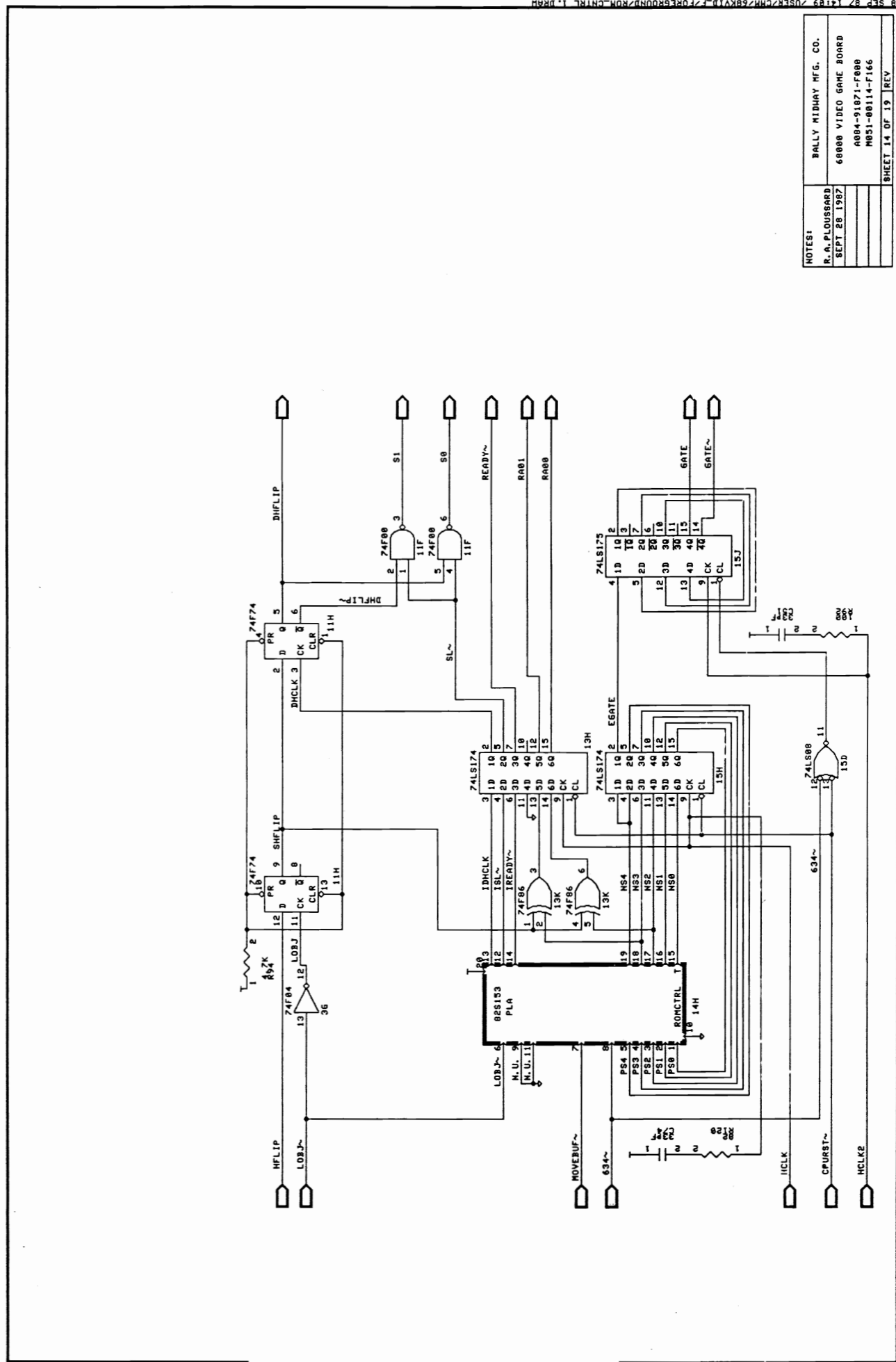


NOTES:
 R. A. PLOUSSARD
 SEPT 28 1987

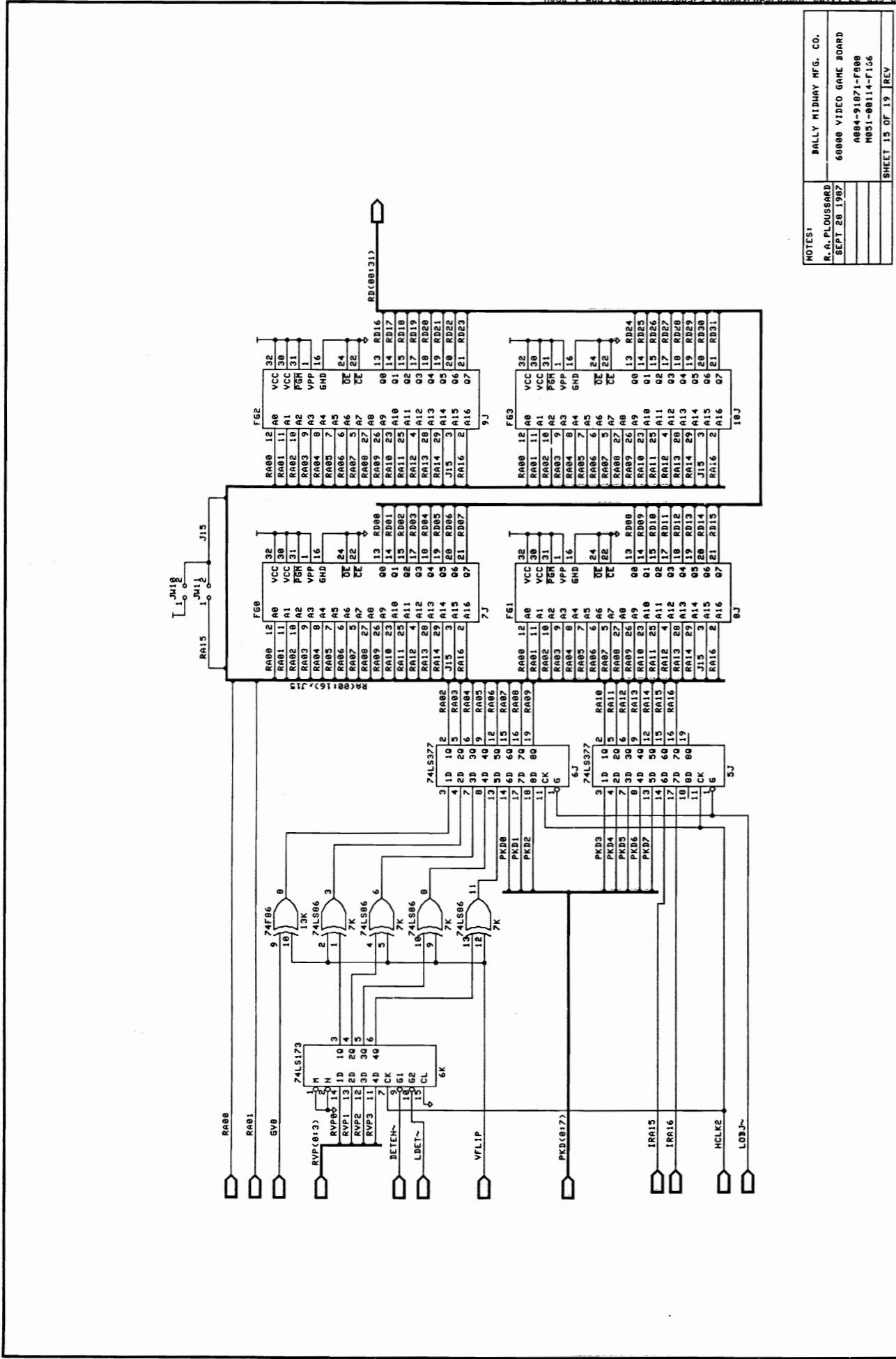
BALLY MIDWAY MFG. CO.
 68008 VIDEO GAME BOARD
 0884-91871-F088
 0851-80114-F166
 SHEET 12 OF 19 REV



