

# STAR GUARDS U.R. TO RAMPAGE U.R.

## Field Conversion Kit Instructions

*Bally*

MIDWAY MFG. CO.

10601 W Belmont Avenue  
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U.S.A.



Phone (312) 451-9200 Cable Address MIDCO Telex No. 72-1596

**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 not 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.

**Bally/MIDWAY**  
T.M.

*Invites You To Use*

**OUR TOLL FREE NUMBER FOR  
SERVICE INFORMATION CONCERNING THIS GAME, OR ANY  
OTHER BALLY/MIDWAY™ GAME YOU NOW HAVE ON LOCATION.**

**CALL US FOR PROMPT, COURTEOUS  
ANSWERS TO YOUR PROBLEMS.**

**Video or Pinball - Continental U.S. 800-323-7182**

**Bally/MIDWAY**  
T.M.

10601 West Belmont Avenue Franklin Park, Illinois, 60131 phone (312) 451-9200

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Printed in U.S.A.

## W A R N I N G

The parts contained in this field conversion kit must be installed without deviation from the instructions contained in this manual and kit. Failure to follow these instructions in every detail may result in the creation of illegal interference to radio and TV reception.

BALLY MIDWAY has verified that this field conversion kit, when installed in the game(s) specified in this manual, complies with the requirements in Part 15 of the FCC rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception, requiring the operator to take whatever steps are necessary to correct the interference.

BALLY MIDWAY will not be responsible for incomplete or improper conversions, or installation in a game for which this field conversion kit is not intended. If this field conversion kit is installed in a game that is not specified in this manual or in a previously converted game, the operator is required to take whatever steps are necessary to insure compliance with the requirements in Part 15, subpart J, of the FCC rules for a Class A computing device.

## S P E C I A L   N O T E:

**DO NOT DISCARD ANY OF THE PARTS YOU REMOVE  
WHEN MAKING THE MODIFICATIONS EXPLAINED IN  
THIS MANUAL.**

**THEY WILL BE RE-USED IN FUTURE CONVERSION KIT!**

## **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.

### **WARNINGS**

**AC POWER CONNECTION.** Before connecting the game to the AC power source, verify that the proper voltage-selection plug is installed on the game's power supply and the electronic chassis assembly.

**PROPERLY GROUND THE GAME.** Customers may receive an electrical shock if this game is not properly grounded! Sente games should only be plugged into a grounded 3-wire outlet. Customers may receive an electrical shock if the control panel is not properly grounded! After servicing any parts on the panel. Check that the grounded wires are secure. Only then should you lock up the game.

**DISCONNECT POWER DURING REPAIRS.** To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any part of the game. When removing or repairing the monitor, extra precautions must be taken to avoid electrical shock because high voltages may exist within the display circuitry and cathode ray tube (CRT) even after power has been disconnected. Do not touch internal parts of the display 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 end of a large, well-insulated, 20-KV jumper to ground. Momentarily touch the free end of the grounded jumper to the anode by sliding it under the anode cap. Wait two minutes and discharge the anode again.

**USE THE PROPER FUSES.** To avoid electrical shock, use replacement fuses which are specified in the parts list for this game. Replacement fuses must match those replaced in fuse type, voltage rating, and current rating. In addition, the fuse cover must be in place during game operation.

**HANDLE FLUORESCENT TUBE AND CRT WITH CARE.** If you drop a fluorescent tube or CRT and it breaks, it may implode! Shattered glass can fly eight feet or more from the implosion.

### **CAUTION**

**PROPERLY ATTACH ALL CONNECTORS.** Make sure that the connectors on each printed-circuit board (PCB) are properly plugged in. If they do not slip on easily, do not force them. A reversed connector may damage your game and void the warranty.

## STAR GUARDS U.R. TO RAMPAGE U.R. CONVERSION PROCEDURE

The STAR GUARDS U.R. to RAMPAGE U.R. Conversion Kit has been designed to be installed in your game cabinet with a minimum of effort. The only tools needed are: a 1/4" nut-driver, a device for removing I.C. chips, and a special wrench (which you received with your STAR GUARDS U.R. game) for removing torq tamper-resistant screws. Please read the following instructions thoroughly before you begin.

**NOTE:** Included in your conversion kit is a RAMPAGE U.R. Game Manual (Part No. OE36-00300-0000) which provides you with complete game information, however, disregard information on pages 1-6, pages 2-11 through 2-14, and also pages 3-2 through 3-16. Refer instead to pages 6 & 14 through 34 in this conversion kit instruction manual.

### REMOVAL OF OLD GAME HARDWARE

1. Turn the power off to your game and disconnect it from its wall outlet.
2. Unlock and open the cabinet's Coin Door.
3. Unlock and remove the Rear Access Door.
4. Using the special wrench (for removing torq tamper-resistant screws), remove the retaining bracket at the top of the cabinet. Slide the header glass up and remove (and discard) the Header Attract Art.
5. Release and unhook the two latch clamps of the Control Panel. Swing open the Control Panel on its hinge. Disconnect the Control Panel's cabling from the Master Cable. Also, remove the Control Panel's ground strap from the Control Panel. Remove the five wood screws holding the Control Panel's hinge to the cabinet, lift the Control Panel out and discard it.
6. Remove the Test Bracket of the Master Cable and Test Bracket Assembly (from the inside cabinet wall on the left side of the Coin Door) by removing two wood screws.
7. Remove the Master Cable and Test Bracket Assembly by removing its connector plugs from all of the P.C. boards and the POWER CHASSIS ASSEMBLY. Please note that the new Master Cable and Test Bracket Assembly will be routed as the old cabling was. Therefore, leave all cable clamps where they are in the cabinet.
8. Remove and discard the 8 TO 4 MULTIPLEXER P.C. BOARD. Also, remove and discard the LAMP CONTROL P.C. BOARD. Neither board will be used for the RAMPAGE U.R. game.
9. Remove the yellow ground strap of the CARDRACK W/MONBOARD ASSEMBLY, and the yellow ground strap of the CARDRACK W/SOUNDS GOOD BOARD ASSEMBLY from where it is fastened to the POWER CHASSIS ASSEMBLY.

**REMOVAL OF OLD GAME HARDWARE, CONT'D.**

10. Remove the CARDRACK W/MONOBOARD ASSEMBLY by loosening two wood screws holding the Cardrack's brackets to the cabinet's Coin Box Compartment wall. By lifting the assembly up and away from the cabinet wall, remove it from the cabinet and set it aside.
11. Remove the CARDRACK W/SOUNDS GOOD BOARD ASSEMBLY by loosening two wood screws holding the Cardrack's brackets to the inside of the cabinet's left side wall. By moving the assembly towards you and away from the cabinet wall, remove it from the cabinet and set it aside.

# REPLACEMENT OF PROGRAMMED GAME I.C.'S

1. Remove the eight EPROMS located on the MONOBOARD as shown in Figure 1 and discard them. Replace the removed EPROMS with the ones supplied in your conversion kit. They are installed as shown in Figure 1. Also cut jumper JW2.

**NOTE:** ROM/EPROM List information (on the inside back cover of the RAMPAGE U.R. game manual included in your kit) regarding the unprogrammed Monoboard also applies to A084-91787-F000.

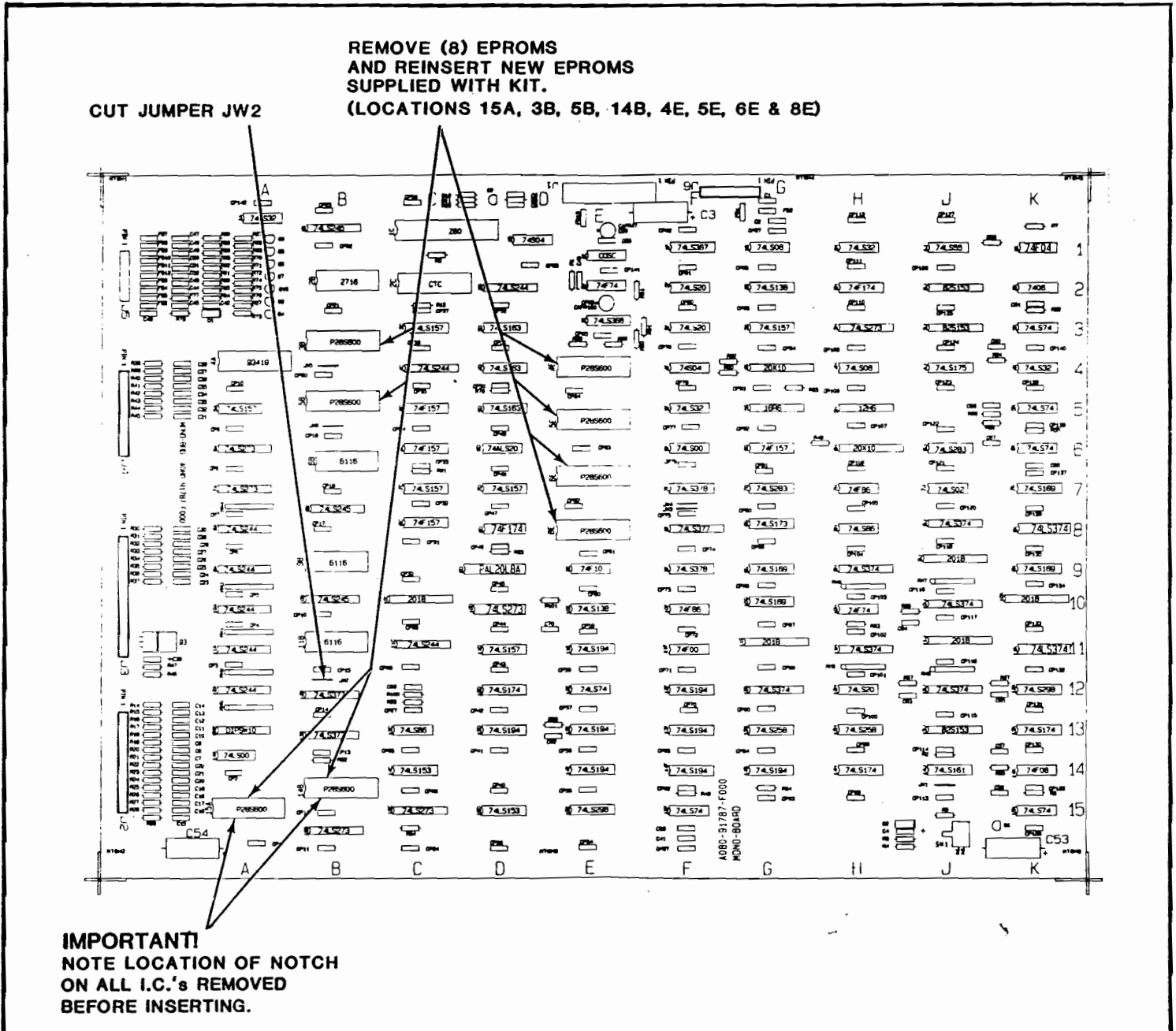


Figure 1

**REPLACEMENT OF PROGRAMMED GAME I.C.'S, CONT'D.**

- Remove the four EPROMS located on the SOUNDS GOOD P.C. BOARD as shown in Figure 2 and discard them. Replace the removed EPROMS with the ones supplied in your conversion kit. They are installed as shown in Figure 2.

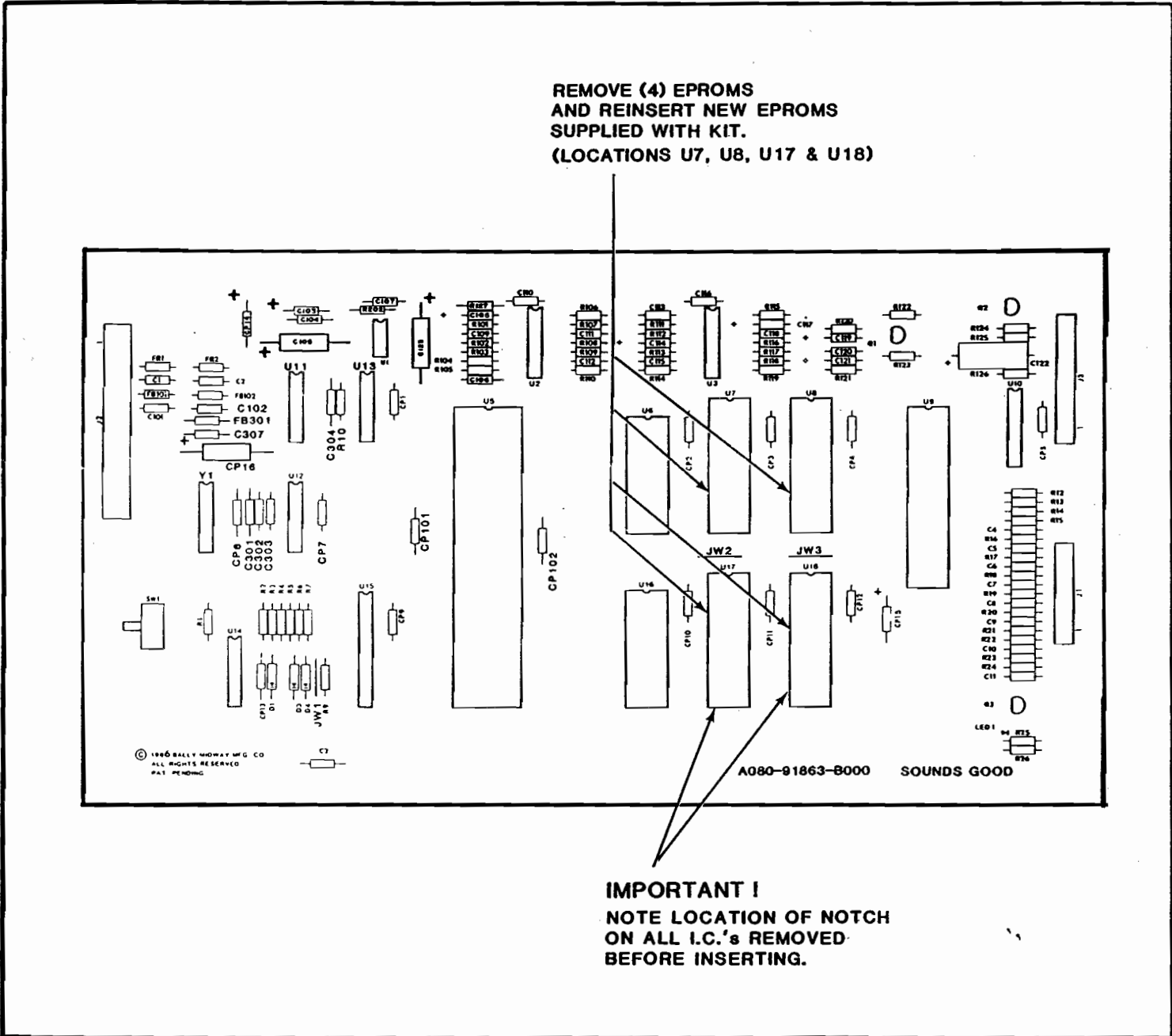


Figure 2



## INSTALLATION OF NEW GAME HARDWARE

1. Reinstall the CARDRACK W/SOUNDS BOARD ASSEMBLY in its original position inside the cabinet.
2. Reinstall the CARDRACK W/MONOBOARD ASSEMBLY in its original position inside the cabinet.
3. Secure the existing yellow ground strap of the CARDRACK W/MONOBOARD ASSEMBLY and the existing yellow ground strap of the CARDRACK W/SOUNDS GOOD BOARD ASSEMBLY to the POWER CHASSIS ASSEMBLY using the hex nut previously removed.
4. Install the new Master Cable Assembly in the existing cable clamps routing it the way the old Master Cable Assembly was. Refer to the RAMPAGE U.R. Wiring Diagram \*(on page 3-25 of the RAMPAGE U.R. game manual included in your kit) for securing the new Master Cable Assembly connectors to the connectors of the existing Monoboard, SOUNDS GOOD P.C. BOARD, DUAL POWER AMP P.C. BOARD and the POWER CHASSIS.
5. Install the Test Bracket of the new Master Cable and Test Bracket Assembly on the left side of the Coin Door on the inside cabinet wall using the two existing wood screws previously removed.
6. Secure the new Control Panel, by its hinge, to the cabinet by using the five existing wood screws previously removed. Secure the existing ground strap to the new Control Panel. Refer to the Rampage Wiring Diagram (on page 3-25 of the RAMPAGE U.R. game manual included in your kit) for securing the new Control Panel's cabling to that of the new Master Cable and Test Bracket Assembly.
7. Close and latch the new Control Panel.
8. Place the new Header Attract Art behind the existing header glass and slide them into place at the top of the cabinet, using the special wrench (for installing torq tamper-resistant screws), secure the existing retaining bracket to the top of the cabinet using the five screws previously removed.
9. Refer to page 1-6 of your new RAMPAGE U.R. game manual included in your kit and reset the dip switch positions of switch SW2 on the MONOBOARD.