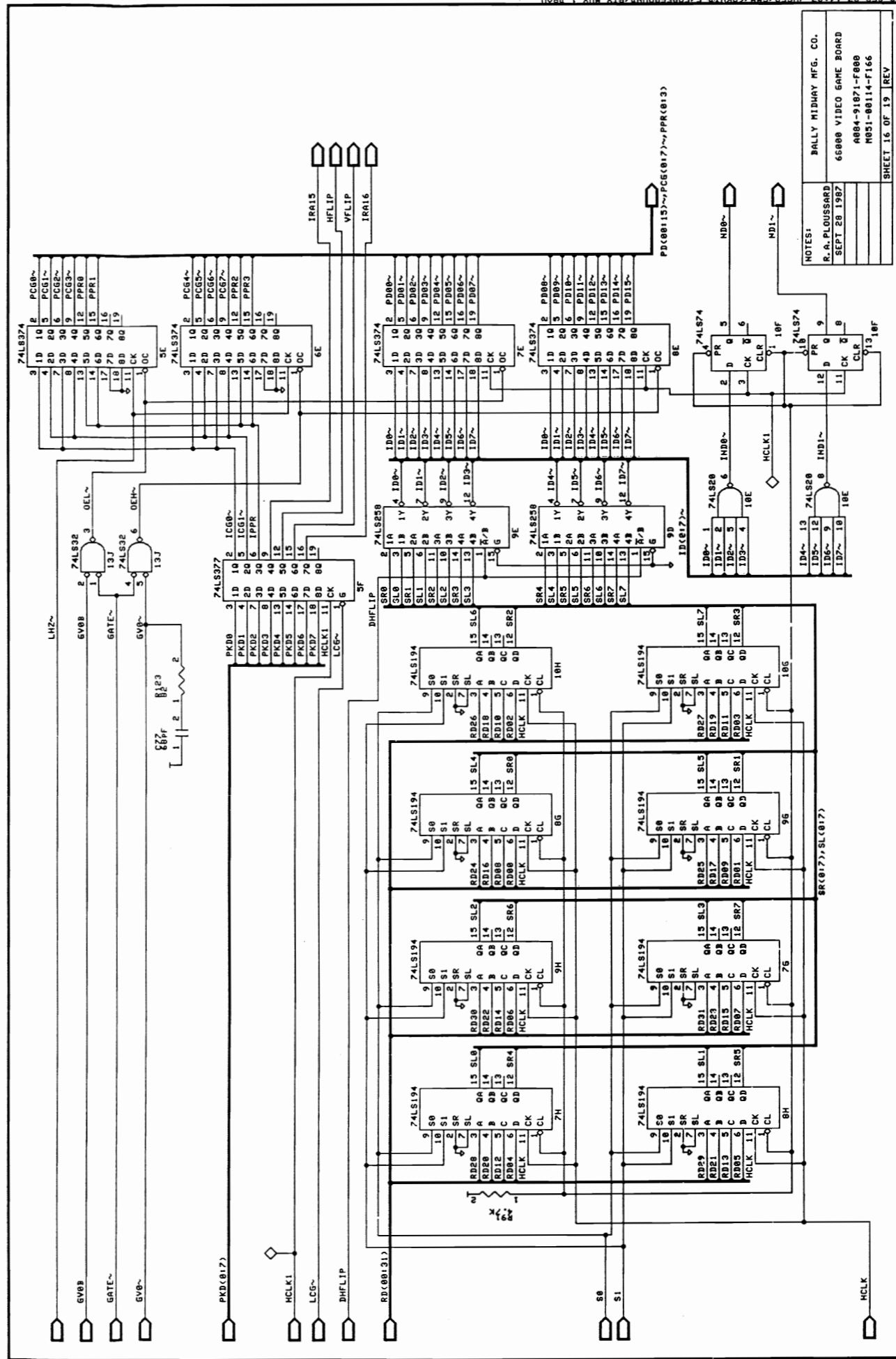
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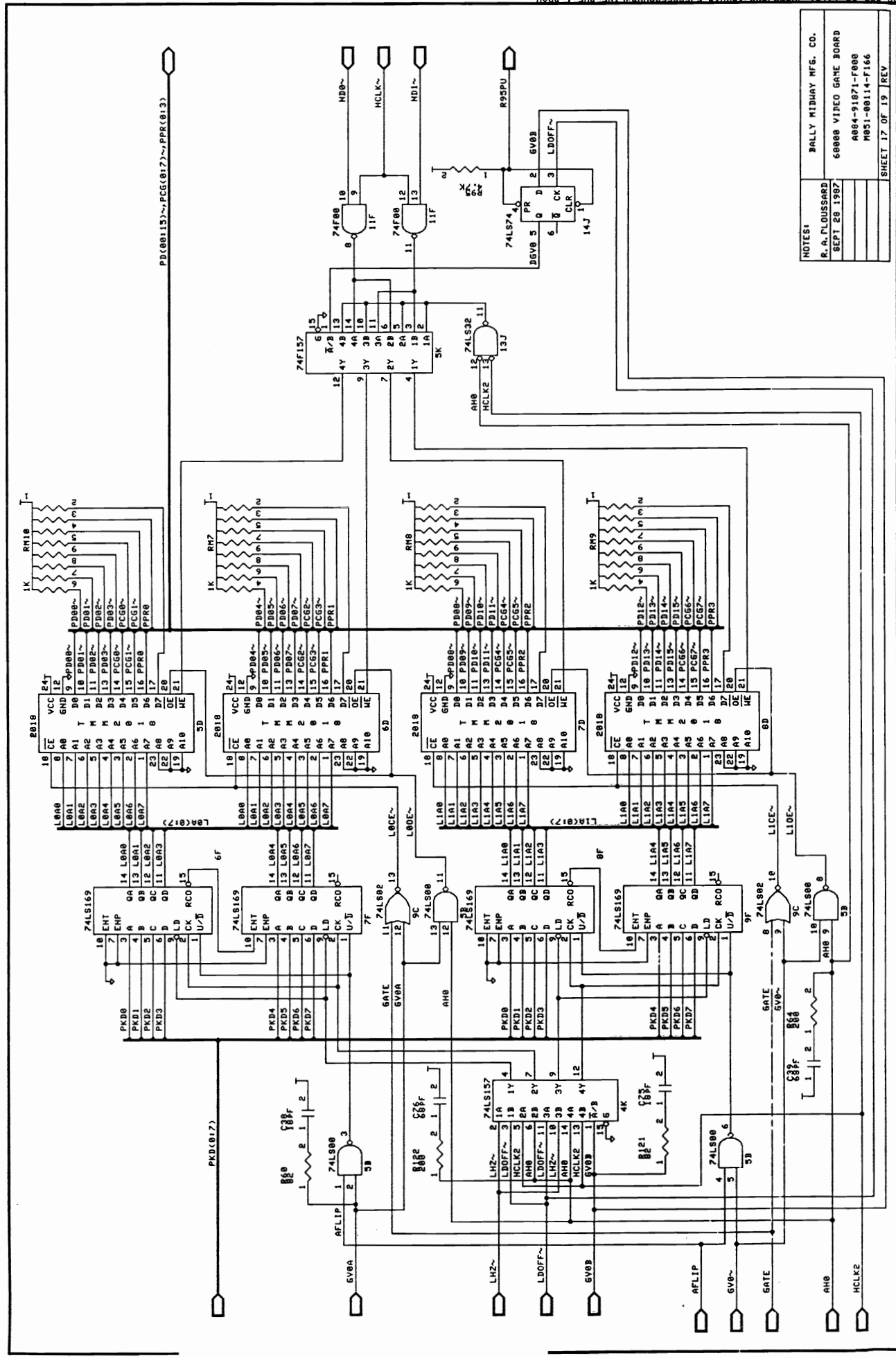
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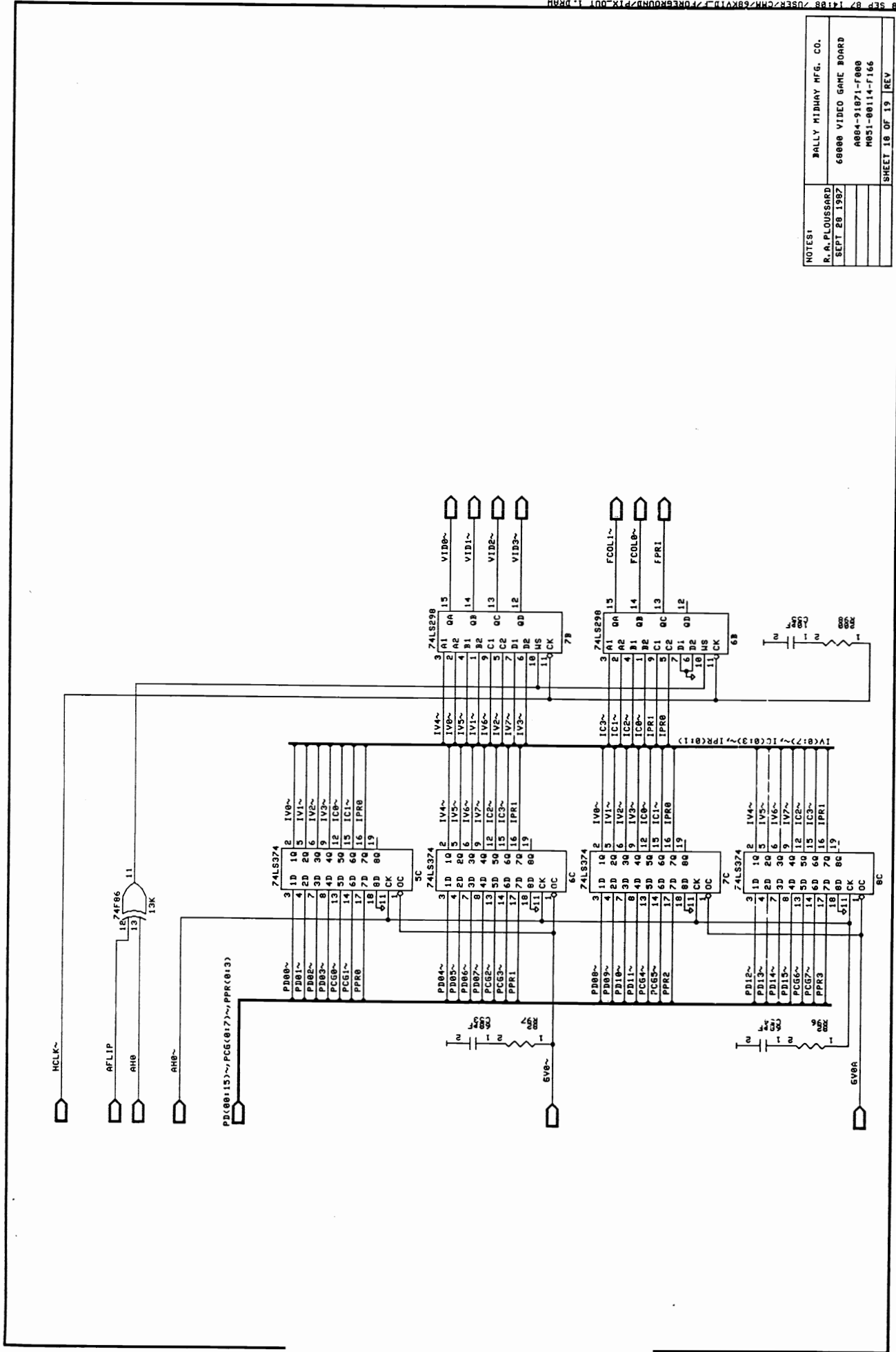
NOTES:
 R.A. PLOUSSARD
 SEPT 28 1987
 BALLY MIDWAY MFG. CO.
 68000 VIDEO GAME BOARD
 MOSI-00114-F156
 SHEET 15 OF 19 REV



NOTES:
 R.A. PLOUSSARD
 SEPT 28 1987
 BALLY MIDWAY MFG. CO.
 68000 VIDEO GAME BOARD
 MOSI-00114-F166
 SHEET 16 OF 19 REV



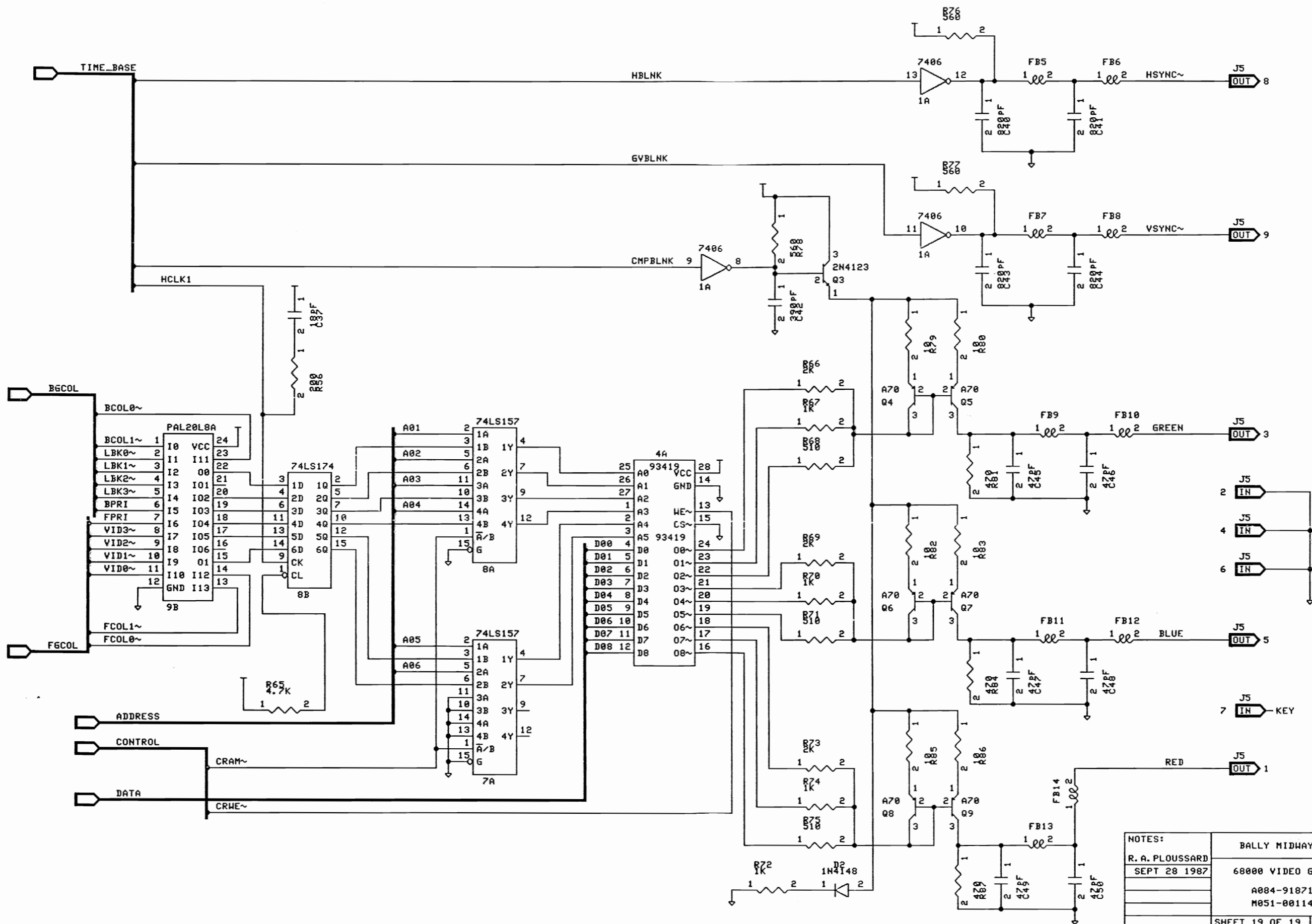
NOTES:
 R. A. FLOUSSARD
 SEPT 28 1987
 BALLY MIDWAY MFG. CO.
 68008 VIDEO GAME BOARD
 A084-91071-F080
 M051-00114-F166
 SHEET 17 OF 19 REV



NOTES:
 R. A. FLOUSSARD
 SEPT 28 1987
 BALLY MIDWAY MFG. CO.
 68008 VIDEO GAME BOARD
 A084-91071-F080
 M051-00114-F166
 SHEET 18 OF 19 REV