**\*NOTE:** The Wiring Diagram in the RAMPAGE U.R. Manual on page 3-25 contains an error. "CHEAP SQUEAK DELUXE A080-91671-C000" should read "SOUNDS GOOD A080-91863-B000". In the new Master Cable & Test Bracket Assembly the COIN CHUTE 3 switch is wired in parallel with the COIN CHUTE 2 switch. Therefore, the Coin/Credit game options for COIN CHUTE 2 (shown on page 6 in the conversion kit instruction manual) are the same for COIN CHUTE 3.

**INSTALLATION OF NEW GAME HARDWARE, CONT'D.**

10. Replace and lock the rear access door.
11. Replace and lock the Coin Door.
12. Secure the cabinet's line card plug to its power outlet and turn the power on.
13. Run the game through its self test procedure. Refer to page 1-5 of your new RAMPAGE U.R. game manual included in your kit for self-test information.

<u>RAMPAGE U. R.</u>										
<u>OPTION SWITCH SETTINGS</u>										
//////////////////// SWITCH NO. 2 - AT A13 - LOCATED ON MONOBOARD //////////////////////										
DURING GAME PLAY:	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8	SW#9	SW#10
									NOT USED	
DIFFICULTY LEVEL 1-NORMAL	OFF	OFF								
DIFFICULTY LEVEL 0-EASY	ON	OFF								
DIFFICULTY LEVEL 2-ADVANCED	OFF	ON								
* SCORE OPTION - ON			OFF							
SCORE OPTION - OFF			ON							
COIN CHUTE 1:										
1 COIN / 1 CREDIT				OFF						
2 COINS/ 1 CREDIT				ON						
COIN CHUTE 2:										
1 COIN / 1 CREDIT					OFF	OFF	OFF			
1 COIN / 2 CREDITS					ON	OFF	OFF			
1 COIN / 3 CREDITS					OFF	ON	OFF			
1 COIN / 4 CREDITS					ON	ON	OFF			
1 COIN / 5 CREDITS					OFF	OFF	ON			
1 COIN / 6 CREDITS					ON	OFF	ON			
2 COINS/ 1 CREDIT					OFF	ON	ON			
3 COINS/ 1 CREDIT					ON	ON	ON			
GAME PLAY								OFF		
** RACK ADVANCE								ON		
NORMAL VIDEO										OFF
FREEZE VIDEO										ON
* ALLOWS PLAYER TO RETAIN POINT TOTAL WHEN HE "BUYS BACK IN" WITHIN A FIXED TIME LIMIT.								PART NO. M051-00E36-C007		
** SERVICE BUTTON ADVANCES RACK										
FACTORY SETTING - ALL LOGIC SWITCHES SET IN THE "OFF" POSITION										

**RAMPAGE/STAR GUARDS FIELD KIT - PARTS LIST**  
**PART NO. GF06-00001-0000**

ORDER BY PART NUMBER ONLY

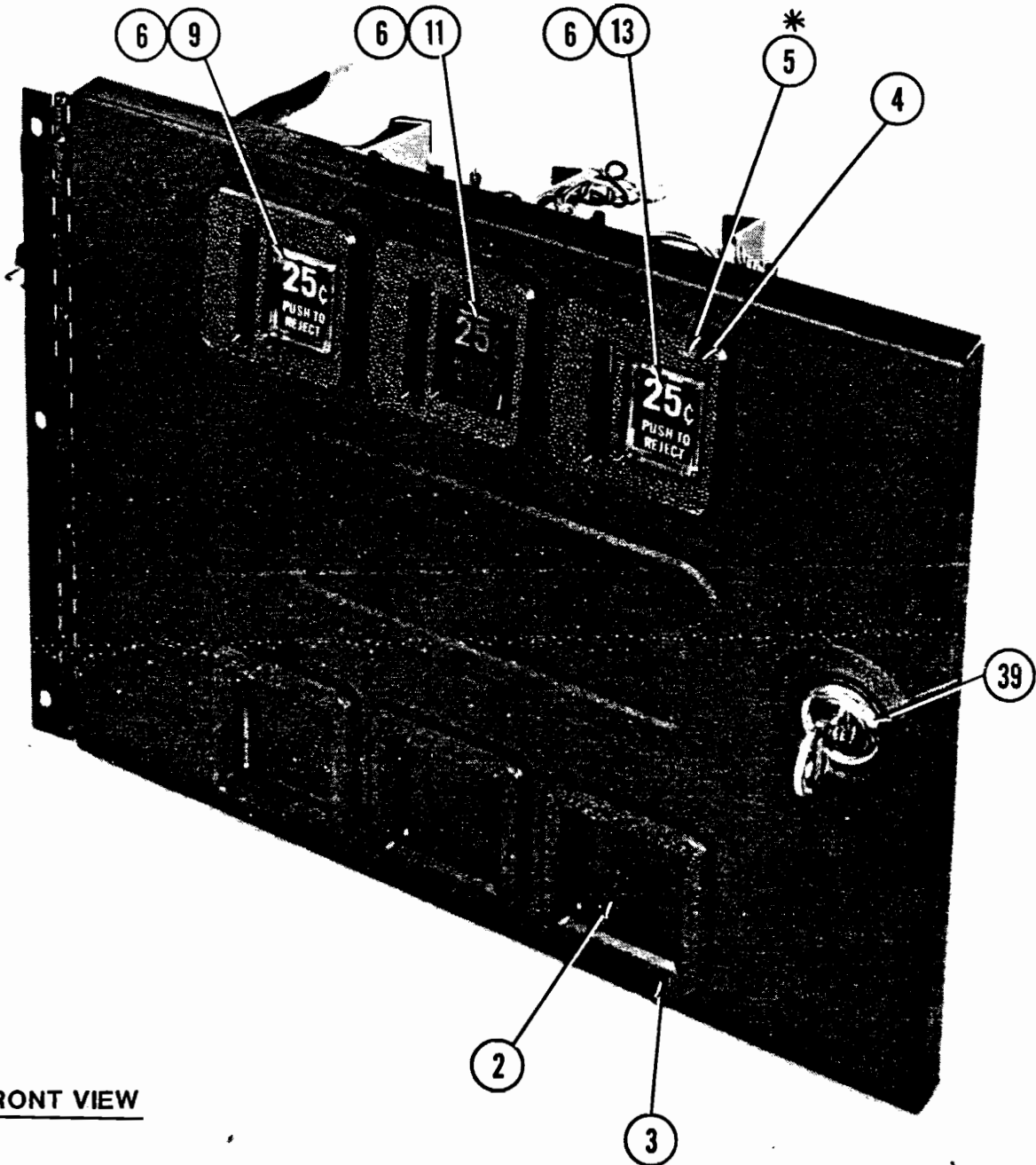
ITEM	PART NO.	DESCRIPTION
	AE36-00004-0000	CONTROL SHELF ASSY.: RAMPAGE (INCLUDES ITEMS 1 THRU 10)
1	AE36-00005-0000	CONTROL SHELF CABLE ASSY.
2	AE36-00010-00XF	CONTROL-APRON WELD ASSY.
3	0E36-00501-0000	CONTROL SHELF: RAMPAGE (WOOD)
4	0017-00009-0645	JOYSTICK ASSY.: SHAFT W/BALL (3 REQ'D.)
5	0E36-00104-00XF	PLATE: CONTROL-MTG.
6	0E36-00106-0000	STRIKE: CONTROL SHELF (2 REQ'D.)
7	0E36-00903-00XF	OVERLAY: RAMPAGE
8	0017-00032-0093	SWITCH: WHITE W/HOLDER (6 REQ'D.)
9	0017-00042-0300	BUTTON: PUSH, ROUND, WHITE (3 REQ'D.)
10	0017-00042-0304	BUTTON: PUSH, ROUND, RED (3 REQ'D.)
	AF06-00006-0000	MASTER CABLE W/BRKT. ASSY. (INCLUDES ITEMS 2 & 3)
11	AF06-00007-0000	MASTER CABLE ASSY.
12	A515-00021-0000	MULTI-FUNCTION SWITCH W/BRKT.: 1-POT (INCLUDES FOLLOWING 6 ITEMS)
	0017-00032-0007	SWITCH: SPDT SLIDE 4 AMP
	0515-00107-0000	BRKT.: SWITCH; TEST, VOLUME, CREDIT
	0017-00032-0051	BUTTON: SWITCH, RED
	0017-00103-0075	NUT: 3/8" X 32 HEX
	0017-00104-0104	WASHER: .375" I.D., .562" O.D., & .018" TH.
	105E-00001-0017	POT: 0-1K CBN 1/2W
13	0E36-00900-00XF	HEADER: SCREENED
14	0E36-00901-00XF	VIEWING GLASS
15	E36A-42AAE-AX4D	EPROM: 27128-25 RAMPAGE POSITION 15A
16	E36A-42AAE-BX4D	EPROM: 27128-25 RAMPAGE POSITION 14B

**RAMPAGE/STAR GUARDS FIELD KIT - PARTS LIST, CONT'D.  
PART NO. GF06-00001-0000**

ORDER BY PART NUMBER ONLY

ITEM	PART NO.	DESCRIPTION
17	E36C-47AAE-AX4D	EPROM: 27256-25 RAMPAGE POSITION 3B
18	E36C-47AAE-BX4D	EPROM: 27256-25 RAMPAGE POSITION 5B
19	E36A-81AAE-AXFD	EPROM: 27512-25 RAMPAGE POSITION 8E
20	E36A-81AAE-BXFD	EPROM: 27512-25 RAMPAGE POSITION 6E
21	E36A-81AAE-CXFD	EPROM: 27512-25 RAMPAGE POSITION 5E
22	E36A-81AAE-DXFD	EPROM: 27512-25 RAMPAGE POSITION 4E
23	E36C-47AAE-CX4D	EPROM: 27256-25 RAMPAGE POSITION U17 OR
23	E36C-47AAE-CXFD	EPROM: 27256-25 RAMPAGE POSITION U17
24	E36C-47AAE-DX4D	EPROM: 27256-25 RAMPAGE POSITION U7 OR
24	E36C-47AAE-DXFD	EPROM: 27256-25 RAMPAGE POSITION U7
25	E36C-47AAE-EX4D	EPROM: 27256-25 RAMPAGE POSITION U18 OR
25	E36C-47AAE-EXFD	EPROM: 27256-25 RAMPAGE POSITION U18
26	E36C-47AAE-FX4D	EPROM: 27256-25 RAMPAGE POSITION U8 OR
26	E36C-47AAE-FXFD	EPROM: 27256-25 RAMPAGE POSITION U8
	AF06-00300-0000	CATALOG & BAG ASSY. (INCLUDES ITEMS 27 THRU 29)
27	M051-00E36-A007	TAG: OPTION SWITCH SETTINGS
28	M051-00F06-A010	INSTRUCTION: RAMPAGE/STAR GUARDS FIELD KIT
29	0E36-00300-0000	CATALOG: RAMPAGE

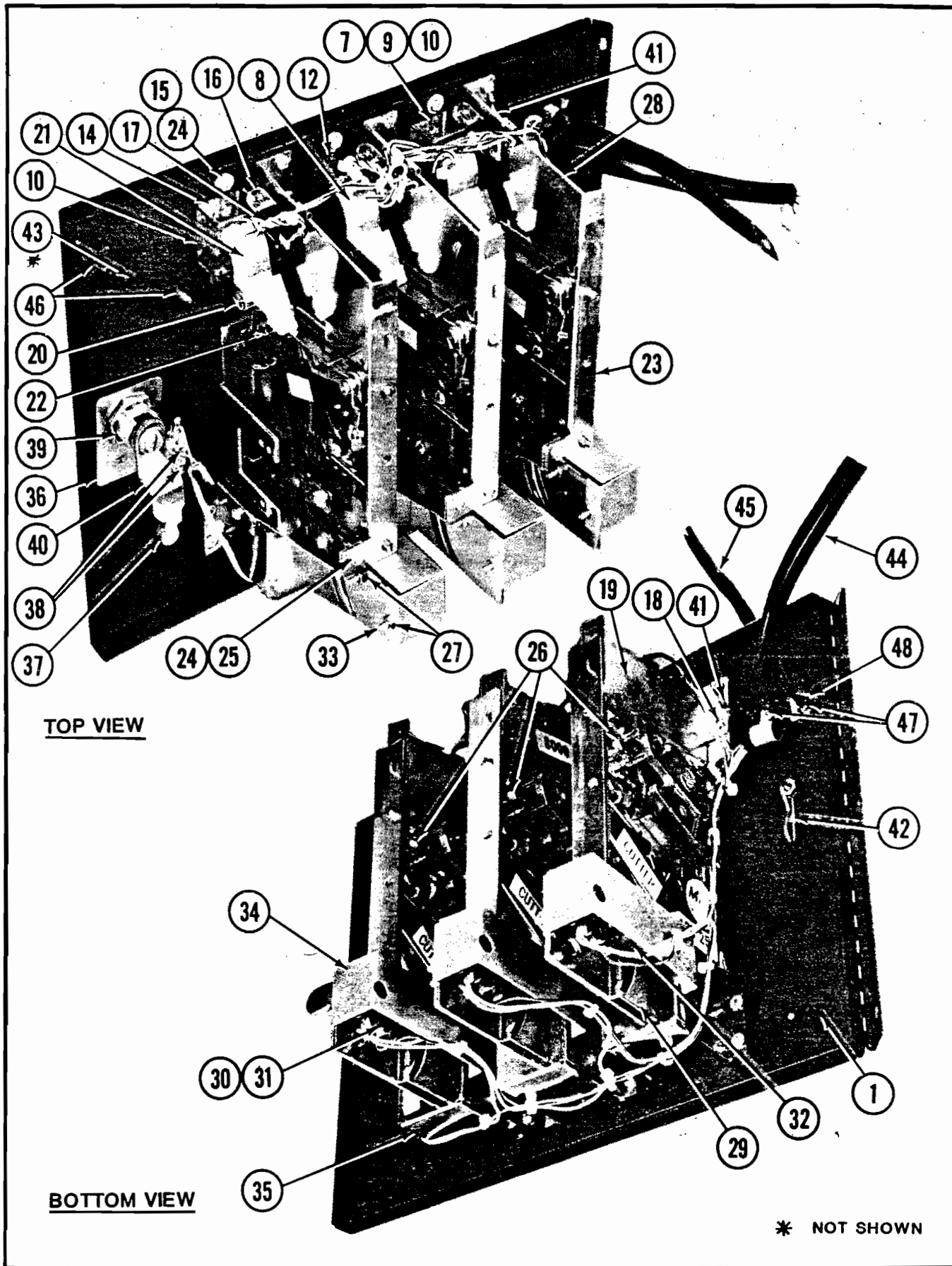
COIN DOOR W/CABLE: BLACK 3-CHUTE  
PART NO. A982-00014-0021



FRONT VIEW

\* NOT SHOWN

COIN DOOR W/GABLE: BLACK 3-CHUTE  
 PART NO. A982-00014-0021



TOP VIEW

BOTTOM VIEW

\* NOT SHOWN

**COIN DOOR W/CABLE: BLACK 3-CHUTE - PARTS LIST**  
**PART NO. A982-00014-0021**  
**ORDER FROM COIN MECHANISM BY PART NUMBER ONLY (312) 279-9150**

ITEM	PART NO.	DESCRIPTION
1	BS-X573-1	LARGE DOOR: 3 SLOT
2	BS-8000-12	COIN RETURN CUP DOOR (3 REQ'D.)
3	BS-8000-7	COIN RETURN CUP BEZEL (3 REQ'D.)
4	BS-8000-6	COIN ENTRY CASTING (3 REQ'D.)
5	8000-8	COIN INSERT PLATE (3 REQ'D.)
6	7800-6	DENOMINATION INSERT (3 REQ'D.)
7	7800-37	REJECT BUTTON RETURN SPRING (3 REQ'D.)
8	7300-105	"C" WASHER (3 REQ'D.)
9	7800-11-RED	REJECT BUTTON - RED
10	A780-12-RED	REJECT BUTTON HOUSING (RED)
11	7800-11-AMBER	REJECT BUTTON - AMBER
12	A780-12-AMBER	REJECT BUTTON HOUSING (AMBER)
13	7800-11-BLUE	REJECT BUTTON - BLUE
14	A780-12-BLUE	REJECT BUTTON HOUSING (BLUE)
15	8000-22	WASHER 3/8 O.D. (3 REQ'D.)
16	8000-24-12	12V WEDGE LAMP (3 REQ'D.)
17	8000-23	WEDGE LAMP SOCKET (3 REQ'D.)
18	8000-14	HOUSING RETAINING BRKT. (3 REQ'D.)
19	8000-9	COIN ENTRY CHUTE (3 REQ'D.)
20	3300-34	"C" WASHER (3 REQ'D.)
21	8000-21	REJECT LEVER ASSY. (3 REQ'D.)
22	7800-14	TORSION SPRING (3 REQ'D.)
23	7600-141-1	MECH. RETAINING BRKT. (3 REQ'D.)
24	216-6-4	6-32 X 1/4 PHILLIPS PAN HEAD SCREW (27 REQ'D.)
25	606-110-N	NYLON WASHER (3 REQ'D.)