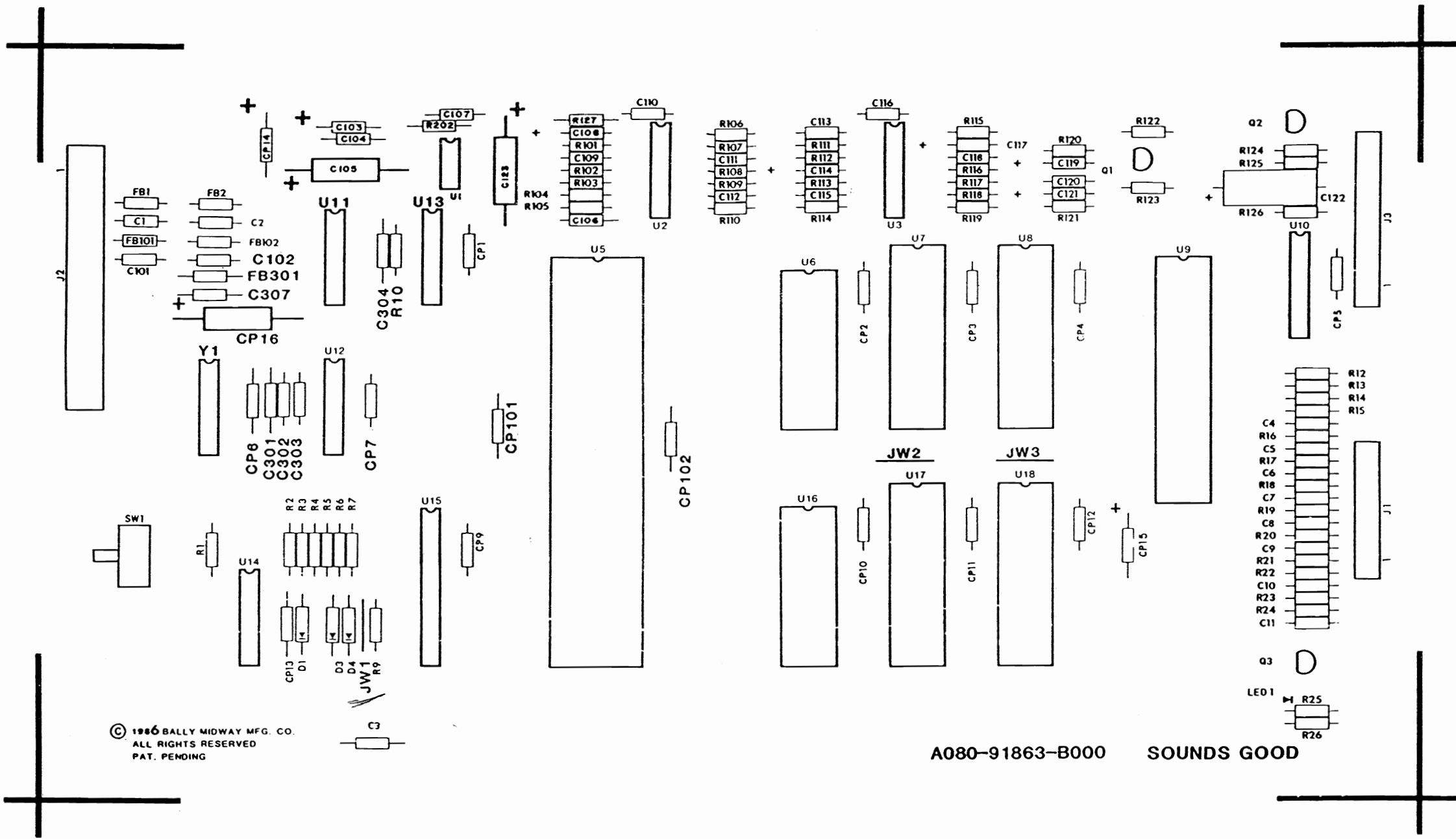
28 SEP 87 14:08 USER:CMH/68K/113/FOREGROUND/PLX-D01.L.DRAW

28 SEP 87 14:08 USER:CMH/68K/113/FOREGROUND/PLX-D01.L.DRAW



NOTES:	BALLY MIDWAY MFG. CO.
R. A. PLOUSSARD	68000 VIDEO GAME BOARD
SEPT 28 1987	A084-91871-F000
	M051-00114-F166
	SHEET 19 OF 19 REV

28 SEP 87 13:55 / USER/CMM/68KVID_F/COLOR_OUT 1.DRAW



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PAT. PENDING

A080-91863-B000 SOUNDS GOOD

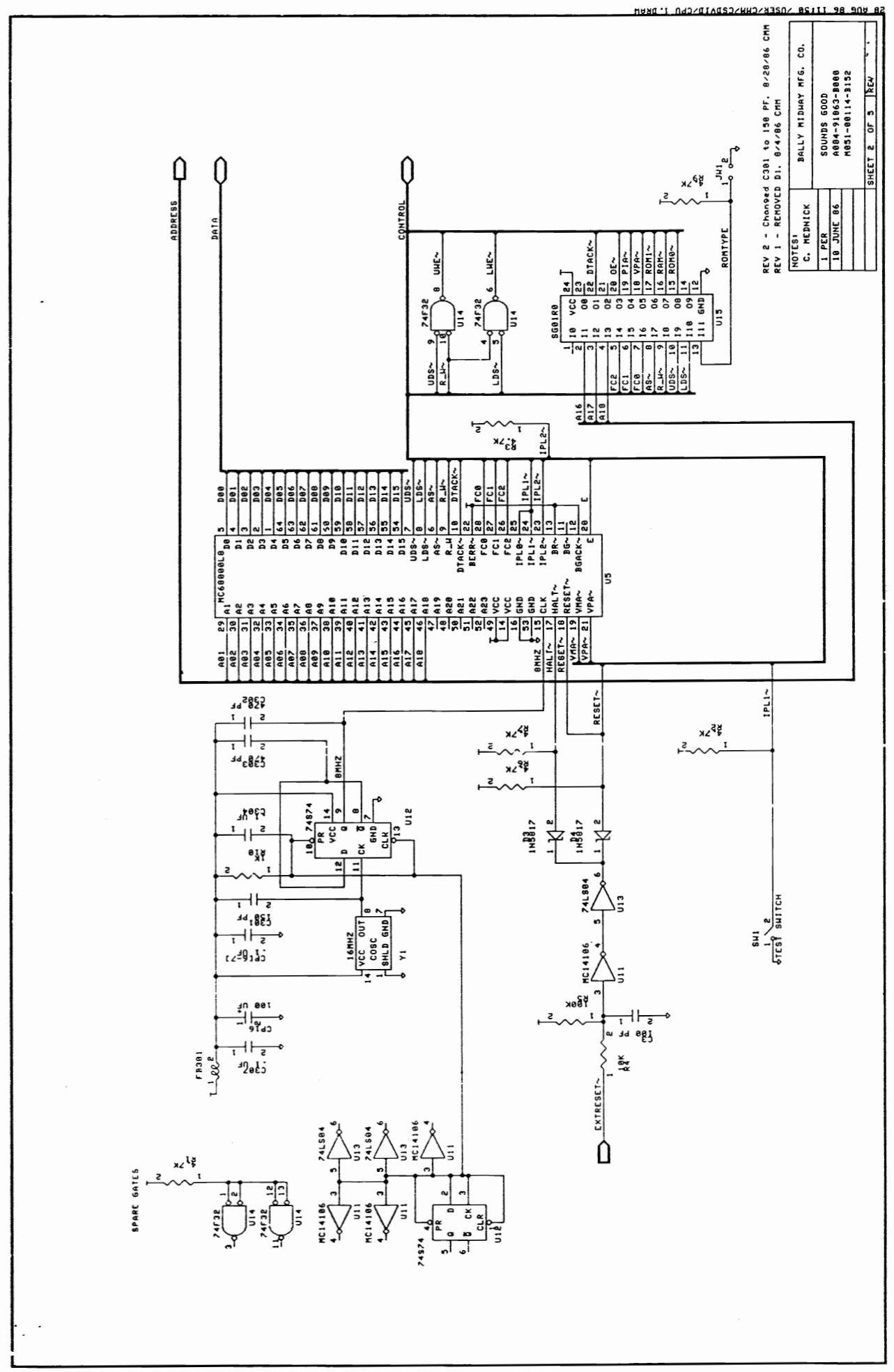
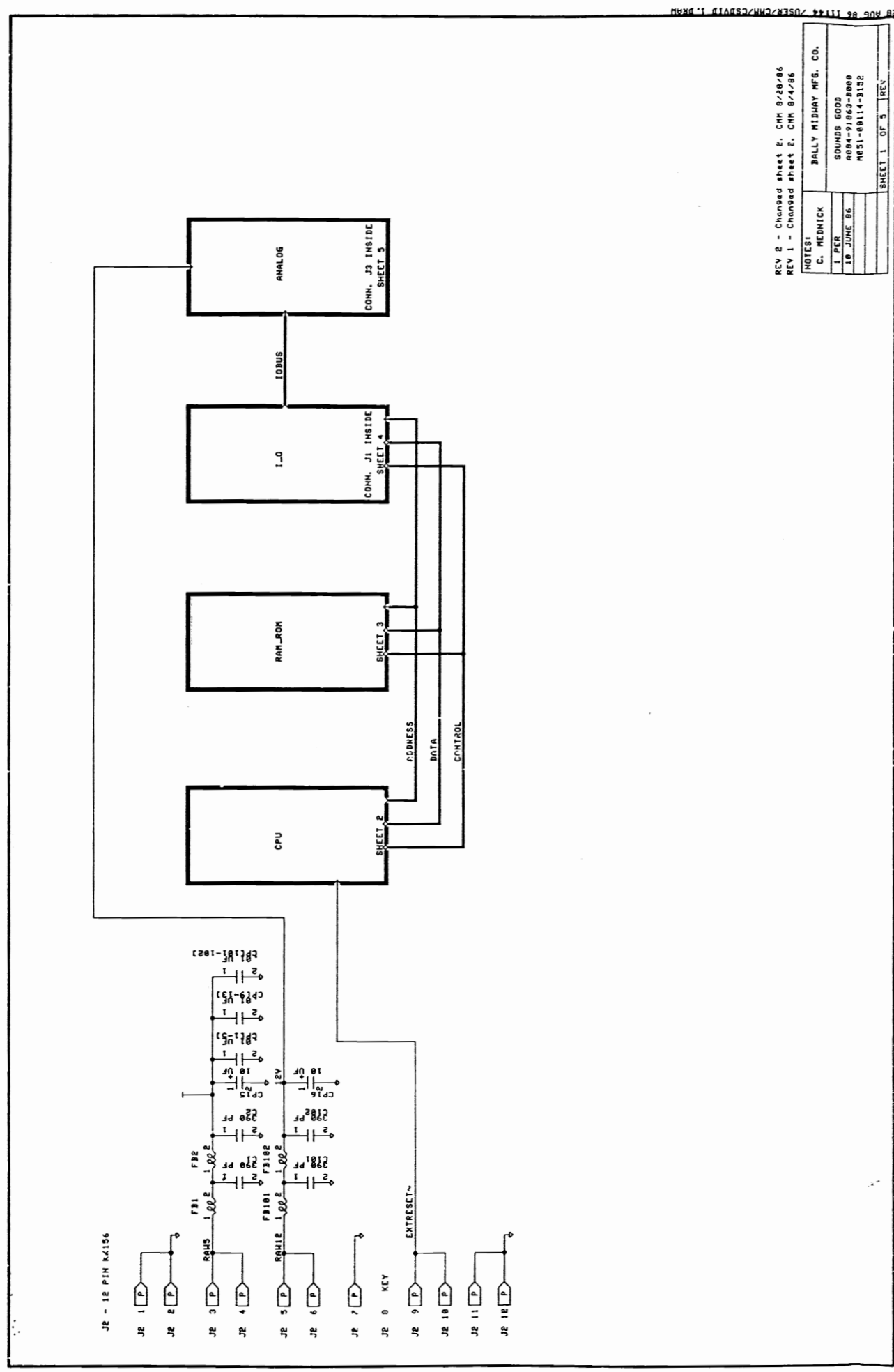
6/13/86	Rel. for Production	CMH
REVISIONS		