**COIN DOOR W/CABLE: BLACK 3-CHUTE - PARTS LIST, CONT'D.**  
**PART NO. A982-00014-0021**  
**ORDER FROM COIN MECHANISM BY PART NUMBER ONLY (312) 279-9150**

ITEM	PART NO.	DESCRIPTION
26	0017-00005-0003	COIN ACCEPTOR W/STRING CUTTER (3 REQ'D.) OR
26	0017-00005-0214	COIN ACCEPTOR W/STRING CUTTER
27	404-4	4-40 HEX NUT (6 REQ'D.)
28	8000-10	MECH. MTG. BRACKET "STAKED" (3 REQ'D.)
29	8000-18	SW. CHUTE (SMALL) (3 REQ'D.)
30	7300-134	SWITCH INSULATOR (3 REQ'D.)
31	7300-100-1	BLUE, SWITCH (3 REQ'D.)
32	8000-19	5¢ / 25¢ / SW. WIRE (3 REQ'D.)
33	101-4-16	4-4 X 1" ROUND HEAD MACHINE SCREW (6 REQ'D.)
34	8000-28	SWITCH COVER (3 REQ'D.)
35	8000-13	COIN RETURN CUP (3 REQ'D.)
36	8800-9-1-R	SLAM SWITCH BRACKET
37	7800-42	SLAM SWITCH
38	100-4-6	4-36 X 3/8 ROUND HEAD MACHINE SCREW (3 REQ'D.)
39	8800-24	DBL. BTD. LOCK & KEY W/NUTS
40	X615	LOCKING CAM
41	7800-7	KEY HOOK
42 *	0017-00007-0019	KEY HOOK
43 *	A090-00089-0000	COIN METER ASSY. W/DIODE
44 *	A982-00015-0011	COIN DOOR CABLE ASSY.
45 *	0017-00009-0609	GROUND STRAP: L = 7" W/BLACK COVER
46 *	0017-00103-0061	NUT: 8-32 HEX W/SEMS ST. (2 REQ'D.)
47 *	0017-00103-0084	NUT: 6-32 HEX W/SEMS ST. (2 REQ'D.)
48 *	0017-00104-0019	WASHER: 6 145 - .375 - 032 FLAT ST.
*		NOT PART OF ABOVE ASSEMBLY & MUST BE
		ORDERED SEPARATELY, THROUGH BALLY MIDWAY MFG. CO.



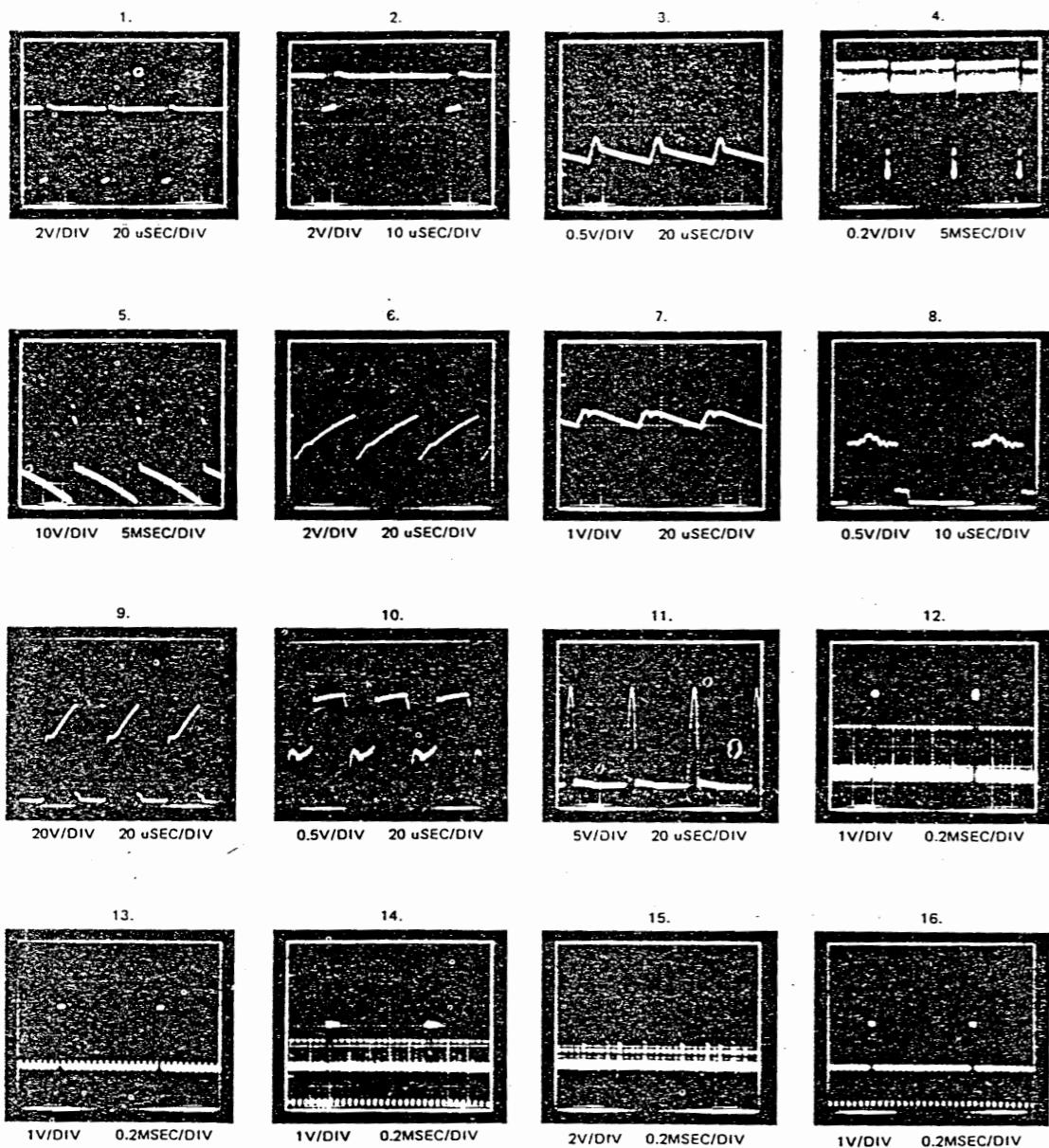
**NEW MONITOR INFORMATION &  
NEW COMPONENT LAYOUT  
AND SCHEMATIC INFORMATION**

## TYPICAL OSCILLOSCOPE WAVEFORM PATTERNS

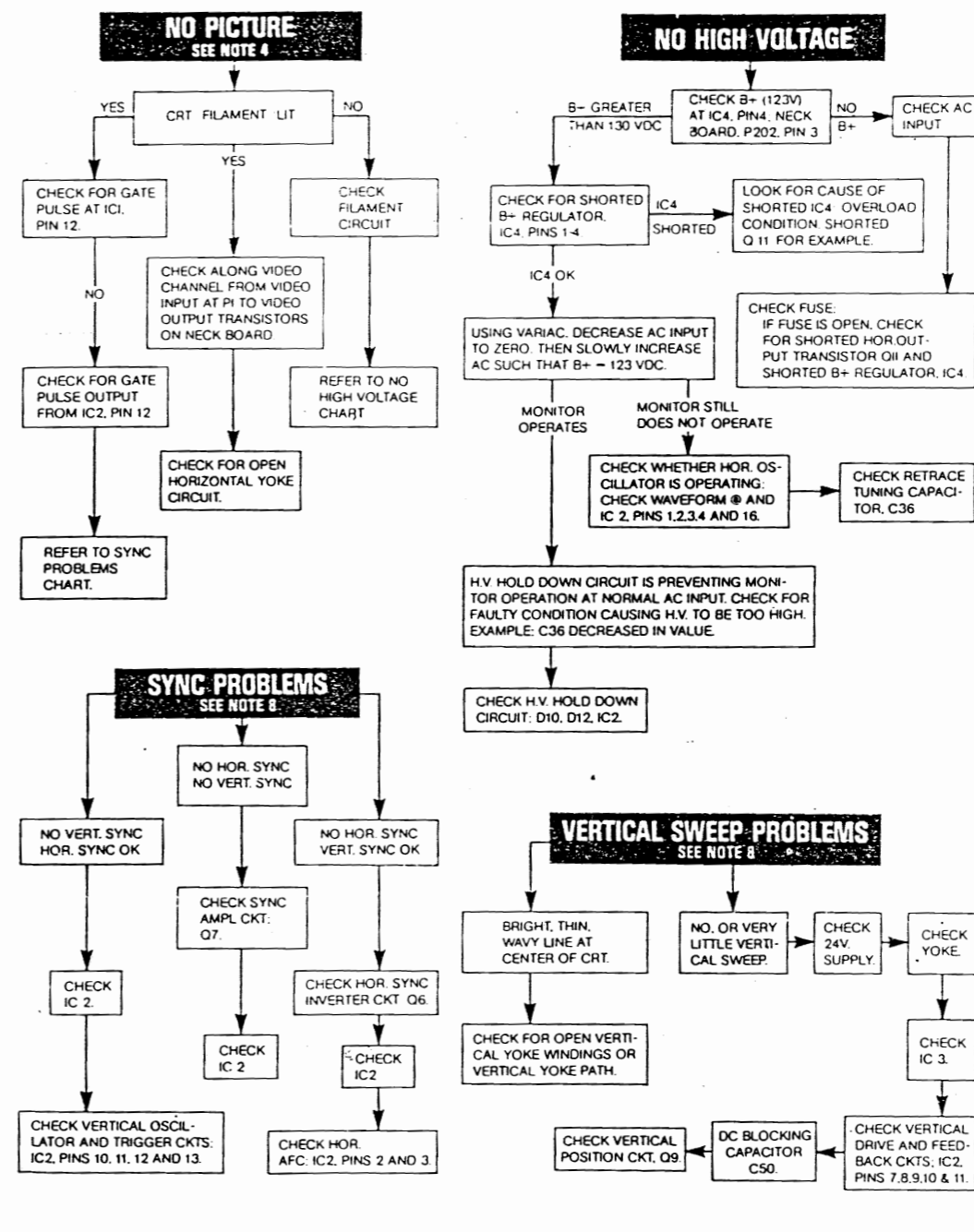
The waveforms shown below were observed on a wide band oscilloscope. The input signal was from a crosshatch generator with a horizontal sync frequency of 15.73kHz and a vertical frequency of 60 Hz. If the waveforms are observed on an oscilloscope with a limited high frequency response, the corners of 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.



## 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.

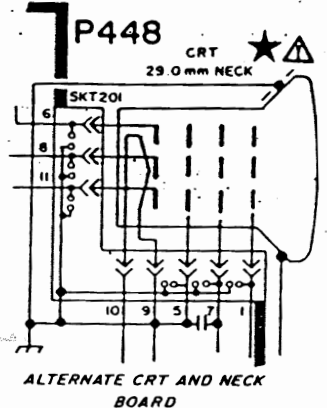
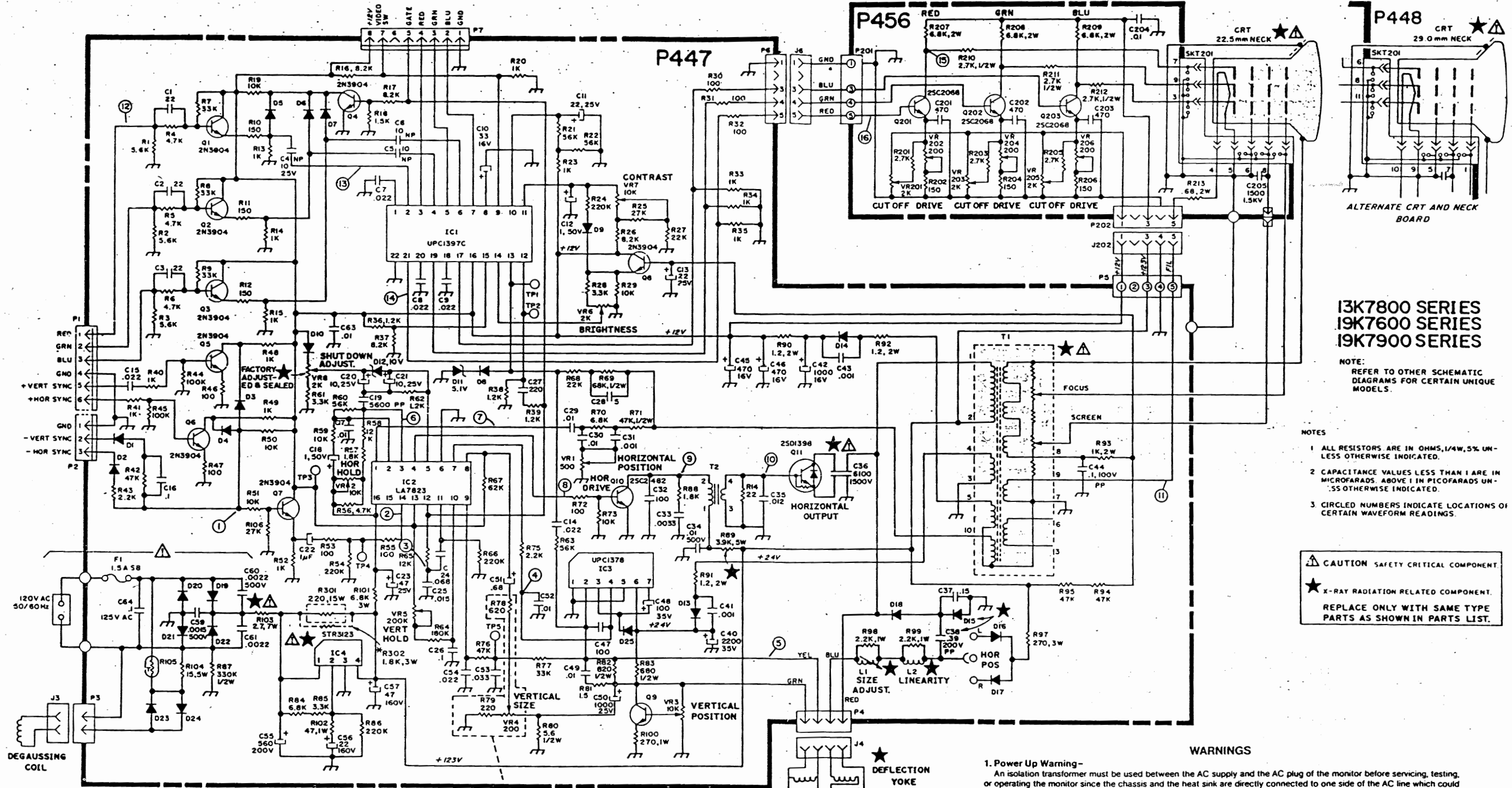
7. All monitors are equipped with automatic degaussing coils which demagnetize the picture tube every time the monitor is turned on after being off for a minimum of 20 minutes. Should any part of the chassis become magnetized it will be necessary to degauss the affected area with a manual degaussing 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 long dimension of the picture tube.

# K7000 COLOR MONITOR SCHEMATIC DIAGRAM



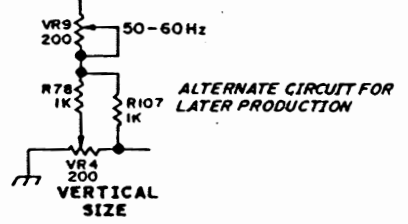
**13K7800 SERIES  
19K7600 SERIES  
19K7900 SERIES**

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.

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



## 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 H.V. and power supply circuits). Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

## 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—holddown 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

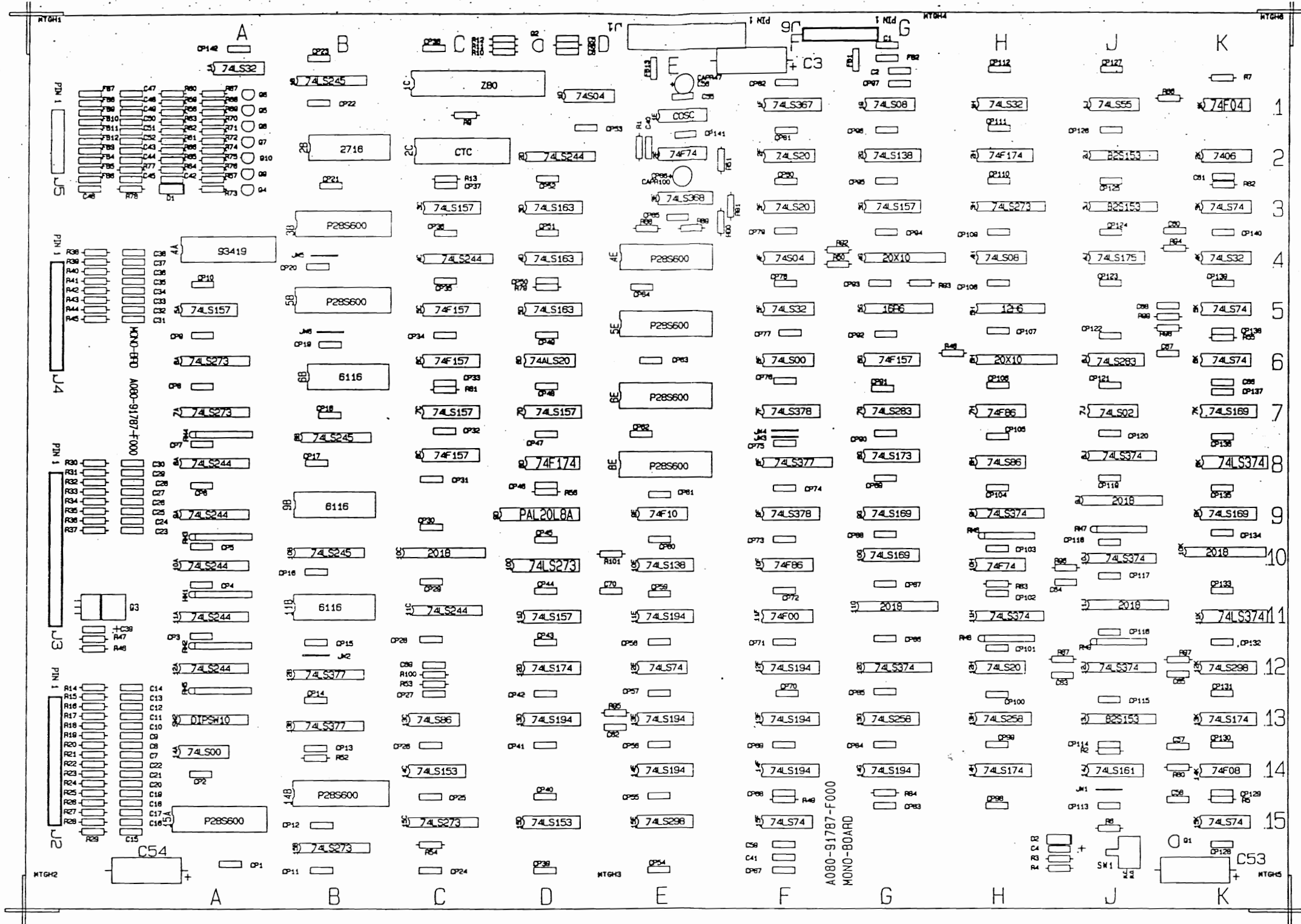
The ADG circuit automatically demagnetizes the CRT. This circuit is activated only when the monitor is initially powered up after having been off for at least 20 minutes.

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.







REVISIONS	

PROJECT ENG:		USED ON		BALLY/MIDWAY MFG. CO.	
DO NOT SCALE DWG.		HEAT TREAT	SCALE	FRANKLIN PARK ILL.	
DRN. JS	MATL.	NON-SCROLL MONO BD. A084-91787-F000		PART NO.	
CHK. C.M.H.	FINISH			M051-00114-F128	
DATE 07/25/88					

MONOBOARD  
A084-91787-F000  
M051-00114-F156

CROSS REFERENCE LIST:

DESCRIPTION	QTY	DESIGNATION NO.	PART NO.
18 PF AX. CER.	4	C60,C62,C67,C68	0A15-00800-0011
33 PF AX. CER.	2	C5,C65	0986-00800-0300
47 PF AX. CER.	6	C47-C52	0986-00800-2800
68 PF AX. CER.	3	C57,C63,C64	0360-00800-0028
270 PF AX. CER.	2	C69,C70	0A15-00800-0013
390 PF AX. CER.	5	C1,C2,C41,C42,C55	0986-00800-3000
820 PF AX. CER.	4	C43-C46	0945-00816-0400
.01 UF AX. CER.	146	CP1-CP65,C67-C142 C40,C58,C59,C61,C66	0986-00800-2000
.1 UF AX. CER.	33	C6-C38	0986-00800-1100
10 UF 25V AX. TANT.	2	C4,C39	0986-00800-0700
47 UF 25V RD TANT	1	C56	0A59-00800-0001
100 UF 16V RD TANT	1	CP66	0945-00811-0500
470 UF 16V AX. ELEC.	3	C3,C53,C54	0986-00800-2700
10 OHM 1/4W 5% CRBN.	6	R58,R59,R61,R62,R64, R65	100E-00005-0011
22 OHM 1/4W 5% CRBN.	1	R48	100E-00005-0016
47 OHM 1/4W 5% CRBN.	4	R88-R90,R93	100E-00005-0025
68 OHM 1/4W 5% CRBN.	4	R50,R51,R91,R92	100E-00005-0029
82 OHM 1/4W 5% CRBN.	7	R9,R80,R87,R96,R97, R100,R101	100E-00005-0031
220 OHM 1/4W 5% CRBN.	32	R14-R45	100E-00005-0041
470 OHM 1/4W 5% CRBN.	3	R60,R63,R66	100E-00005-0051
510 OHM 1/4W 5% CRBN.	3	R69,R72,R76	100E-00005-0053
560 OHM 1/4W 5% CRBN.	3	R57,R77,R78	100E-00005-0054
680 OHM 1/4W 5% CRBN.	4	R94,R95,R98,R99	100E-00005-0056
1K OHM 1/4W 5% CRBN.	5	R68,R71,R73,R75,R86	100E-00005-0061
2K OHM 1/4W 5% CRBN.	3	R67,R70,R74	100E-00005-0068
2.7K OHM 1/4W 5% CRBN.	2	R46,R47	100E-00005-0071
4.7K OHM 1/4W 5% CRBN.	20	R1,R2,R5-R7,R10-R13, R49,R52-R56,R79, R81-84	100E-00005-0079
10K OHM 1/4W 5% CRBN.	2	R3,R4	100E-00005-0088
82K OHM 1/4W 5% CRBN.	1	R8	100E-00005-0112
1K OHM 9 PIN SIP	4	RM6-RM9	102E-00004-0011
2.7K OHM 10 PIN SIP	4	RM1-RM4	102E-00004-0020
4.7K OHM 10 PIN SIP	1	RM5	102E-00004-0026
1N4148 DIODE	2	D1,D2	103E-00002-0005
2N4123 NPN XSIR.	2	Q1,Q4	104E-00001-0007
2N4403 PNP XSIR.	1	Q2	104E-00002-0006
MPSA70 PNP XSIR	6	Q5-Q10	104E-00002-0012
TIPL10 NPN XSIR.	1	Q3	104E-00009-0001
20 MHZ COSC.	1	IC 1E	0304-00804-0007
7406	1	IC 2K	0986-00803-7600
74ALS20	1	IC 6D	0A59-00803-0015

CROSS REFERENCE LIST:

DESCRIPTION	QTY	DESIGNATION NO.	PART NO.
74F00	1	IC 11F	0A59-00803-0001
74F04	1	1K	0A59-00803-0034
74F08	1	IC 14K	0A59-00803-0030
74F10	1	IC 9E	0A59-00803-0002
74F74	2	IC 2E,10H	0A59-00803-0003
74F86	2	IC 10F,7H	0A59-00803-0031
74F157	4	IC 5C,6C,8C,6G	0A59-00803-0004
74F174	2	IC 8D, 2H	0A59-00803-0005
74LS00	2	IC 14A,6F	0304-00803-0010
74LS02	1	IC 7J	0986-00803-7400
74LS08	2	IC 1G,4H	0986-00803-7300
74LS20	3	IC 2F,3F,12H	0986-00803-1004
74LS32	4	IC 5F,1H,4K,1A	0986-00803-6100
74LS55	1	IC 1J	0A59-00803-0026
74LS74	6	IC 12E,15F,3K,5K,6K, 15K	0986-00803-1005
74LS86	2	IC 13C,8H	0986-00803-9900
74LS138	2	IC 10E,2G	0986-00803-6500
74LS153	2	IC 14C,15D	0A59-00803-0006
74LS157	6	IC 5A,3C,7C,7D,11D,3G	0304-00803-0021
74LS161	1	IC 14J	0986-00803-1003
74LS163	3	IC 3D-5D	0A59-00803-0008
74LS169	4	IC 9G,10G,7K,9K	0304-00803-0023
74LS173	1	IC 8G	0A59-00803-0009
74LS174	3	IC 12D,14H,13K	0304-00803-0024
74LS175	1	IC 4J	0304-00803-0025
74LS194	8	IC 13D,11E,13E,14E, 12F-14F,14G	0304-00803-0026
74LS244	8	IC 8A-12A,4C,11C,2D	0986-00803-4800
74LS245	3	IC 1B,8B,10B	0986-00803-6400
74LS258	2	IC 13G,13H	0304-00803-0028
74LS273	6	IC 6A,7A,15B,15C,10D, 3H	0986-00803-4700
74LS283	2	IC 7G,6J	0304-00803-0030
74LS298	2	IC 15E,12K	0A59-00803-0010
74LS367	1	IC 1F	0986-00803-7000
74LS368	1	IC 3E	0A59-00803-0011
74LS374	8	IC 12G,9H,11H,8J,10J, 12J,8K,11K	0986-00803-4600
74LS377	3	IC 8F,12B,13B	0A59-00803-0012
74LS378	2	IC 7F,9F	0A59-00803-0013
74S04	2	IC 1D,4F	0986-00803-6600
COLARB RI PAL	1	IC 9D	0E61-00803-0001
MMCO1A HAL	1	IC 4G	0986-00803-8900
MMCO2B HAL	1	IC 6H	0986-00803-9000
MMCO3B HAL	1	IC 5G	0986-00803-9100
MMCO6 HAL	1	IC 5H	See Rom/Eprom Chart
PACNS REV 1.0 PLA	1	IC 2J	A59A-26AAJ-BXHD

CROSS REFERENCE LIST:

DESCRIPTION	QTY	DESIGNATION NO.	PART NO.
PACOUT REV 1.0 PLA	1	IC 3J	A59A-26AAJ-AXHD
ROMCTRL REV 1.0 PLA	1	IC 13J	A59A-26AAJ-CXHD
2018 2Kx8 RAM 45NS	4	IC 11G,10K,9J,11J	0A59-00803-0028
2018 2Kx8 RAM 55NS	1	IC 10C	0A59-00803-0029
6116 2Kx8 RAM 120NS	1	IC 11B	0A59-00803-0027
6116 2Kx8 RAM 150NS	2	IC 6B,9B	0A59-00803-0014
93419 64x9 RAM	1	IC 4A	0986-00803-9600
Z80B	1	IC 1C	0304-00803-0041
Z80B CTC	1	IC 2C	0304-00803-0040
BG0 64K ROM/EPROM	1	IC 15A	SEE ROM/EPROM CHART
BG1 64K ROM/EPROM	1	IC 14B	SEE ROM/EPROM CHART
FG0 256K ROM/EPROM	1	IC 8E	SEE ROM/EPROM CHART
FG1 256K ROM/EPROM	1	IC 6E	SEE ROM/EPROM CHART
FG2 256K ROM/EPROM	1	IC 5E	SEE ROM/EPROM CHART
FG3 256K ROM/EPROM	1	IC 4E	SEE ROM/EPROM CHART
PROG0 256K ROM/EPROM	1	IC 3B	SEE ROM/EPROM CHART
PROG1 256K ROM/EPROM	1	IC 5B	SEE ROM/EPROM CHART
16 PIN IC SOCKET(.300)	1	ICS 3E	110E-00001-0003
20 PIN IC SOCKET(.300)	5	ICS 5G,5H,2J,3J,13J	110E-00001-0005
24 PIN IC SOCKET(.300)	8	ICS 10C,4G,9D,11G,6H, 9J,11J,10K	110E-00001-0009
24 PIN IC SOCKET(.600)	3	ICS 6B,9B,11B	110E-00001-0007
28 PIN IC SOCKET(.600)	10	ICS 4A,15A,3B,5B,14B, 2C,4E-6E,8E	110E-00001-0010
40 PIN IC SOCKET(.600)	1	ICS 1C	110E-00001-0011
AUTO INSERT PIN TIN .025 SQ	18	J2	0304-00804-0009
AUTO INSERT PIN TIN .025 SQ	22	J3	0304-00804-0009
AUTO INSERT PIN TIN .025 SQ	15	J4	0304-00804-0009
AUTO INSERT PIN TIN .025 SQ	8	J5	0304-00804-0009
AUTO INSERT PIN TIN .025 SQ	10	J6	0304-00804-0009
AUTO INSERT PIN TIN .045 SQ	11	J1	0304-00804-0010
FERRITE BEAD	13	FBI-FB13	0316-00804-0002
ZERO OHM RESISTOR (JUMPER)	6	JW1-JW6	117E-00001-0003

MONOBOARD  
A084-91787-F000  
M051-00114-F156

CROSS REFERENCE LIST:

DESCRIPTION	QTY	DESIGNATION NO.	PART NO.
SWITCH PC. MTG.	1	SW1	0986-00804-3100
10 POS. DIP SWITCH	1	SW2	113E-00001-0004
SNAP	1	MHQ3	0017-00007-0134
PC BOARD	1		A080-91787-F000

DESIGNATION LIST:

DESCRIPTION	DESIGNATION NO.
CP1-CP65	.01 UF AX. CER.
CP66	100 UF 16V RD. TANT
CP67-CP142	.01UF AX. CER.
C1,C2	390 PF AX. CER.
C3	470 UF 16V AX. ELEC.
C4	10 UF 25V AX. TANT.
C5	33 PF AX. CER.
C6-C38	.1 UF AX. CER.
C39	10 UF 25V AX. TANT.
C40	.01 UF AX. CER
C41,C42	390 PF AX. CER.
C43-C46	820 PF AX. CER.
C47-C52	47 PF AX. CER.
C53,C54	470 UF 16V AX. ELEC.
C55	390 PF AX. CER.
C56	47 UF 25V RD. TANT.
C57	68 PF AX. CER.
C58,C59	.01 UF AX. CER.
C60	18 PF AX. CER.
C61	.01 UF AX. CER.
C62	18 PF AX. CER.
C63	68 PF AX. CER.
C64	68 PF AX. CER.
C65	33 PF AX. CER.
C66	.01 UF AX. CER.
C67	18 PF AX. CER.
C68	18 PF AX. CER.
C69	270 PF AX. CER
C70	270 PF AX. CER
R1,R2	4.7K OHM 1/4W 5% CRBN.
R3,R4	10K OHM 1/4W 5% CRBN.
R5-R7	4.7K OHM 1/4W 5% CRBN.
R8	82K OHM 1/4W 5% CRBN.
R9	82 OHM 1/4W 5% CRBN.
R10-R13	4.7K OHM 1/4W 5% CRBN.
R14-R45	220 OHM 1/4W 5% CRBN.
R46,R47	2.7K OHM 1/4W 5% CRBN.
R48	22 OHM 1/4W 5% CRBN.
R49,R52-R56	4.7K 1/4W 5% CRBN.
R50,R51	68 OHM 1/4W 5% CRBN.
R57	560 OHM 1/4W 5% CRBN.
R58,R59	10 OHM 1/4W 5% CRBN.
R60	470 OHM 1/4W 5% CRBN.
R61,R62	10 OHM 1/4W 5% CRBN.
R63	470 OHM 1/4W 5% CRBN.
R64,R65	10 OHM 1/4W 5% CRBN.
R66	470 OHM 1/4W 5% CRBN.
R67	2K OHM 1/4W 5% CRBN.
R68	1K OHM 1/4W 5% CRBN.
R69	510 OHM 1/4W 5% CRBN.
R70	2K OHM 1/4W 5% CRBN.