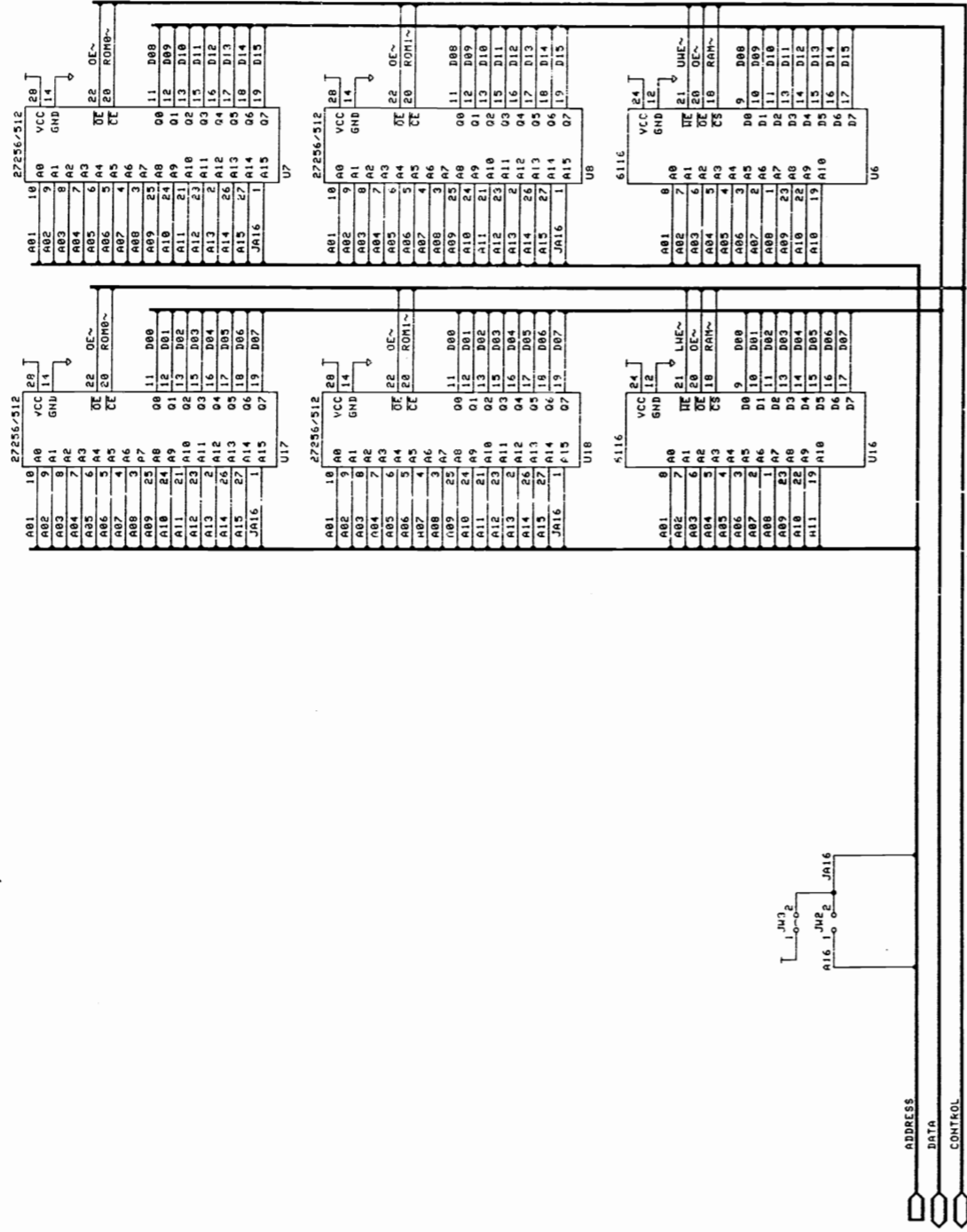
PROJECT ENG: C. MEDNICK		USED ON		Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG.		HEAT TREAT	NO. REQ'D	
DIM. TOLERANCES UNLESS SPECIFIED		SCALE FULL	ASSEMBLY DRAWING SOUNDS GOOD A084-91863-B000	
CONCENTRICITY F.L.R. .003	DRW. DBS	MAT'L.		
FRACTIONAL .002-1/64	CKD. CMM	FINISH		
DECIMAL .005	DATE 6 11 21 86		PART NO. M051-00114-B150	
HOLE DIA. +.002-.000				

SOUNDS GOOD
A084-91863-8000
M051-00114-B151

Rev. 3

DESCRIPTION	QTY.	DESIGNATION	PART NUMBER	DESCRIPTION	QTY.	DESIGNATION	PART NUMBER
68 PF AX CER 10%	1	C109	0307-00800-0011	74S74	1	U12	0304-00803-0061
100 PF AX CER	7	C3-C5,C8-C11	0304-00800-0001	14584/40106	1	U11	0304-00803-0056
150 PF AX CER 10%	2	C111,C301	0307-00800-0010	6821 PIA	1	U9	0304-00803-0054
270 PF AX CER 10%	2	C113,C118	0307-00800-0009	68000G8 CPU	1	U5	0304-00803-0051
390 PF AX CER	4	C1,C2,C101,C102	0986-00800-3000	AD7533JN DAC	1	U10	0304-00803-0055
470 PF AX CER 10%	3	C112,C302,C303	0307-00800-0008	SG01R0 PAL	1	U15	0E36-00803-0009
680 PF AX CER	1	C106	0358-00800-0002	LM359	2	U2,U3	0304-00803-0053
820 PF AX CER	2	C6,C7	0304-00800-0002	MC3340	1	U1	0358-00803-0002
5600 PF AX CER 10%	1	C115	0307-00800-0007	RAM 2KX8	2	U6,U16	0304-00803-0057
.01 MF AX CER	17	C104,C107,C110	0986-00800-2200	ROM/EPROM	1	U7	
		C116,C120,CP1-CP7, CP9-CP13		ROM/EPROM	1	U8	SEE ROM/EPROM CHART
		C304,C307,CP101,CP102	0986-00800-0200	ROM/EPROM	1	U17	
0.1 UF AX CER	4	C103,C108,C114,C117	0307-00800-0004	ROM/EPROM	1	U18	
1 MF RD TANT	4	CP14,CP15	0986-00800-0700	FERRITE BEAD	5	FB1,FB2,FB101,FB102, FB301	0316-00804-0002
10 MF AX TANT	2	C119,C121	0307-00800-0005	16 PIN IC SOCKET	1	ICS U10	110E-00001-0003
10 MF RD TANT	2	C105,C122	0307-00800-0003	24 PIN IC SOCKET .300	1	ICS U15	110E-00001-0009
47 MF AX ELECT	2	CP16,C123	0307-00800-0006	24 PIN IC SOCKET .600	2	ICS U6,U16	110E-00001-0007
100 MF AX ELECT	2	R17,R18,R25,R103, R202	100E-00005-0033	28 PIN IC SOCKET	4	ICS U7,U8,U17,U18	110E-00001-0010
100 OHM 1/4W CRBN	5	R125	100E-00005-0039	40 PIN IC SOCKET	1	ICS U9	110E-00001-0011
180 OHM 1/4W CRBN	1	R123,R124	100E-00005-0048	64 PIN IC SOCKET	1	ICS U5	110E-00001-0016
360 OHM 1/4W CRBN	2	R10,R121	100E-00005-0061	AUTO INSERT PIN TIN .025 SQ	8	J1	0304-00804-0009
1K OHM 1/4W CRBN	2	R122,R126	100E-00005-0071	AUTO INSERT PIN TIN .025 SQ	11	J3	0304-00804-0009
2.7K OHM 1/4W CRBN	2	R106	100E-00005-0074	AUTO INSERT PIN TIN .045 SQ	11	J2	0304-00804-0010
3.3K OHM 1/4W CRBN	1	R1-R3,R6-R7,R9	100E-00005-0079	ZERO OHM RES	3	JW1-JW3	117E-00001-0003
4.7K OHM 1/4W CRBN	9	R12-R14		GREEN LED	1	LED 1	119E-00001-0001
10K OHM 1/4W CRBN	7	R4,R15,R16,R19-R21, R23	100E-00005-0088	SWITCH PC MTG	1	SW1	0986-00804-3100
12K OHM 1/4W CRBN	1	R101	100E-00005-0090	16 MHZ XSTAL OSC	1	Y1	0304-00804-0008
18K OHM 1/4W CRBN	1	R117	100E-00005-0093	PC BOARD	1		A080-91671-G000
24K OHM 1/4W CRBN	2	R105,R107	100E-00005-0097				
33K OHM 1/4W CRBN	2	R113,R116	100E-00005-0100				
47K OHM 1/4W CRBN	2	R26,R120	100E-00005-0104				
82K OHM 1/4W CRBN	1	R109	100E-00005-0112				
100K OHM 1/4W CRBN	4	R5,R22,R24,R118	100E-00005-0115				
120K OHM 1/4W CRBN	2	R111,R112	100E-00005-0118				
150K OHM 1/4W CRBN	2	R108,R115	100E-00005-0120				
160K OHM 1/4W CRBN	1	R102	100E-00005-0121				
330K OHM 1/4W CRBN	2	R104,R114	100E-00005-0128				
510K OHM 1/4W CRBN	2	R110,R119	100E-00005-0133				
560K OHM 1/4W CRBN	1	R127	100E-00005-0134				
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74F32	1	U14	0304-00803-0059				

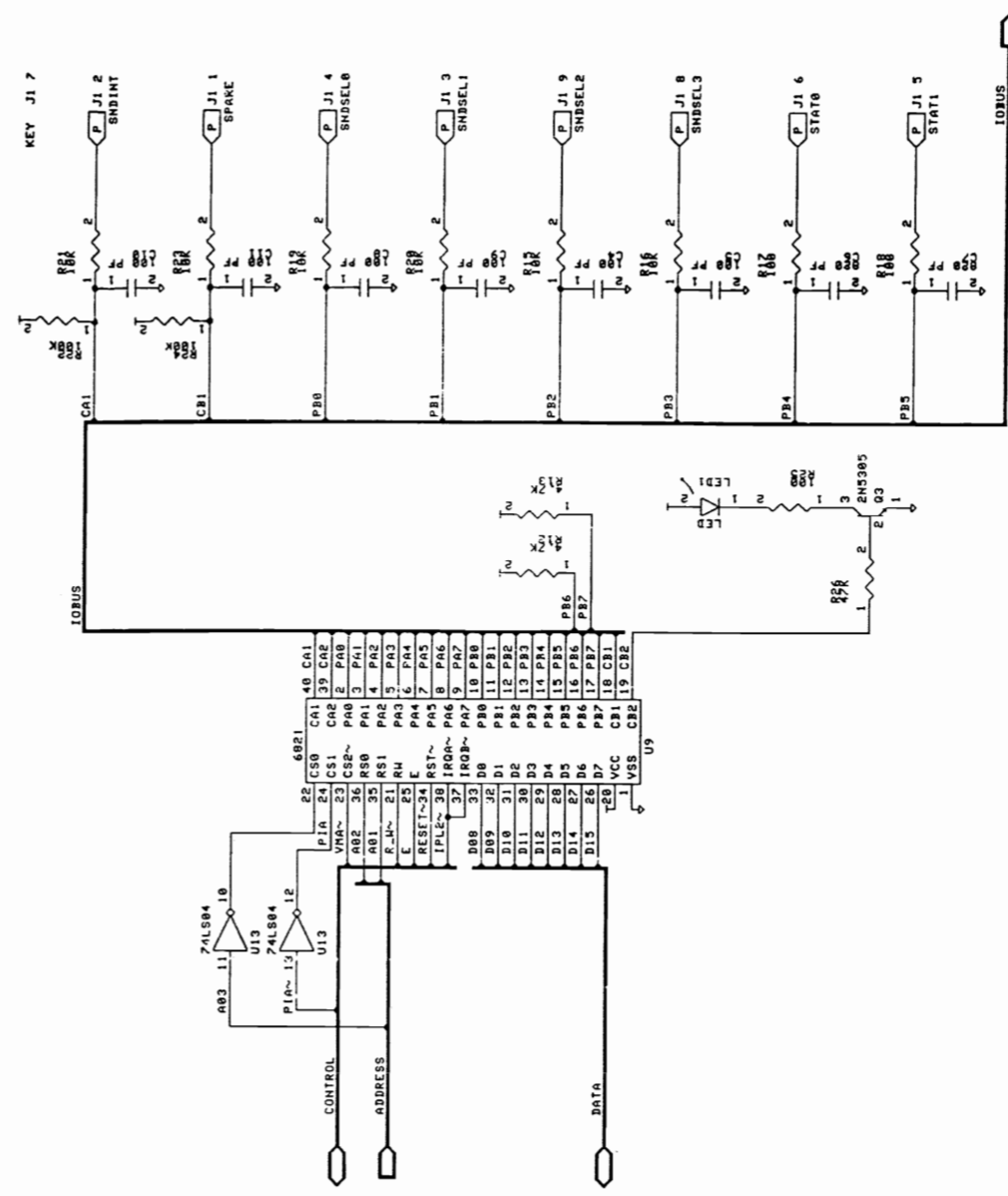




NOTES:
 C. MEDNICK
 1 PER
 18 JUNE 86

RALLY MIDWAY MFG. CO.
 SOUNDS GOOD
 A884-91863-8888
 M851-88114-8152

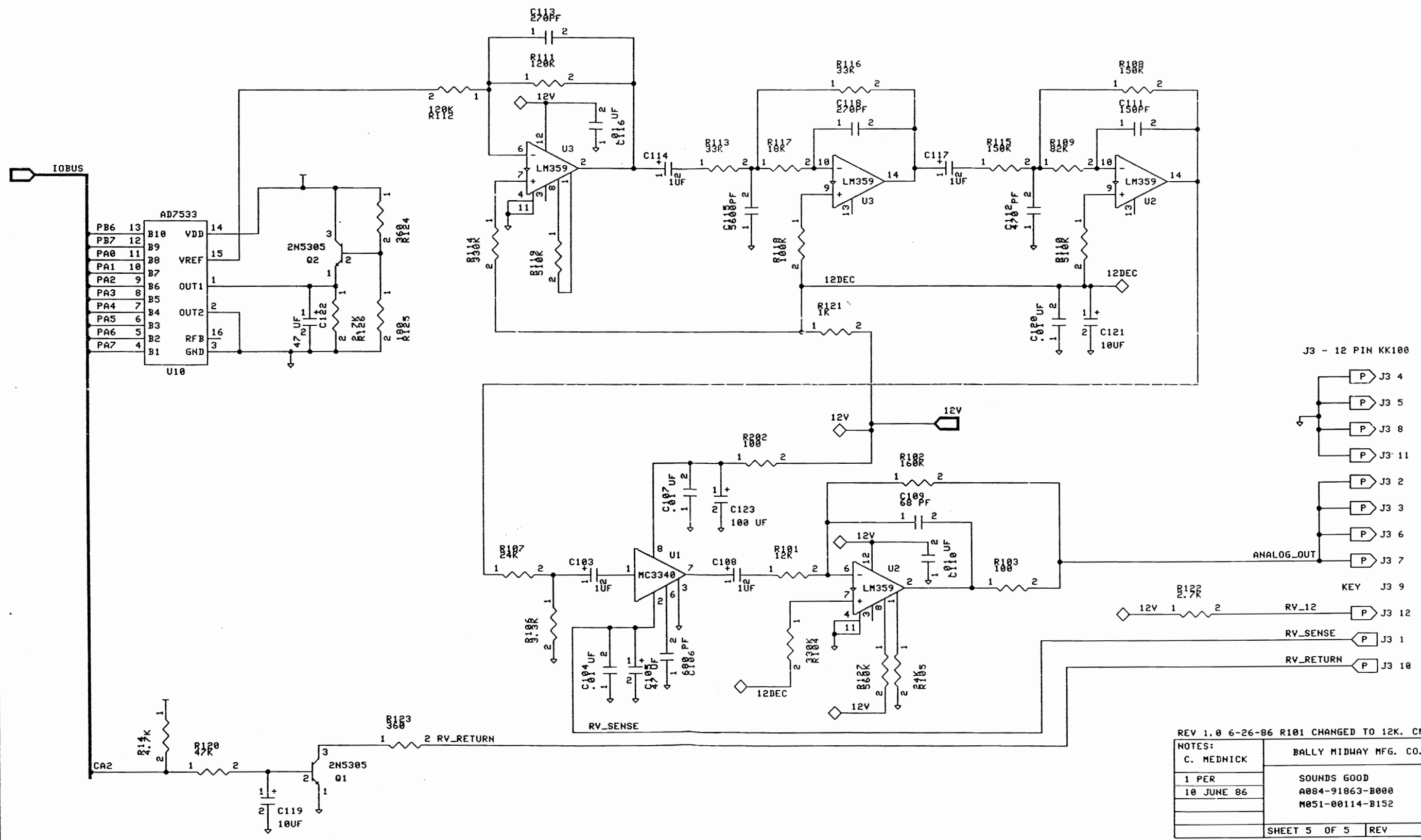
SHEET 3 OF 3 REV



NOTES:
 C. MEDNICK
 1 PER
 18 JUNE 86

RALLY MIDWAY MFG. CO.
 SOUNDS GOOD
 A884-91863-8888
 M851-88114-8152

SHEET 4 OF 3 REV



REV 1.0 6-26-86 R101 CHANGED TO 12K. CMM

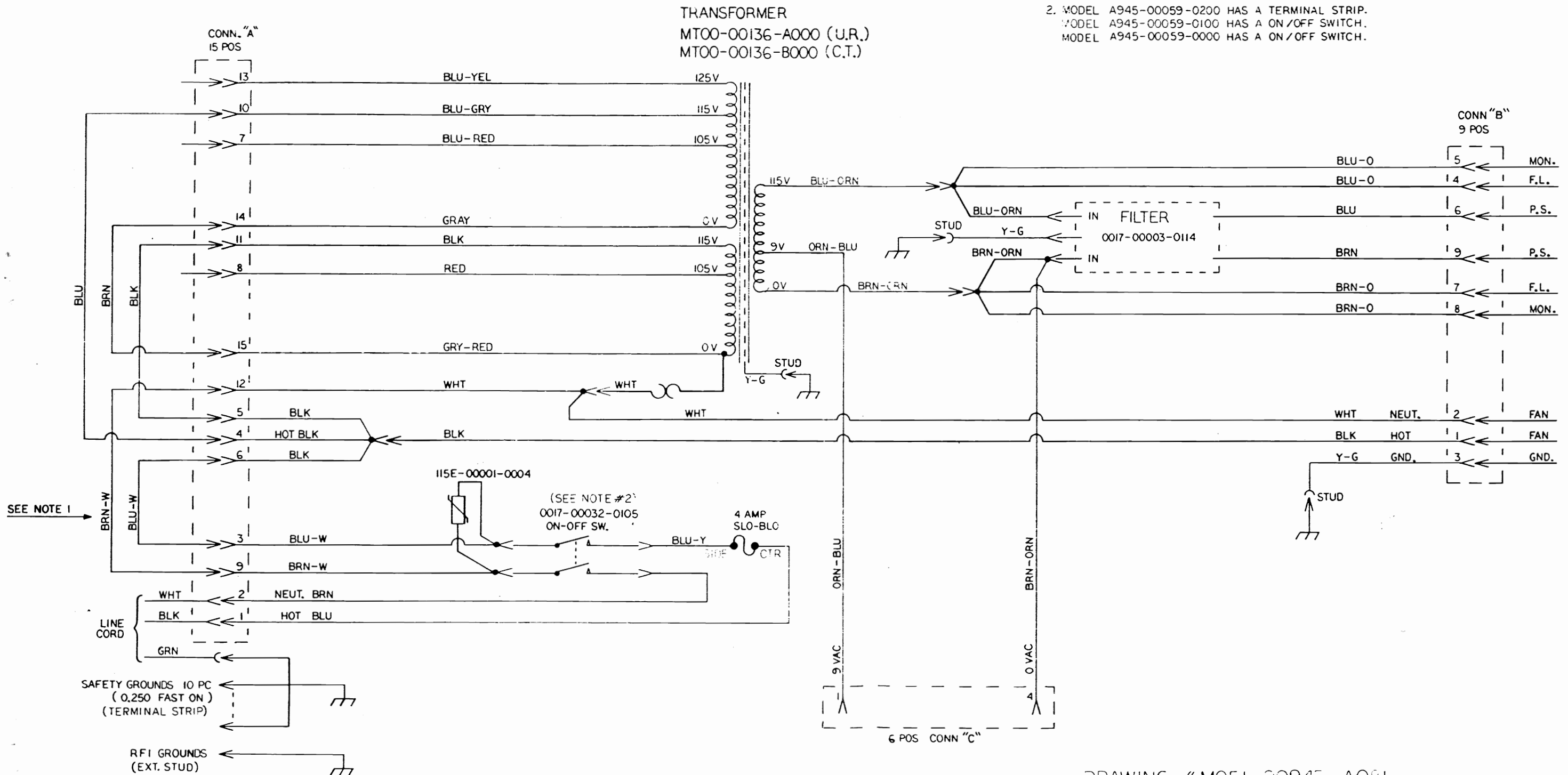
NOTES:	BALLY MIDWAY MFG. CO.
C. MEDNICK	SOUNDS GOOD
1 PER	A084-91863-B000
10 JUNE 86	M051-00114-B152
	SHEET 5 OF 5
	REV

26 JUN 86 1414 USER/CMM/CSDVD/ANALOG 1. DRAM

A945-00059-0000/0100/0200
 UNI PWR SUPPLY CHASSIS ASS'Y # 125 SWUR + 125 SWCT

	105	115	210	220	230	240
BLK	5-8	5-11	8-14	11-14	11-14	11-14
BRN	14-15	14-15	---	---	---	---
BLU	4-7	4-10	4-7	4-7	4-10	4-13

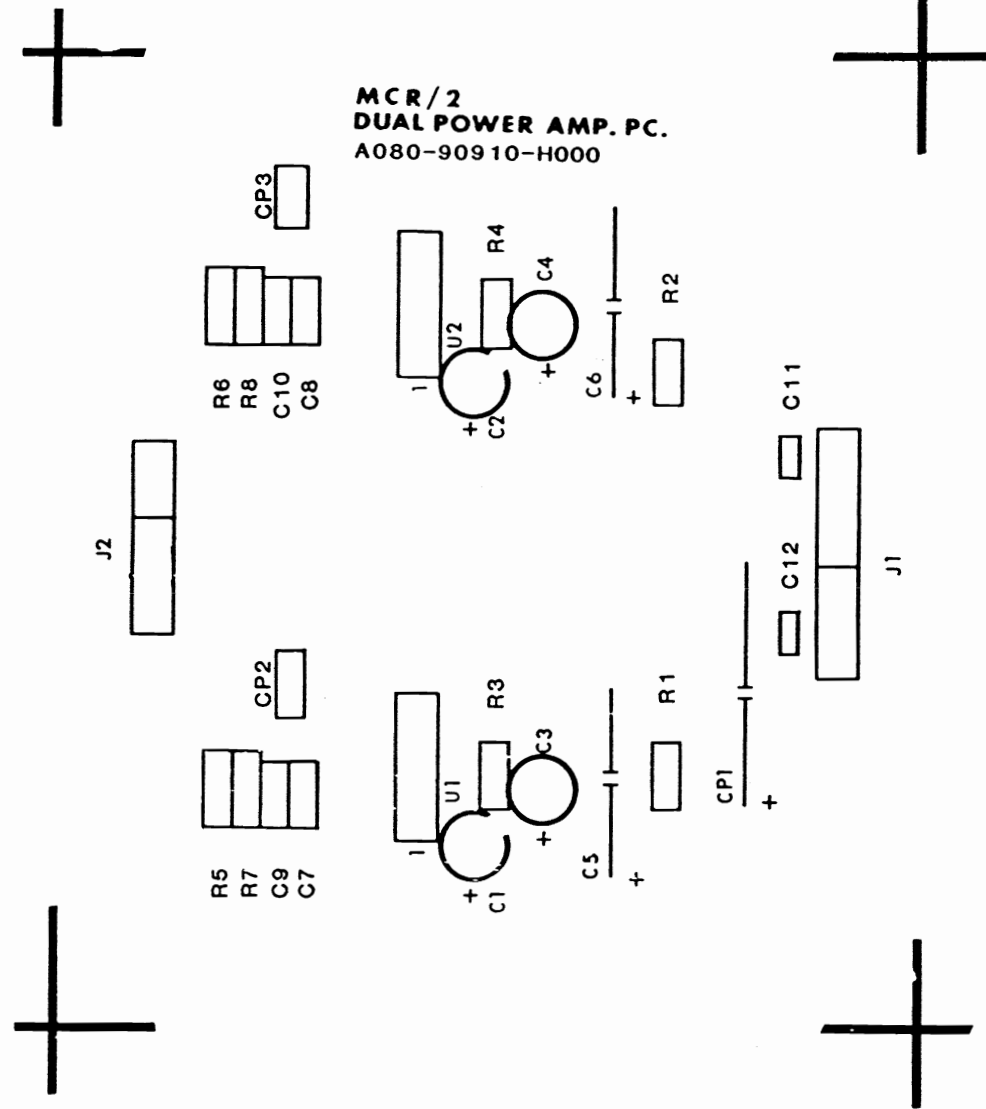
- NOTES: 1. JUMPERS ON CONN "A" 3-6 AND 9-12 CAN BE REPLACED WITH A SAFETY SW. AND/OR AUX. ON OFF SW.
 2. MODEL A945-00059-0200 HAS A TERMINAL STRIP.
 MODEL A945-00059-0100 HAS A ON/OFF SWITCH.
 MODEL A945-00059-0000 HAS A ON/OFF SWITCH.