DESIGNATION LIST:

DESCRIPTION	DESIGNATION NO.
R71	1K OHM 1/4W 5% CRBN.
R72	510 OHM 1/4W 5% CRBN.
R73	1K OHM 1/4W 5% CRBN.
R74	2K OHM 1/4W 5% CRBN.
R75	1K OHM 1/4W 5% CRBN.
R76	510 OHM 1/4W 5% CRBN.
R77,R78	560 OHM 1/4W 5% CRBN.
R79	4.7K OHM 1/4W 5% CRBN.
R80	82 OHM 1/4W 5% CRBN.
R81-R84	4.7K OHM 1/4W 5% CRBN.
R86	1K OHM 1/4W 5% CRBN.
R87	82 OHM 1/4W 5% CRBN.
R88	47 OHM 1/4W 5% CRBN.
R89	47 OHM 1/4W 5% CRBN.
R90	47 OHM 1/4W 5% CRBN.
R91	68 OHM 1/4W 5% CRBN.
R92	68 OHM 1/4W 5% CRBN.
R93	47 OHM 1/4W 5% CRBN.
R94	680 OHM 1/4W 5% CRBN.
R95	680 OHM 1/4W 5% CRBN.
R96	82 OHM 1/4W 5% CRBN.
R97	82 OHM 1/4W 5% CRBN.
R98	680 OHM 1/4W 5% CRBN.
R99	680 OHM 1/4W 5% CRBN.
R100	82 OHM 1/4W 5% CRBN.
R101	82 OHM 1/4W 5% CRBN.
RM1-RM4	2.7K OHM 10 PIN SIP
RM5	4.7K OHM 10 PIN SIP
RM6-RM9	1K OHM 9 PIN SIP
D1,D2	1N4148 DIODE
Q1	2N4123 XSTR.
Q2	2N4403 XSTR.
Q3	TIP110 XSTR.
Q4	2N4123 XSTR.
Q5-Q10	MPSA70 XSTR.
IC 1A	74LS32
IC 4A	93419 64x9 RAM
IC 5A	74LS157
IC 6A,7A	74LS273
IC 8A-12A	74LS244
IC 14A	74LS00
IC 15A	BG0 64K ROM/EPROM
IC 1B	74LS245
IC 2B	NOT USED
IC 3B,5B	PROG0,PROG1 256K ROM/EPROM
IC 6B	6116 2Kx8 RAM 150 NS.
IC 8B	74LS245
IC 9B	6116 2Kx8 RAM 150 NS.
IC 10B	74LS245



MONOBOARD  
A084-91787-F000  
M051-00114-F156

DESIGNATION LIST:

DESCRIPTION	DESIGNATION NO.
IC 11B	6116 2Kx8 RAM 120 NS.
IC 12B,13B	74LS377
IC 14B	BG1 64K ROM/EPROM
IC 15B	74LS273
IC 1C	Z80B CPU
IC 2C	Z80B CTC
IC 3C	74LS157
IC 4C	74LS244
IC 5C,6C	74F157
IC 7C	74LS157
IC 8C	74F157
IC 10C	2018 2Kx8 RAM 55NS
IC 11C	74LS244
IC 13C	74LS86
IC 14C	74LS153
IC 15C	74LS273
IC 1D	74S04
IC 2D	74LS244
IC 3D-5D	74LS163
IC 6D	74ALS20
IC 7D	74LS157
IC 8D	74F174
IC 9D	Colarb Rl Pal
IC 10D	74LS273
IC 11D	74LS157
IC 12D	74LS174
IC 13D	74LS194
IC 15D	74LS153
IC 1E	20 MHZ COSC.
IC 2E	74F74
IC 3E	74LS368
IC 4E-6E,8E	FG3,FG2,FGL,FG0 256K ROM/EPROM
IC 9E	74F10
IC 10E	74LS138
IC 11E	74LS194
IC 12E	74LS74
IC 13E,14E	74LS194
IC 15E	74LS298
IC 1F	74LS367
IC 2F,3F	74LS20
IC 4F	74S04
IC 5F	74LS32
IC 6F	74LS00
IC 7F	74LS378
IC 8F	74LS377
IC 9F	74LS378
IC 10F	74F86
IC 11F	74F00
IC 12F-14F	74LS194
IC 15F	74LS74

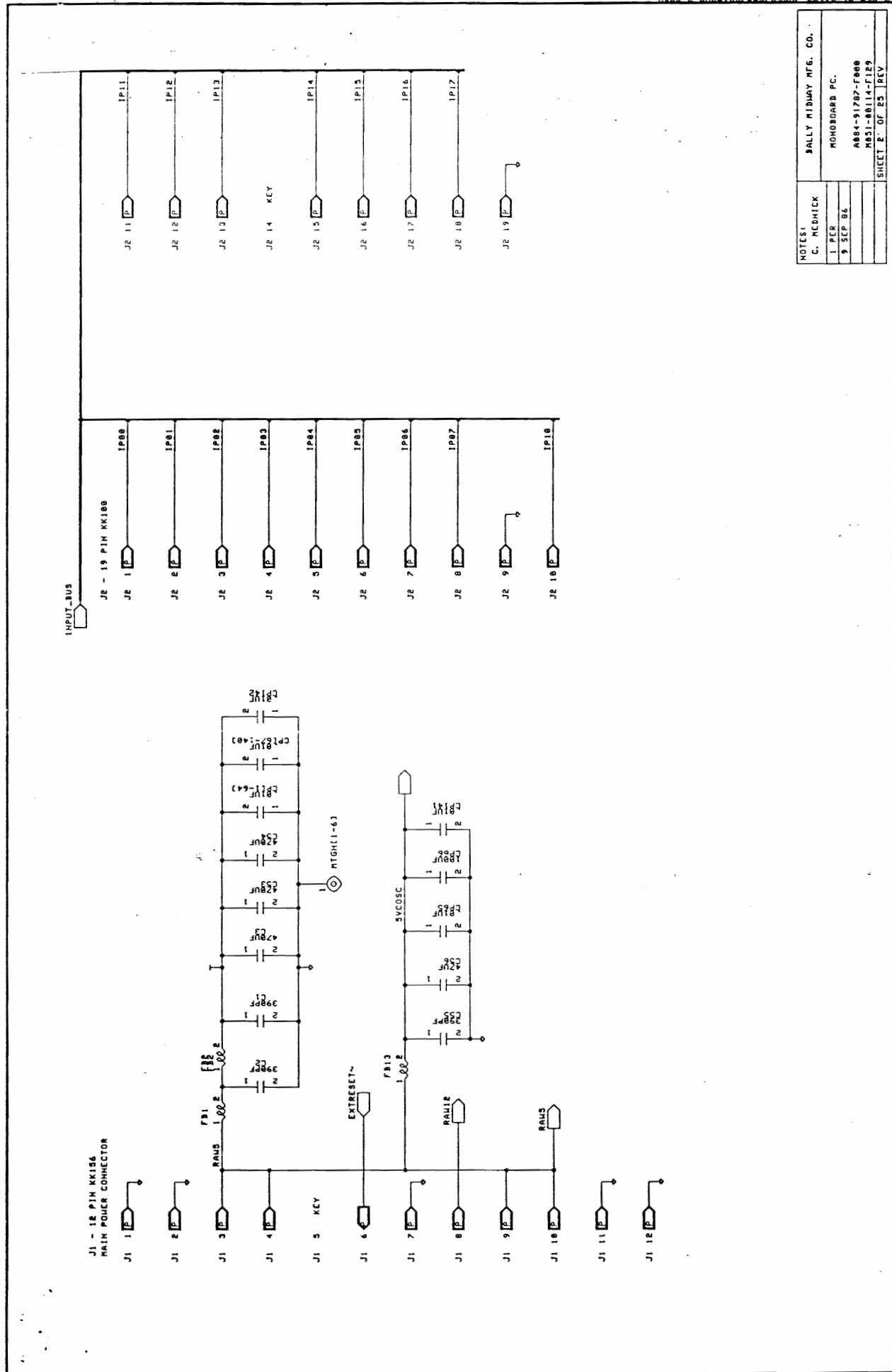
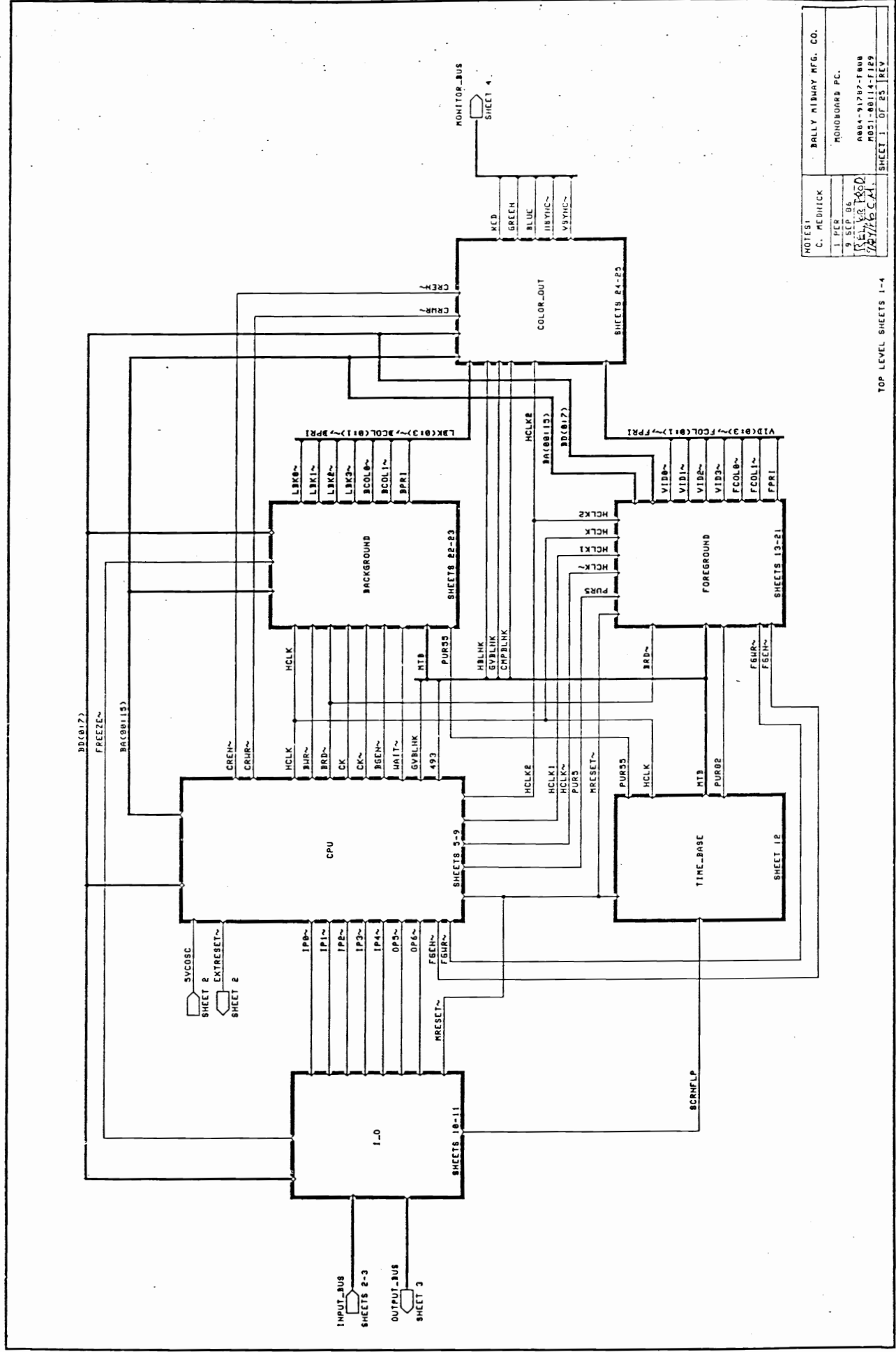
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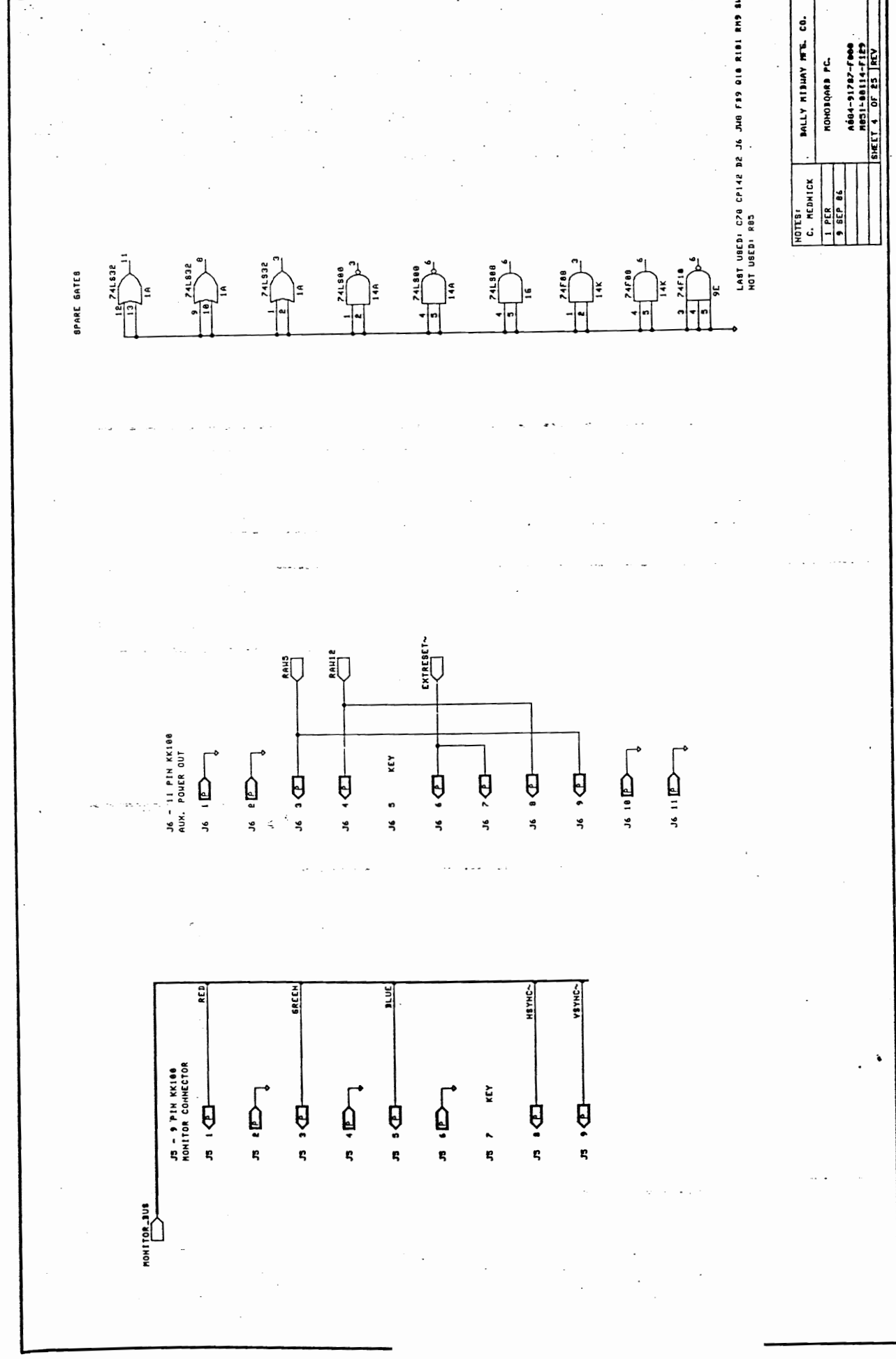
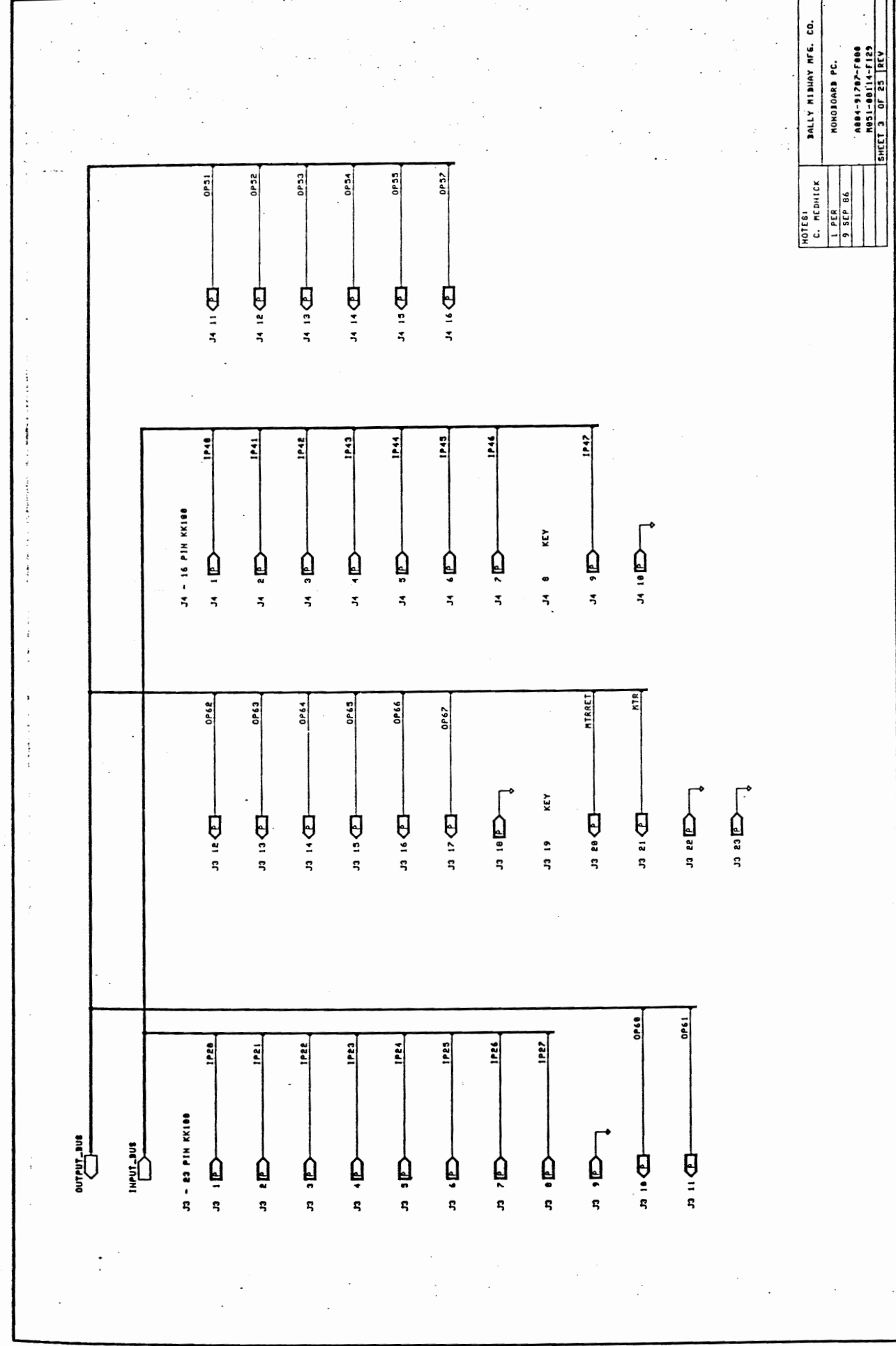
DESCRIPTION	DESIGNATION NO.
IC 1G	74LS08
IC 2G	74LS138
IC 3G	74LS157
IC 4G	MMC01A HAL
IC 5G	MMC03B HAL
IC 6G	74F157
IC 7G	74LS283
IC 8G	74LS173
IC 9G,10G	74LS169
IC 11G	2018 2Kx8 RAM 45NS
IC 12G	74LS374
IC 13G	74LS258
IC 14G	74LS194
IC 1H	74LS32
IC 2H	74F174
IC 3H	74LS273
IC 4H	74LS08
IC 5H	PAL
IC 6H	MMC02B HAL
IC 7H	74F86
IC 8H	74LS86
IC 9H	74LS374
IC 10H	74F74
IC 11H	74LS374
IC 12H	74LS20
IC 13H	74LS258
IC 14H	74LS174
IC 1J	74LS55
IC 2J	PACNS REV 1.0 PLA
IC 3J	PACOUT REV 1.0 PLA
IC 4J	74LS175
IC 6J	74LS283
IC 7J	74LS02
IC 8J	74LS374
IC 9J	2018 2Kx8 RAM 45NS
IC 10J	74LS374
IC 11J	2018 2Kx8 RAM 45NS
IC 12J	74LS374
IC 13J	ROMNIRL REV 1.0 PLA
IC 14J	74LS161
IC 1K	74F04
IC 2K	7406
IC 3K	74LS74
IC 4K	74LS32
IC 5K,6K	74LS74
IC 7K	74LS169
IC 8K	74LS374
IC 9K	74LS169
IC 10K	2018 2Kx8 RAM 45NS
IC 11K	74LS374