DRAWING # M051-00945-A081
 REL FOR PRODUCTION: 4/26/85

DUAL POWER AMP
A084-90910-H000
M051-00986-H017 (PAGE 2 OF 2) REV. 3

MCR/2
DUAL POWER AMP. PC.
A080-90910-H000



CROSS REFERENCE LIST

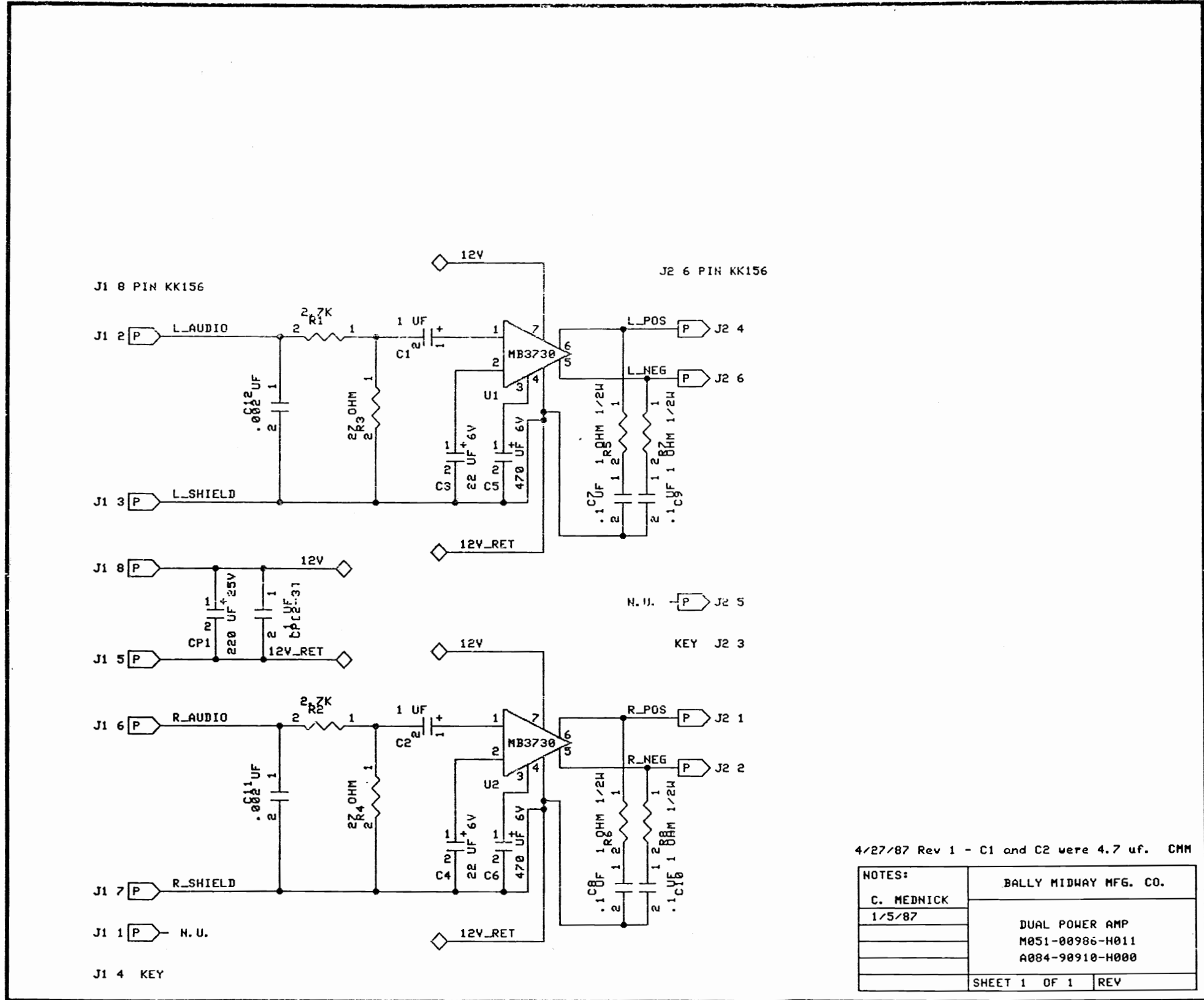
DESCRIPTION	QTY.	DESIGNATION NO.	PART NOS.
.002 MF RD CER.	2	C11,C12	0360-00800-0012
.1 MF 50V AX. CER.	6	C7-C10,CP2,CP3	0986-00800-1100
1 MF RD TANT	2	C1,C2	0B75-00800-0002
22 MF 6V RD TANT.	2	C3,C4	0986-00800-1600
220 MF 25V AX ELECT.	1	CP1	0986-00800-3200
470 MF 6V AX ELECT.	2	C5,C6	0986-00800-1700
1 OHM 1/2W 5%	4	R5-R8	100E-00006-0002
27 OHM 1/4W 5%	2	R3,R4	100E-00005-0018
2.7K 1/4W 5%	2	R1,R2	100E-00005-0071
* MB3730	2	U1,U2	0066-188XX-XX4X
TIN .045 SQ. PINS	12	J1,J2	0304-00804-0010
HEATSINK ASSY.	2	HSA1,HSA2	A986-00010-0000
PC BOARD	1		A080-90910-H000

* NOTE: THIS PART IS ACTUALLY PART OF THE HEATSINK ASSY.

RELEASED 5, JANUARY, 87. CMM
10 FEB. 87 - REV. 1 - C11 & C12 WERE AXIAL. CMM
27 APRIL 87 - REV. 2 - C1 & C2 WERE 4.7UF TANT. CMM
1 SEPT. 87 - REV. 3 - C1,C2 WERE PART #0B75-00803-0002

11/18/87	Released For Production	CMM
REVISIONS		

PROJECT ENG: C. MEDNICK		USED ON		Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.	
DO NOT SCALE DWG.		HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED		DRAWN DBS 11/18/86	ASSEMBLY DRAWING		PART NO.
CONCENTRICITY T.J.R. .003		DATE 1 / 1	DUAL POWER AMP		M051-00986-H010
FRACTIONAL .005			A084-90910-H000		
DECIMAL .005					
HOLE DIA. +.002-.000					



NOTES:	BALLY MIDWAY MFG. CO.
C. MEDNICK	
1/5/87	DUAL POWER AMP
	M051-00986-H011
	A004-90910-H000
	SHEET 1 OF 1
	REV

27 APR 87 09147 USER/CMM/RDDI/AMP 1. DRAM

**BALLY MIDWAY'S BLASTED (2 PLAYER)
UPRIGHT GAME #F09
ROM/EPROM LISTING**

UNPROGRAMMED 68000 VIDEO BOARD #A084-91871-E000 OR #A084-91871-F000
PROGRAMMED 68000 VIDEO BOARD #A084-91871-AF09

POS.	PART NUMBER	POS.	PART NUMBER
3C	F09B-12605-0000	9J	F09A-12611-0000
3B	F09B-12606-0000	10J	F09A-12612-0000
2C	F09B-12607-0000	11D	F09A-12613-0000
2B	F09B-12608-0000	12D	F09A-12614-0000
7J	F09A-12609-0000	14E	F09A-12801-0000
8J	F09A-12610-0000		

VIDEO BOARD JUMPER WIRE CONFIGURATION

		JUMPERS											
		JW1	JW2	JW3	JW4	JW5	JW6	JW7	JW8	JW9	JW10	JW11	JW12
IN				X		X		X	X	X		X	
OUT		X	X		X		X				X		X

UNPROGRAMMED SOUNDS GOOD BOARD #A084-91863-B000
PROGRAMMED SOUNDS GOOD BOARD #A084-91863-AF09

POS.	PART NUMBER
U17	F09A-12601-0000
U7	F09A-12602-0000
U18	F09A-12603-0000
U8	F09A-12604-0000

SOUNDS GOOD BOARD JUMPER WIRE CONFIGURATION

		JUMPERS		
		JW1	JW2	JW3
IN		X	X	
OUT				X

RELEASED FOR PRODUCTION BY: ENGINEERING INITIAL: *Y.S.* DATE: 4-28-88
RELEASED TO EDC BY: TECHNICAL INFORMATION INITIAL: *[Signature]* DATE: 4/28/88

GLOSSARY OF UNIQUE TERMS AND ABBREVIATIONS

The following list of unique terms and abbreviations are used in the XENOPHOBE Parts & Operating Manual. Service Technicians and Operators should note that more than one description may apply to a particular term or abbreviation. Also, more than one term or abbreviation may apply to a particular description. Either way, the Technician or Operator need only be concerned with correctly matching the term or abbreviation with the corresponding description.

TERM/ABBREVIATION	DESCRIPTION
A, AD, ADDR	Address
AX	Axial
BD, BRD	Board
C	Capacitor, Common
CER	Ceramic
COM	Common
CONN	Connector
CPURST	CPU Reset
CR	Diode
CRBN	Carbon
D	Data, Diode
DAC	Digital-Analog Convertor
F	Fuse
FB	Ferrite Bead
HS	Heatsink
J	Connector, Plug
JW	Jumper Wire
MTG	Mounting
MTR	Meter
N.C.	Normally Closed
N.O.	Normally Open
PB	Push Button
PLY, PLYR	Player
PWR	Power
Q	Transistor, Silicon Controlled Rectifier (SCR), Darlington
R, RES, RM	Resistor
RTN	Return
SHLD	Shield
SND	Sound
SW	Switch
T	Transformer
W/MXR	With/Mixer
XSTR	Transistor
XTAL, Y	Crystal

SECTION 4 - APPENDIX

The following information consists of excerpts from the WELLS GARDNER SERVICE MANUAL for K7000 Monitors.

This information is reprinted with the permission of Wells Gardner Electronics Company.

MONITOR THEORY OF OPERATION

VIDEO INTERFACE AND OUTPUT

The red, green, and blue video inputs come into the monitor at P1. Isolation and attenuation is provided by emitter followers Q1, Q2 and Q3. Forced blanking of the video signals is provided by the circuit of Q4, D5, D6, and D7. The forced blanking causes there to be an interruption in the video signal before it goes to the inputs of IC1. This interruption occurs between scan periods, while retrace is taking place; it is required by IC1. The forced blanking is not necessary for most video signals since they already have an interruption of video (blanking) between scan periods. Some do not; it is to accommodate such signals that the forced blanking circuit is included.

The red, green, and blue signals go into IC1 at pins 2, 4, and 6. Their levels are controlled by the gain of separate channels of the contrast amplifier. The gain is controlled by a DC voltage input to pin 11, which varies with the setting of the contrast control.