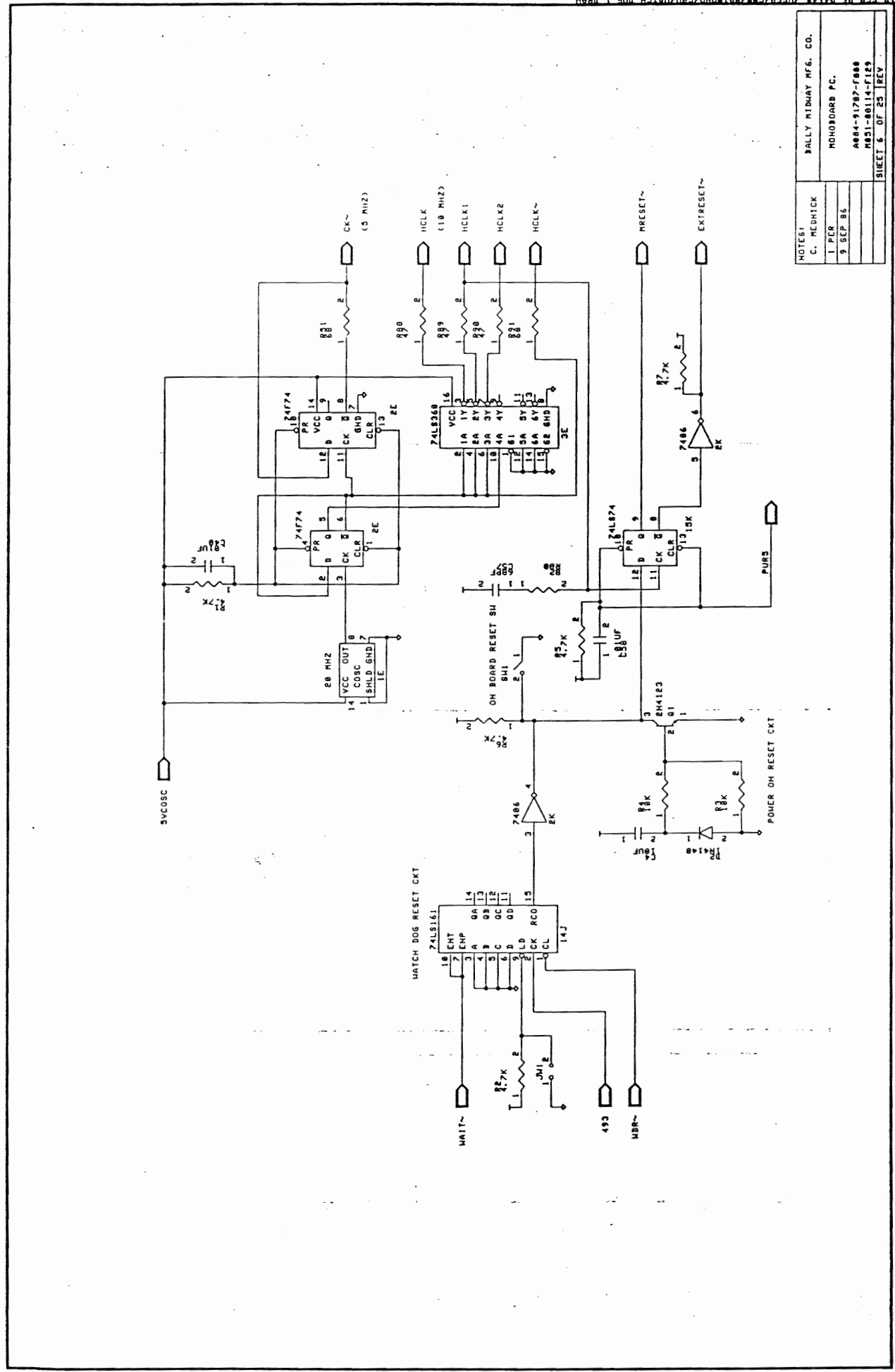
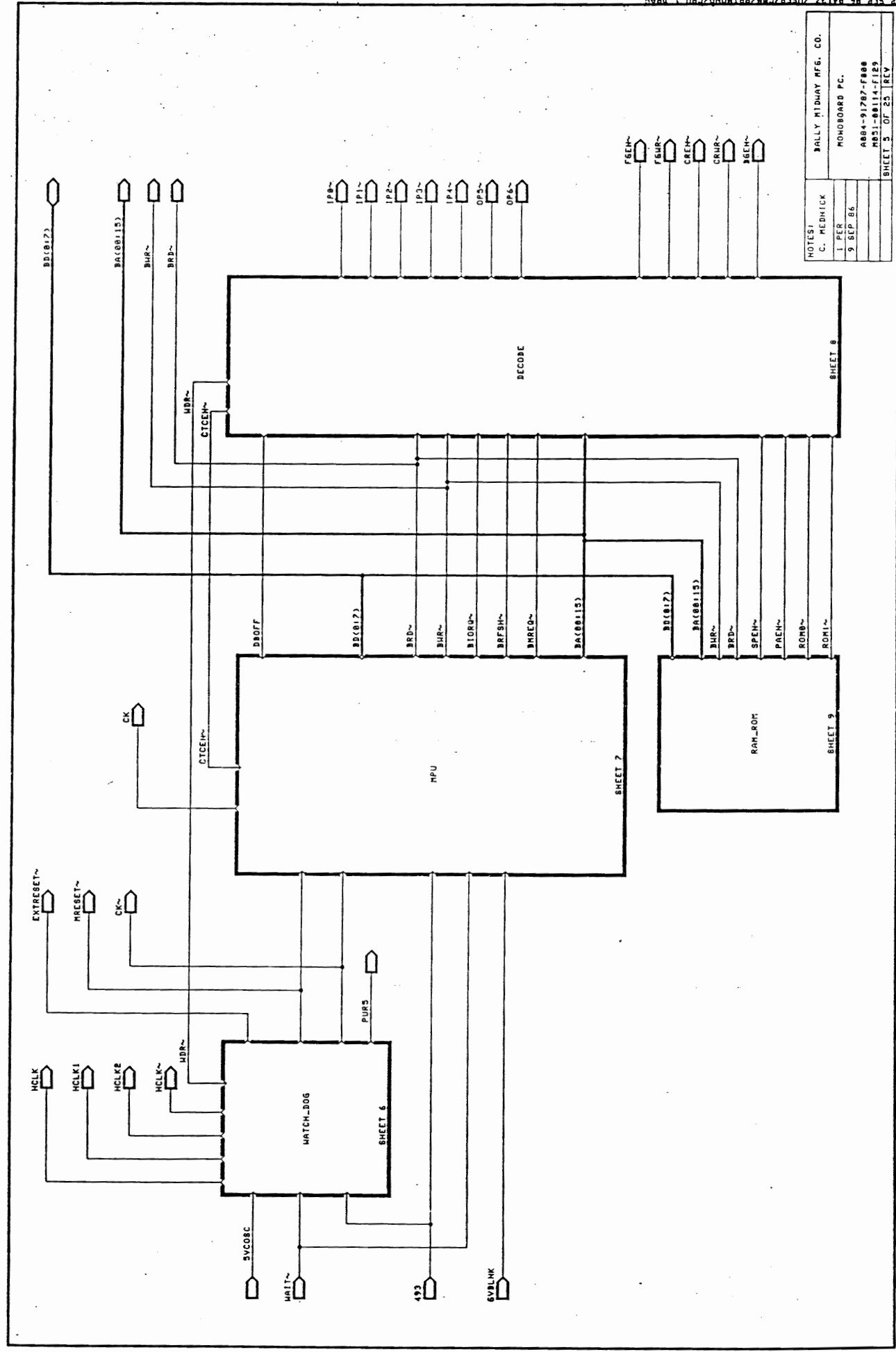
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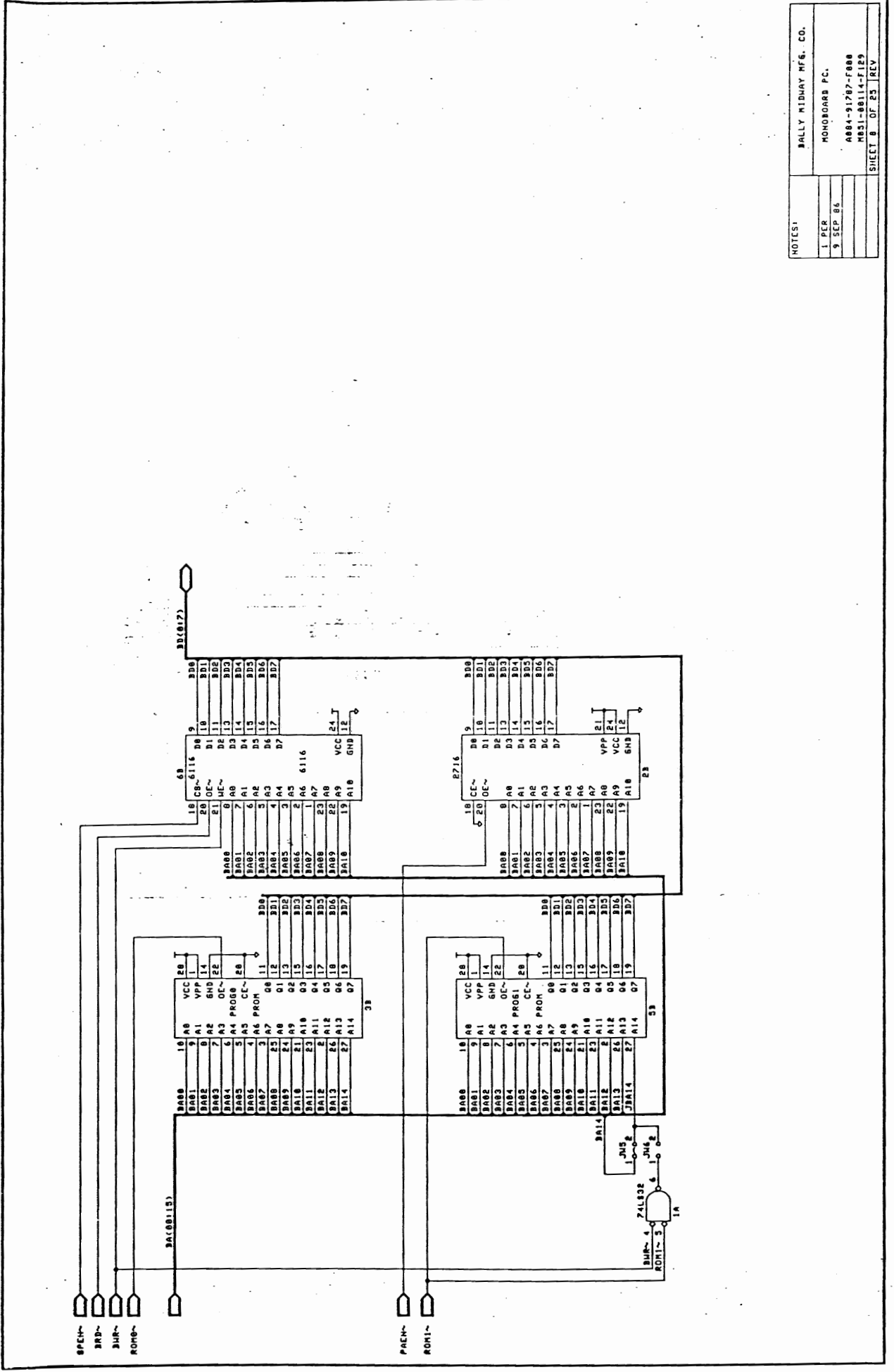
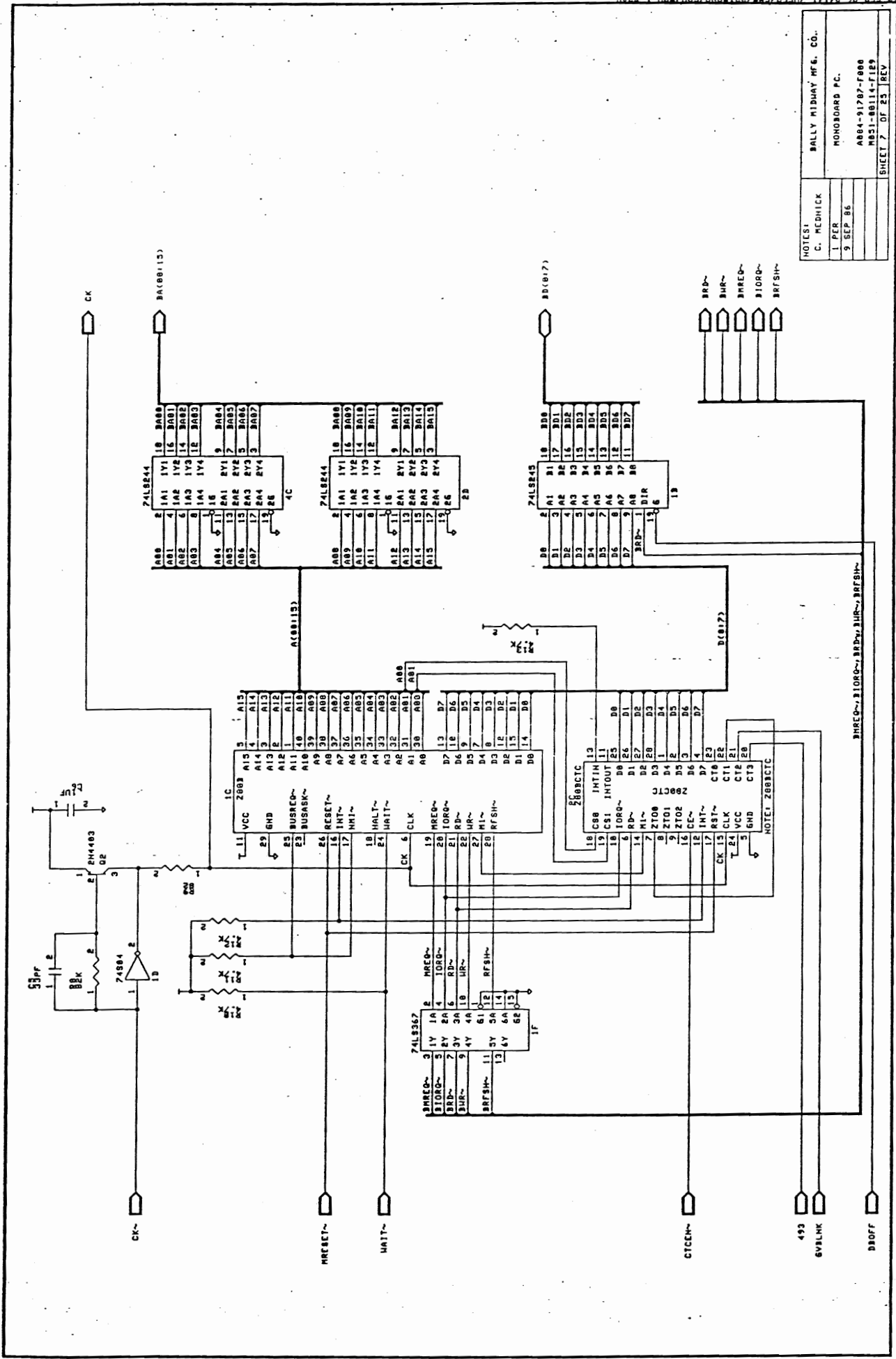
DESCRIPTION	DESIGNATION NO.
IC 12K	74LS298
IC 13K	74LS174
IC 14K	74F08
IC 15K	74LS74
ICS 4A,15A,3B,5B	28 PIN IC SOCKET (.600)
ICS 6B,9B,11B	24 PIN IC SOCKET (.600)
ICS 14B	28 PIN IC SOCKET (.600)
ICS 1C	40 PIN IC SOCKET (.600)
ICS 2C	28 PIN IC SOCKET (.600)
ICS 10C	24 PIN IC SOCKET (.300)
ICS 9D	24 PIN IC SOCKET (.300)
ICS 3E	16 PIN IC SOCKET (.300)
ICS 4E-6E,8E	28 PIN IC SOCKET (.600)
ICS 4G	24 PIN IC SOCKET (.300)
ICS 5G	20 PIN IC SOCKET (.300)
ICS 11G	24 PIN IC SOCKET (.300)
ICS 5H	20 PIN IC SOCKET (.300)
ICS 6H	24 PIN IC SOCKET (.300)
ICS 2J,3J	20 PIN IC SOCKET (.300)
ICS 9J,11J	24 PIN IC SOCKET (.300)
ICS 13J	20 PIN IC SOCKET (.300)
ICS 10K	24 PIN IC SOCKET (.300)
FBI-FB13	FERRITE BEAD
SW1	SWITCH PC. MITG.
SW2	10 POS. DIP SWITCH
JW1-JW6	JUMPER
J1	AUTO INSERT PINS TIN .045 SQ. PIN
J2-J6	AUTO INSERT PINS TIN .025 SQ. PIN
MHQ3	SNAP
PC BOARD	A080-91787-F000

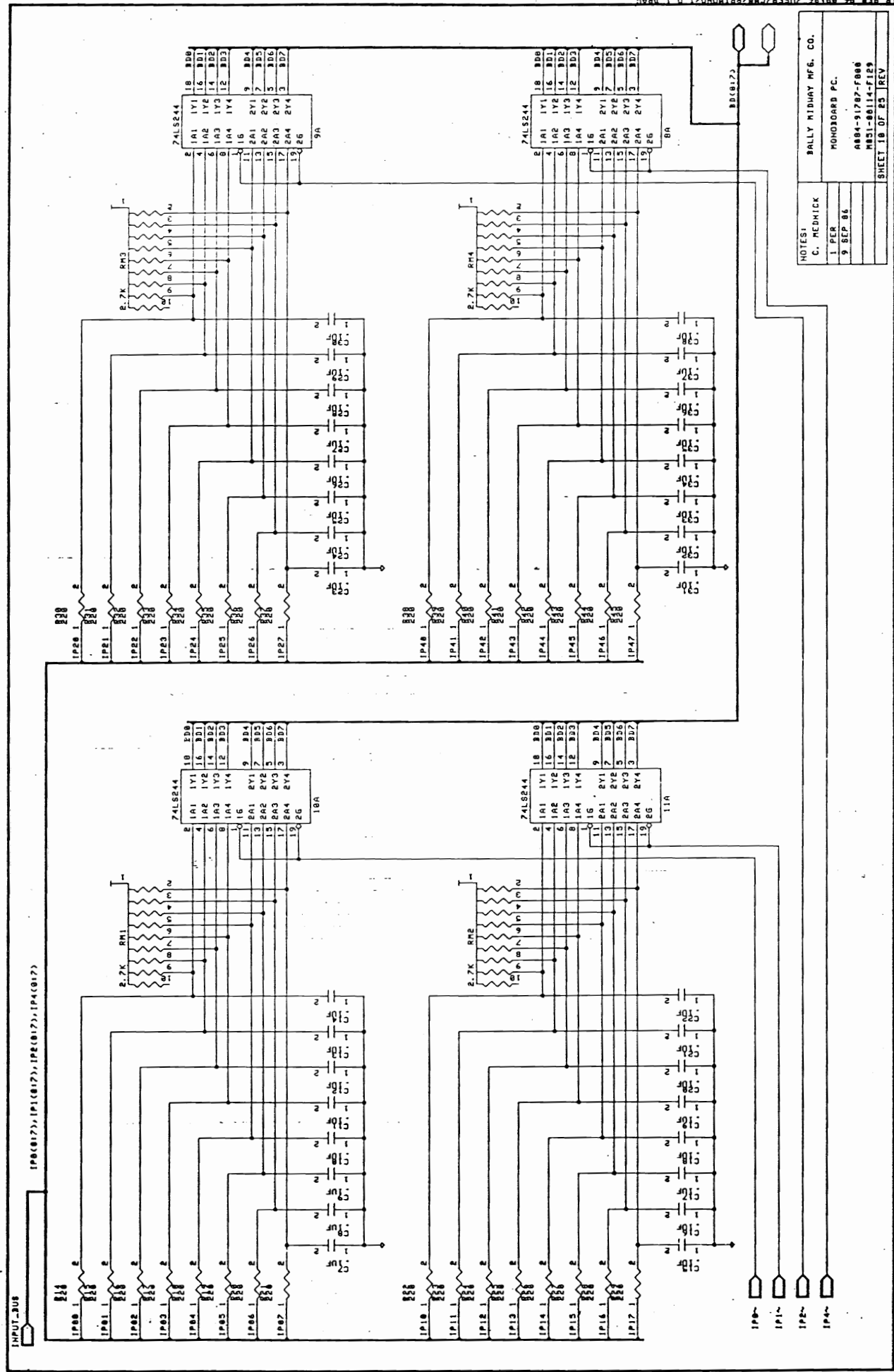
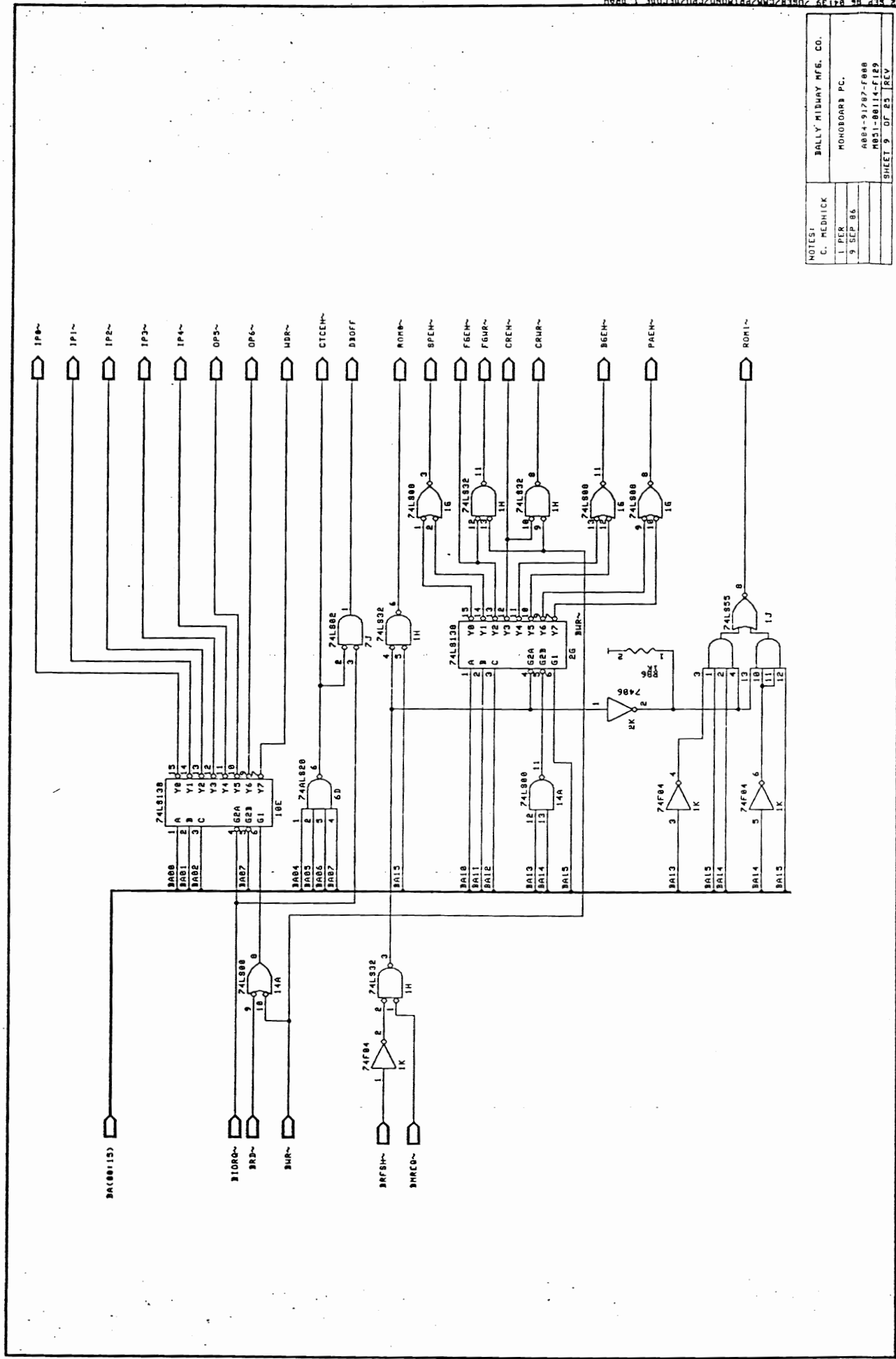
Released 12 Sept. 86 CMM  
Rev. 1 - 20 Nov. 86 moved 5H to chart. CMM