IC1 provides blanking of the video during retrace in response to blanking pulses at pin 13, derived from the horizontal and vertical sweep circuits. IC1 also requires a gating signal at pin 12 in order to provide red, green, and blue outputs at pins 21, 19, and 17. If the gating signal is not present, IC1 will not provide video output signals. The gating signal comes from IC2, pin 12 and is derived from horizontal sync.

The brightness is varied by varying the DC level of the outputs at pins 17, 19, and 21. This is accomplished by varying the DC voltage input to pin 14.

The video outputs from IC1 are provided via R30, R31, and R32 to the neck board where they are amplified by the video output stages Q201, Q202, and Q203 before being applied to the cathodes of the CRT through R10, R11, and R12.

SYNC

Sync is applied at P1 (positive sync) or at P2 (negative sync). Composite sync should be applied only to the horizontal sync input of the appropriate polarity. Positive sync is inverted by Q5 and Q6 then applied through D3, D4 and R51 to the sync amplifier Q7.

The sync amplifier output is applied through C22, R53, and R55 to pin 14 of IC2. Pin 14 is the sync separation input.

The sync separator extracts the horizontal and vertical sync from each other—providing horizontal sync to the horizontal AFC circuit in the IC. A composite sync output is provided at pin 12. This output signal is used for gating IC1 the video interface IC and for triggering the vertical oscillator.

HORIZONTAL OSCILLATOR AND OUTPUT

The horizontal AFC circuit of IC2 receives a horizontal sync input from the sync separator and a feedback signal at pin 1, derived from the horizontal output. Slight differences in frequency and phase of the two signals will cause the AFC to generate a correction voltage at pin 2.

The horizontal oscillator in IC2 has its free running frequency determined by the RC time constant of C19, R56, R57, R58, and VR2, the horizontal hold control. The horizontal hold control varies the horizontal frequency by varying the RC time constant. Slight correction in frequency is provided by a correction voltage at IC2, pin 3 which comes from pin 2 through R60.

The oscillator output at pin 4 is amplified and shaped by the horizontal drive stage Q10. The drive signal is then coupled to the base circuit of the horizontal output transistor Q11 by the horizontal drive transformer T2. T2 is used for impedance transformation to provide the Q11 base circuit with the low impedance source that it requires.

The horizontal output transistor Q11 is operated as a switch. It is either on or off. It is turned on and off at the scan rate which is determined by the horizontal oscillator frequency which is ultimately determined by the incoming horizontal sync frequency. A yoke current with a sawtooth waveform is needed to deflect the beam linearly across the CRT. The beam begins at the center of the CRT and is deflected from center to right. This center-to-right deflection occurs when Q11 is turned on. The deflection yoke coupling capacitor C38, also known as the S-shaping capacitor, begins to discharge through the yoke; the discharge current causes the beam to be deflected to the right CRT edge. At this time, Q11 is turned off, and the current provided by C38 stops. As the current falls to zero, a voltage is induced across the yoke windings as the magnetic field collapses; an oscillation is produced by the yoke windings and C36, the retrace tuning capacitor. During the first half cycle of oscillation, the induced voltage is impressed on the collector of Q11, C36, and the primary of the flyback transformer T1. This induced voltage is stepped up by the flyback transformer's secondary winding. This high voltage is then rectified and applied to the high voltage anode of the CRT. When this induced voltage occurs, the electron beam is deflected from the right edge of the CRT face to the left edge. This is called retrace. During the second half cycle of the oscillation (of C36 and the yoke windings), the voltage at the Q11 collector tries to go negative or below ground. When this happens, the damper diode (include in same package with Q11) becomes forward biased. The conduction of the damper diode allows energy stored in the horizontal system to decay linearly to zero, thus allowing the beam to return to the center of the CRT face.

The focus voltage and the screen, G2, voltage are obtained from the anode voltage with a resistor divider network within the T1 assembly. An auxiliary winding (pin 10) provides feedback to the horizontal AFC through R71, R70, and C29. This signal is also used to furnish the horizontal blanking input to IC1 via C28, R69, and R68. The signal from the auxiliary winding at pin 5 of T1 is rectified by D14 and filtered to provide the +12VDC supply for the video interface and sync circuits. The auxiliary winding of pins 3 and 4 produces a signal which is rectified by D13 and filtered to produce the +24VDC supply for the vertical output circuit.

The horizontal linearity coil L2 is a magnetically biased coil which shapes the yoke current for optimum linearity. The horizontal size coil L1 is a variable series inductor which is used to vary the horizontal size of the display.

HIGH VOLTAGE HOLD-DOWN CIRCUIT

The high voltage hold down circuit is part of the main PC board P447 of this monitor. The +12V DC supply is sensed via D10. Since the +12V DC supply is flyback pulse derived, the +12V DC supply will rise as the high voltage rises. If the +12V DC exceeds a threshold which is set with VR8, then D12 will conduct, thereby providing drive to IC2, pin 5—hold-down input of deflection oscillator IC. The drive being applied to pin 5 causes the horizontal oscillator within the IC to shut down—thus preventing the generation of high voltage.

The horizontal oscillator will remain in its OFF state, even if the input to IC2, pin 5 is removed, unless and until AC power is removed from the monitor input. The power may then be reapplied.

VERTICAL OSCILLATOR AND OUTPUT

The composite sync output of IC2, pin 12 is filtered through the network of R65, C25, C24 and R66 so that only vertical sync is applied to the vertical trigger input at pin 11. The vertical oscillator frequency is controlled by the vertical hold control and its input to pin 10.

The vertical drive output at IC2, pin 7 is applied to pin 4 of IC3, the vertical output IC. Output current from IC3, pin 2 flows through the yoke to cause vertical deflection. During upward deflection, current flows out of pin 2, through the yoke, and into C50 to charge it. Downward deflection is caused by C50 discharging through the yoke in the opposite direction and back into IC3, pin 2. AC feedback is provided through the wiper of the vertical size control VR4 to IC2, pin 8 in order to control the drive amplitude. DC feedback at IC2, pin 9 maintains good vertical linearity at all sizes.

DC current from the +24V supply flows through R83 and through the yoke to provide downward raster shift. Some of this DC current is diverted from the yoke through the collector of Q9. The amount of this current which is diverted from the yoke can be varied by varying the base drive to Q9 by adjusting VR3, the vertical position control, thus providing manual adjustment of the vertical position of the display. The drive signal at IC3, pin 2 is also used to furnish the vertical blanking input to IC1, pin 13 via R63 and C14.

AUTOMATIC DEGAUSSING ADG

The ADG circuit automatically demagnetizes the CRT. This circuit is activated only when the monitor is initially powered up after having been off for at least 20 minutes.

R105 is a positive temperature coefficient device. When it is cold, it has a very low resistance. As it gets warm, its resistance increases. If the monitor is cold when AC power is applied, then R105 with a low resistance allows current to pass through it, D23, D24, and the degaussing coil. As current flows through R105, it heats up and eventually has a very high resistance, allowing very little current to flow through it. The residual current now flowing through R105 produces a voltage drop across R104 of less than 0.6 volts. This is not enough to forward bias D23 and D24, so there is no current through the degaussing coil.

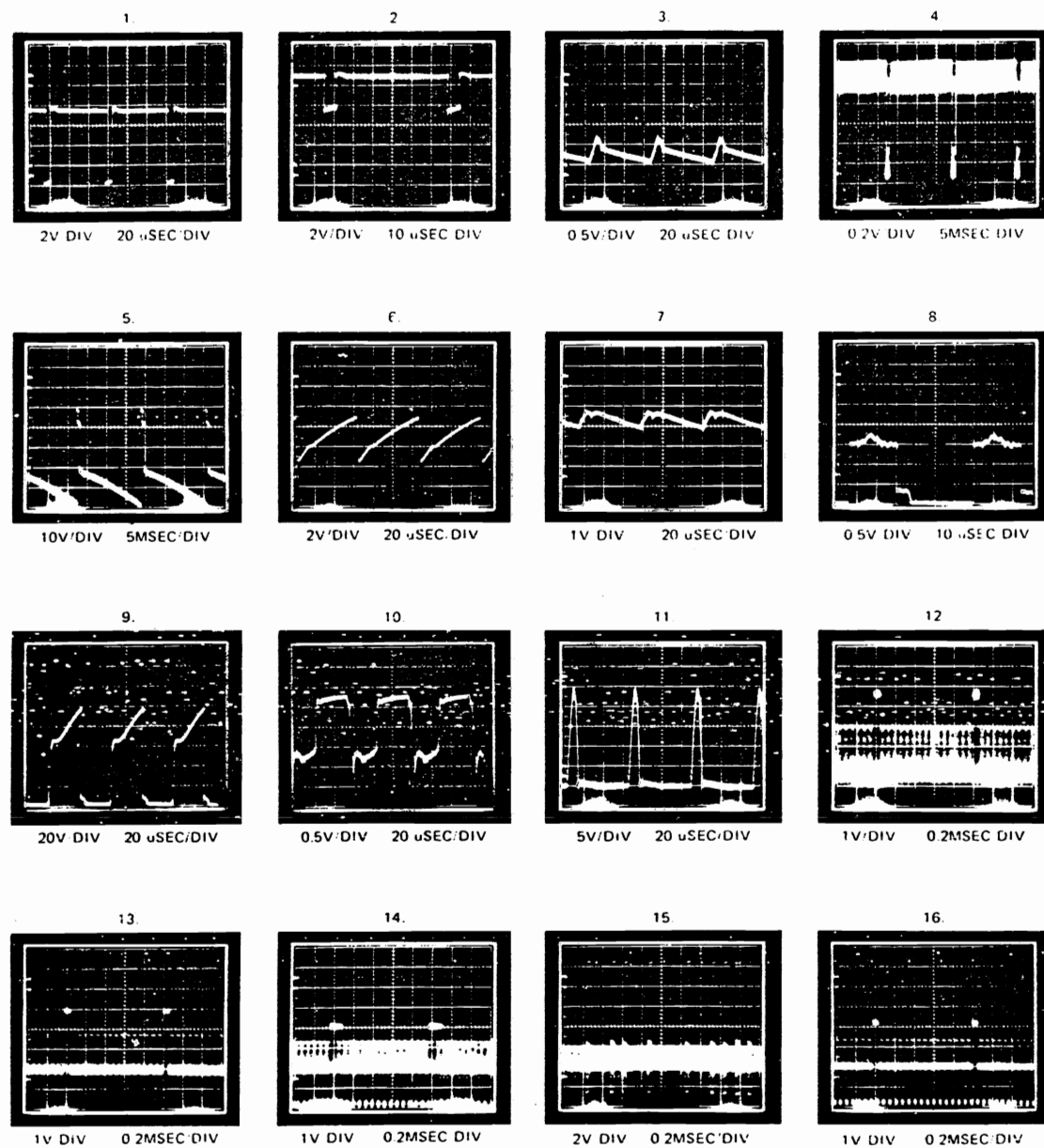
The process of initially having a large current through the degaussing coil and then having the current decay to zero is what produces the degaussing action. The degaussing current decays to zero before the CRT warms up, so the degaussing is completed before the picture comes on.

TYPICAL OSCILLOSCOPE WAVEFORM PATTERNS

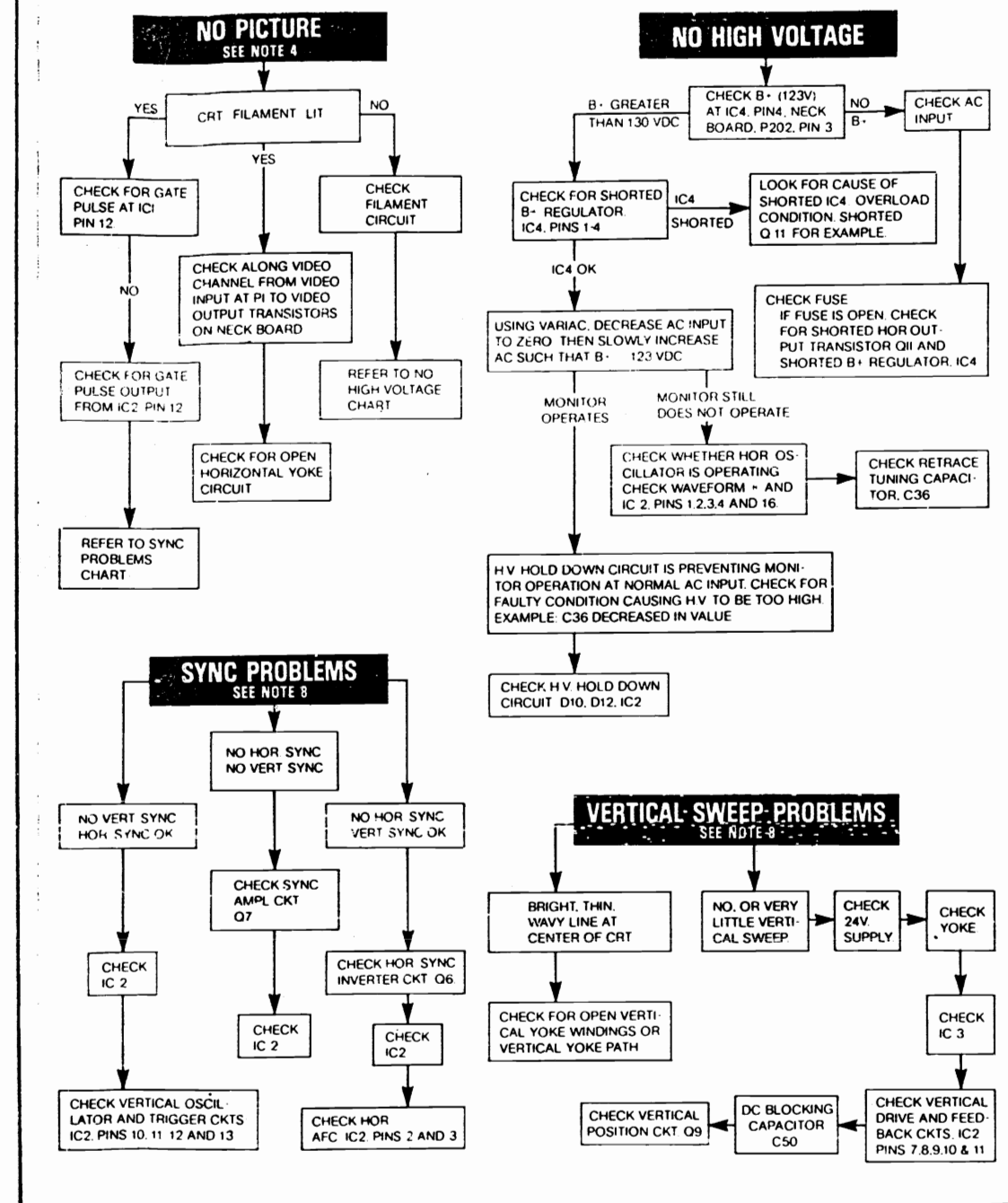
The waveforms shown below were observed on a wide band oscilloscope. The input signal was from a crosshatch generator with a horizontal sync frequency of 15.73kHz and a vertical frequency of 60 Hz. If the waveforms are observed on an oscilloscope with a limited high frequency response, the corners of the pulses will tend to be more rounded than those shown, and the amplitude of any high frequency pulse will tend to be less.

Each photograph is numbered. These numbers correspond to the circled numbers on the schematic diagrams.

Photographs 12, 13, 14, 15 and 16 are of the red signal at various points along the red video channel. The waveforms at corresponding points along the green and blue video channels will look similar.



MONITOR TROUBLESHOOTING CHART



TROUBLESHOOTING NOTES

- The troubleshooting chart mentions specific components to be checked. It is intended that the entire circuit associated with these components be checked.
- This chart is a guide to servicing rather than a complete list of each component that could fail. Therefore, troubleshooting should not be limited only to those components mentioned in the chart.
- It is always useful to begin checking a circuit by measuring the DC voltages and then comparing the measurements to those listed in the Typical DC Voltages chart.
- The cutoff controls and drive controls on the neck board and the screen control at the bottom of the flyback transformer have been preset at the factory. When servicing the monitor for a lack of video, do not adjust any of these controls unless it is suspected that the problem is a result of these controls having been tampered with. Otherwise do not adjust these controls; if they are so severely out of adjustment that there is a lack of video, then there is something malfunctioning.
- The Wells-Gardner Service Department does accept telephone calls for servicing assistance. Call 1-312-252-8220, between 7:00am and 3:30pm Central Time. Ask for the Service Department. The Service Department is closed during the first two weeks of July. Telephone assistance is not available during this period. Before calling, be sure to have available the model number of the monitor being serviced and the schematic diagram of the monitor being serviced.

6. Replacement parts may be ordered from the Service Department between 7:00am and 4:30pm Central Time.

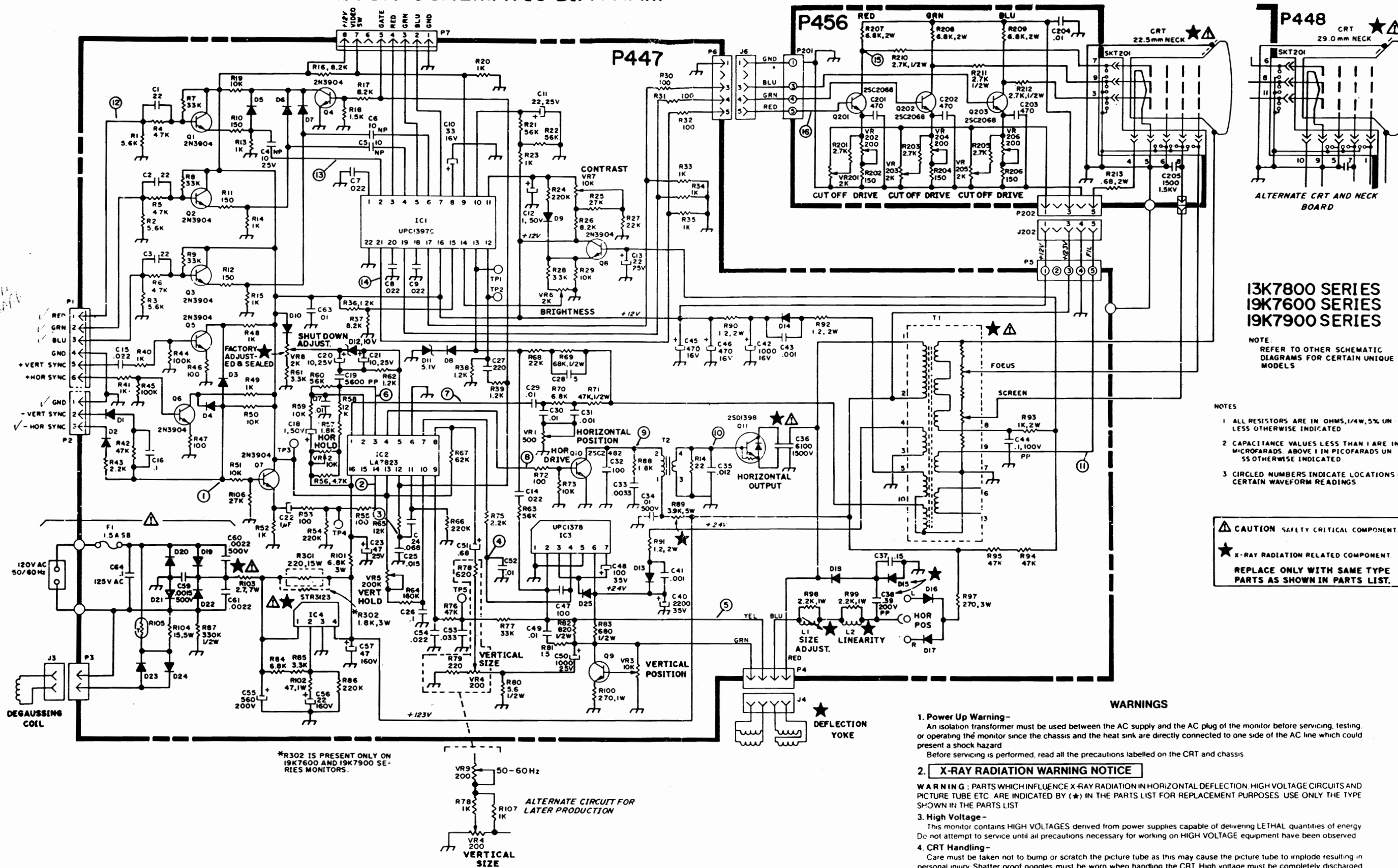
7. All monitors are equipped with automatic degaussing coils which demagnetize the picture tube every time the monitor is turned on after being off for a minimum of 20 minutes. Should any part of the chassis become magnetized it will be necessary to degauss the affected area with a manual degaussing coil. Move the coil slowly around the CRT face area and all surrounding metal parts. Then slowly withdraw for a distance of 6 feet before turning off.

8. Horizontal vs. Vertical:

Some models have the picture tube mounted vertically rather than horizontally. That is, the picture tube is mounted in the frame such that the long dimension of the tube is up and down. Examples of this include (but are not limited to) Models 13K7851 and 19K7951. Other than the physical orientation of the picture tube, there is no electrical difference between these models and their horizontal counterparts. The same circuits, the vertical circuits, produce and control deflection along the short dimension of the tube in all models.

The same circuits, the horizontal circuits, produce and control deflection along the long dimension of the tube in all models. Therefore, wherever "vertical" appears in this manual or on the monitor, it refers to the short dimension of the picture tube, wherever "horizontal" appears, it refers to the

K7000 COLOR MONITOR SCHEMATIC DIAGRAM



**13K7800 SERIES
19K7600 SERIES
19K7900 SERIES**

NOTE:
REFER TO OTHER SCHEMATIC
DIAGRAMS FOR CERTAIN UNIQUE
MODELS

- NOTES
- 1 ALL RESISTORS ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE INDICATED
 - 2 CAPACITANCE VALUES LESS THAN 1 ARE IN MICROFARADS ABOVE 1 IN PICOFARADS UNLESS OTHERWISE INDICATED
 - 3 CIRCLED NUMBERS INDICATE LOCATIONS OF CERTAIN WAVEFORM READINGS

⚠ CAUTION SAFETY CRITICAL COMPONENT
★ X-RAY RADIATION RELATED COMPONENT
REPLACE ONLY WITH SAME TYPE PARTS AS SHOWN IN PARTS LIST.

WARNINGS

- 1. Power Up Warning-**
An isolation transformer must be used between the AC supply and the AC plug of the monitor before servicing, testing, or operating the monitor since the chassis and the heat sink are directly connected to one side of the AC line which could present a shock hazard.
Before servicing is performed, read all the precautions labelled on the CRT and chassis
- 2. X-RAY RADIATION WARNING NOTICE**
WARNING: PARTS WHICH INFLUENCE X-RAY RADIATION IN HORIZONTAL DEFLECTION HIGH VOLTAGE CIRCUITS AND PICTURE TUBE ETC. ARE INDICATED BY (★) IN THE PARTS LIST FOR REPLACEMENT PURPOSES. USE ONLY THE TYPE SHOWN IN THE PARTS LIST
- 3. High Voltage-**
This monitor contains HIGH VOLTAGES derived from power supplies capable of delivering LETHAL quantities of energy. Do not attempt to service until all precautions necessary for working on HIGH VOLTAGE equipment have been observed
- 4. CRT Handling-**
Care must be taken not to bump or scratch the picture tube as this may cause the picture tube to implode resulting in personal injury. Shatter proof goggles must be worn when handling the CRT. High voltage must be completely discharged before handling. Do not handle the CRT by the neck
- 5. PRODUCT SAFETY NOTICE**
WARNING: FOR CONTINUED SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER RECOMMENDED PARTS. THESE PARTS ARE IDENTIFIED BY SHADING AND BY (Δ) ON THE SCHEMATIC DIAGRAM
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT
For replacement purposes, use the same type or specified type of wire and cable, assuring the positioning of the wires is followed (especially for HV and power supply circuits). Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

*R302 IS PRESENT ONLY ON 19K7600 AND 19K7900 SERIES MONITORS.

ALTERNATE CIRCUIT FOR LATER PRODUCTION

VERTICAL SIZE