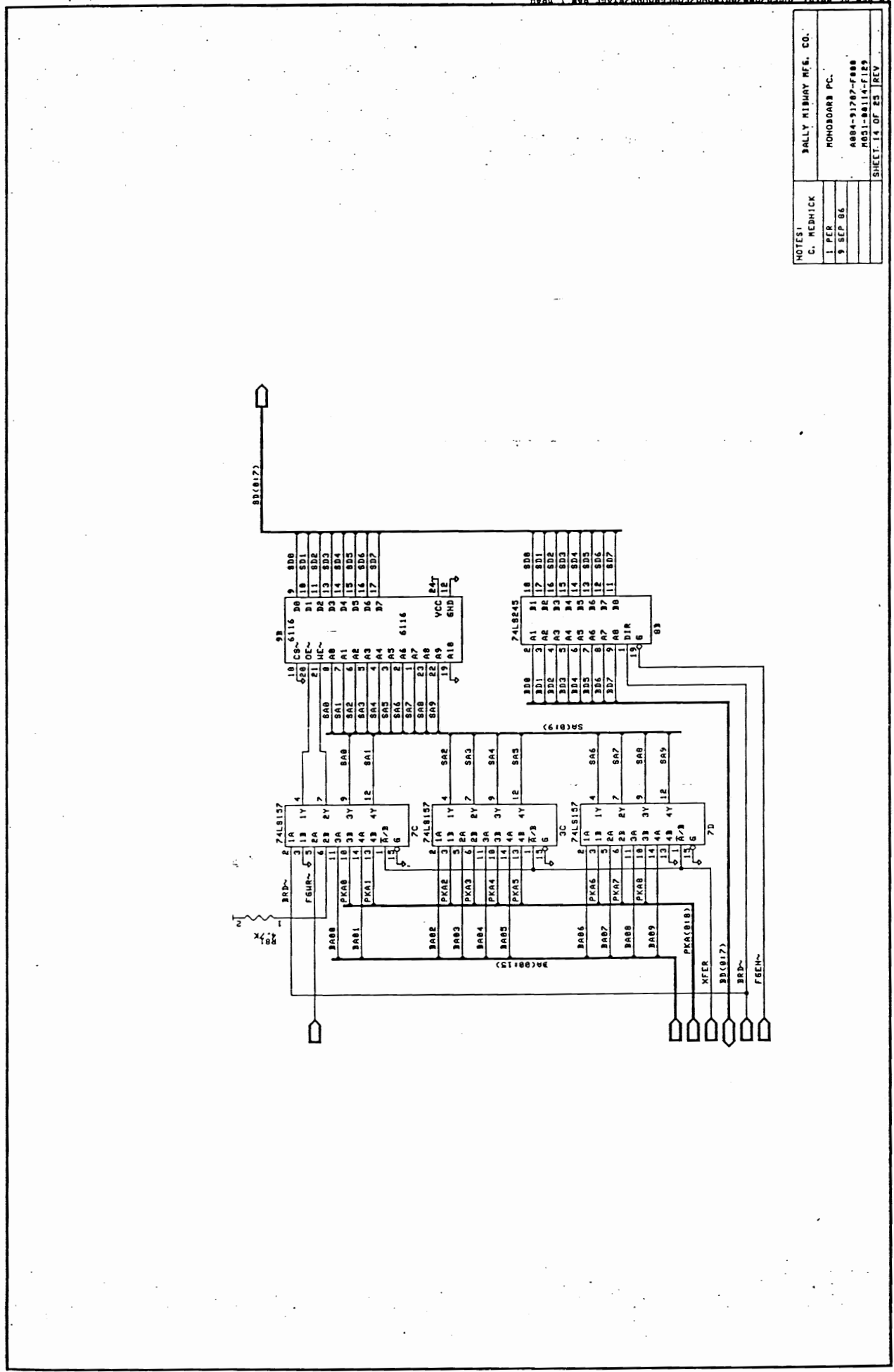
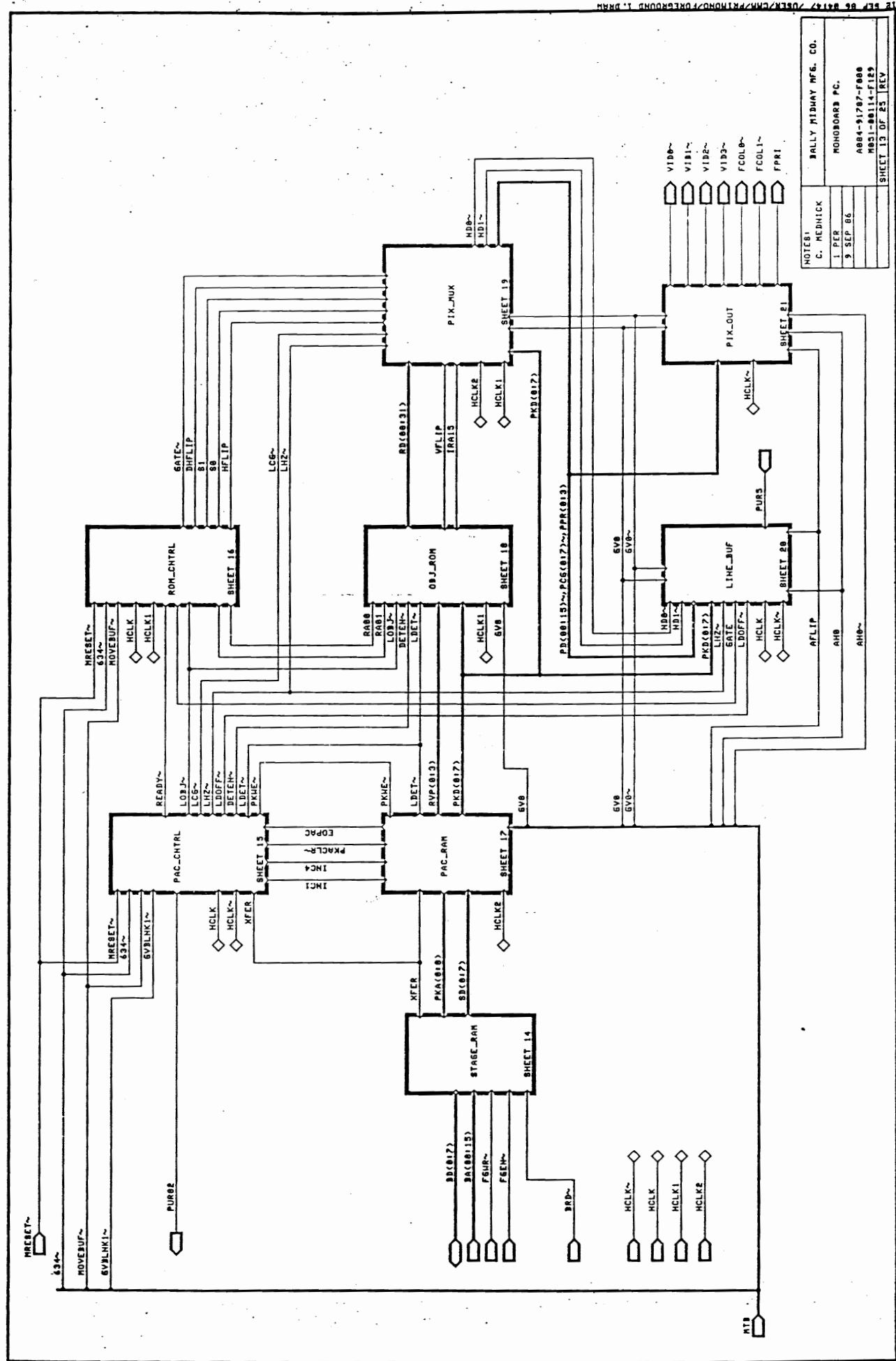




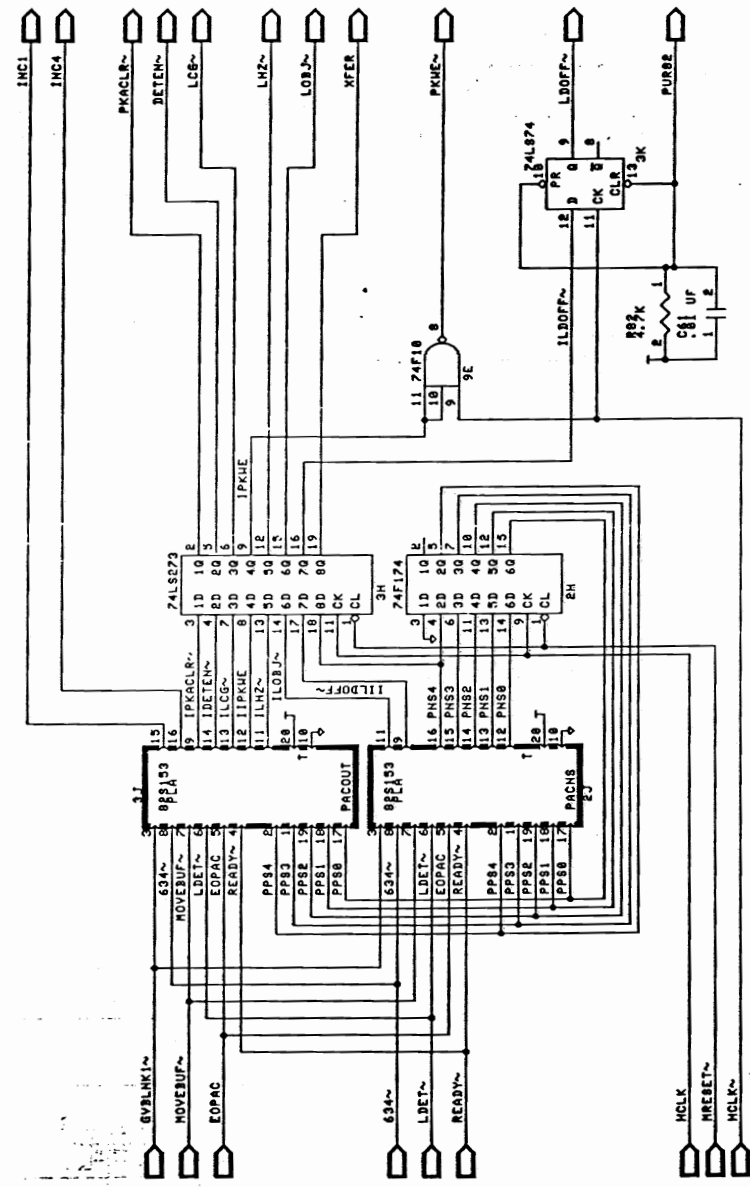






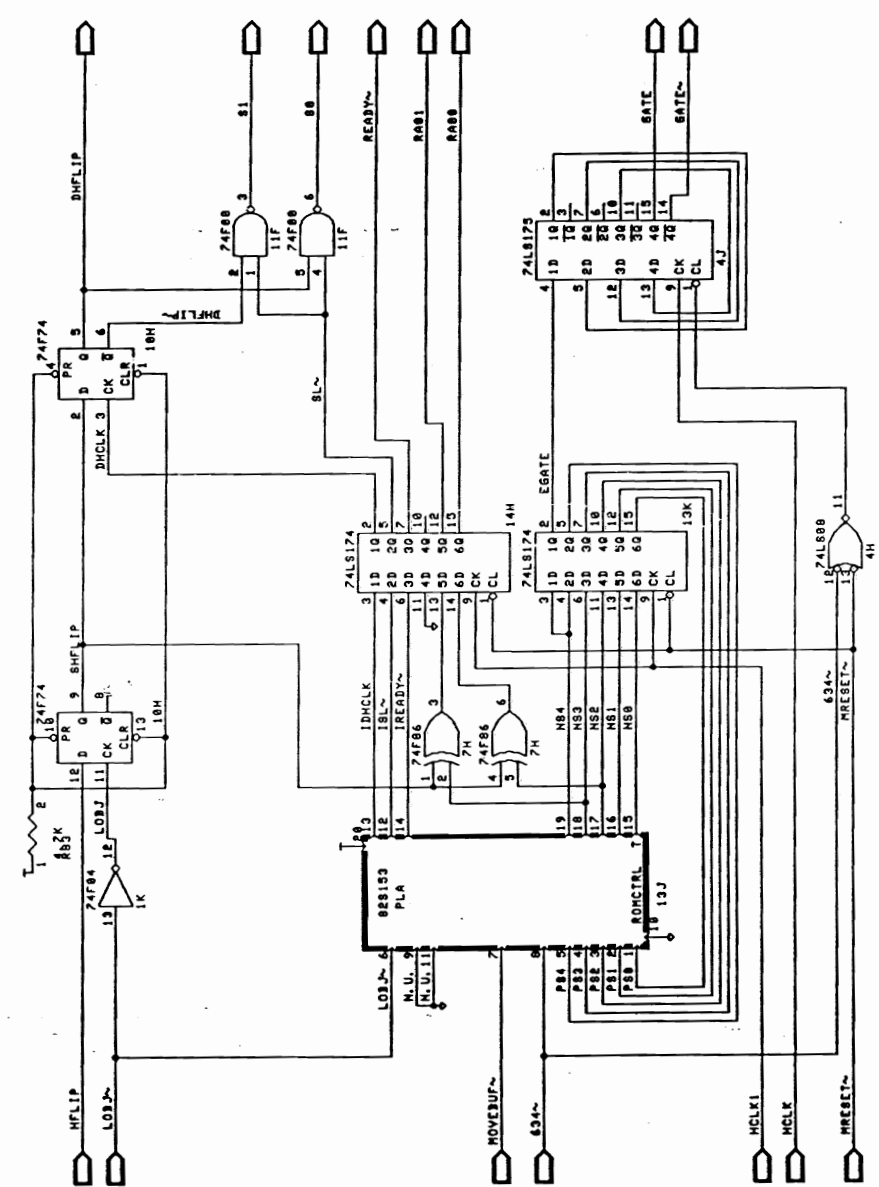






NOTES:  
 C. MEDNICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARD PC.  
 A884-91787-F888  
 M851-88114-F189  
 SHEET 15 OF 25 REV

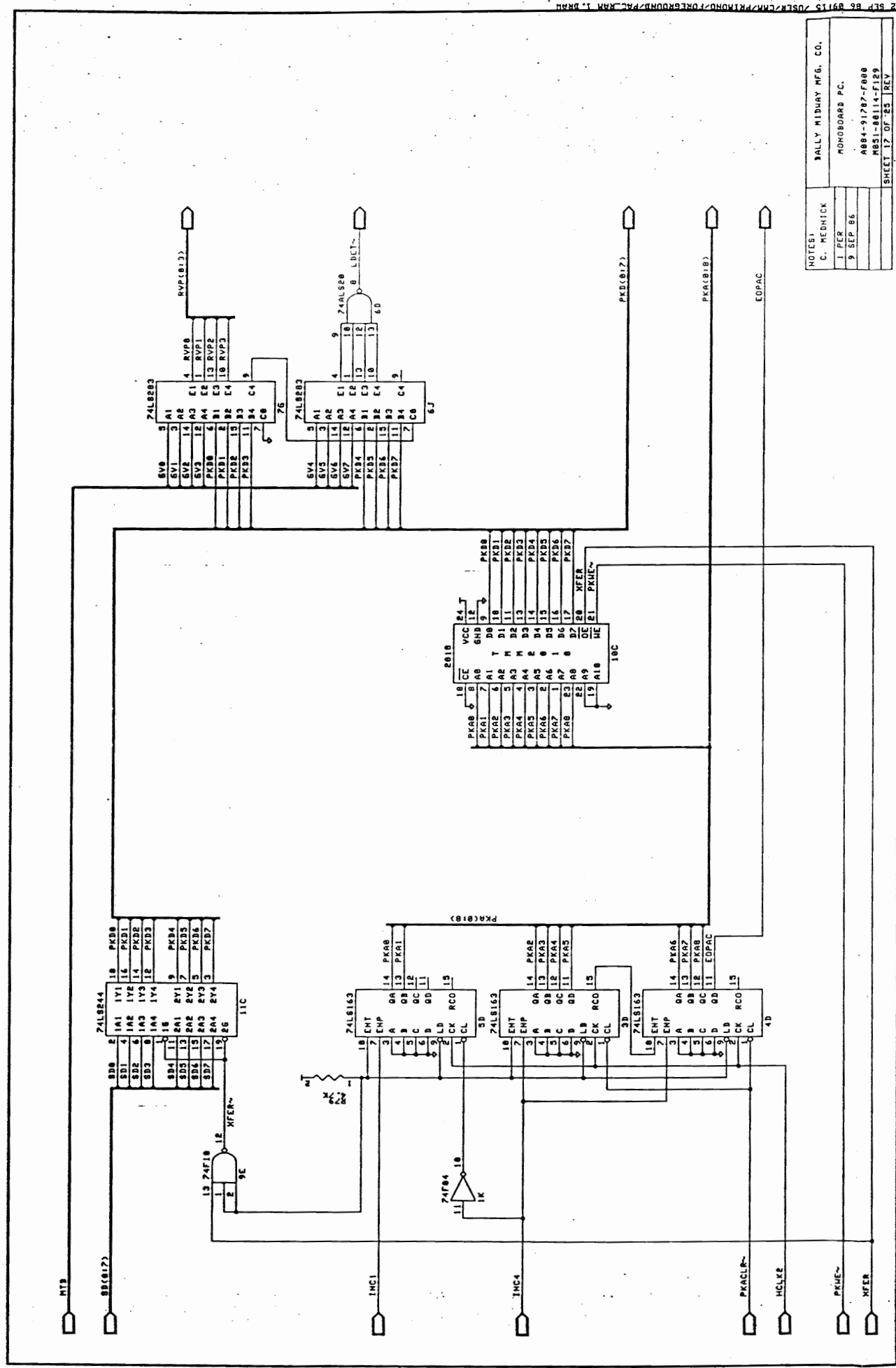


NOTES:  
 C. MEDNICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARD PC.  
 A884-91787-F888  
 M851-88114-F189  
 SHEET 15 OF 25 REV

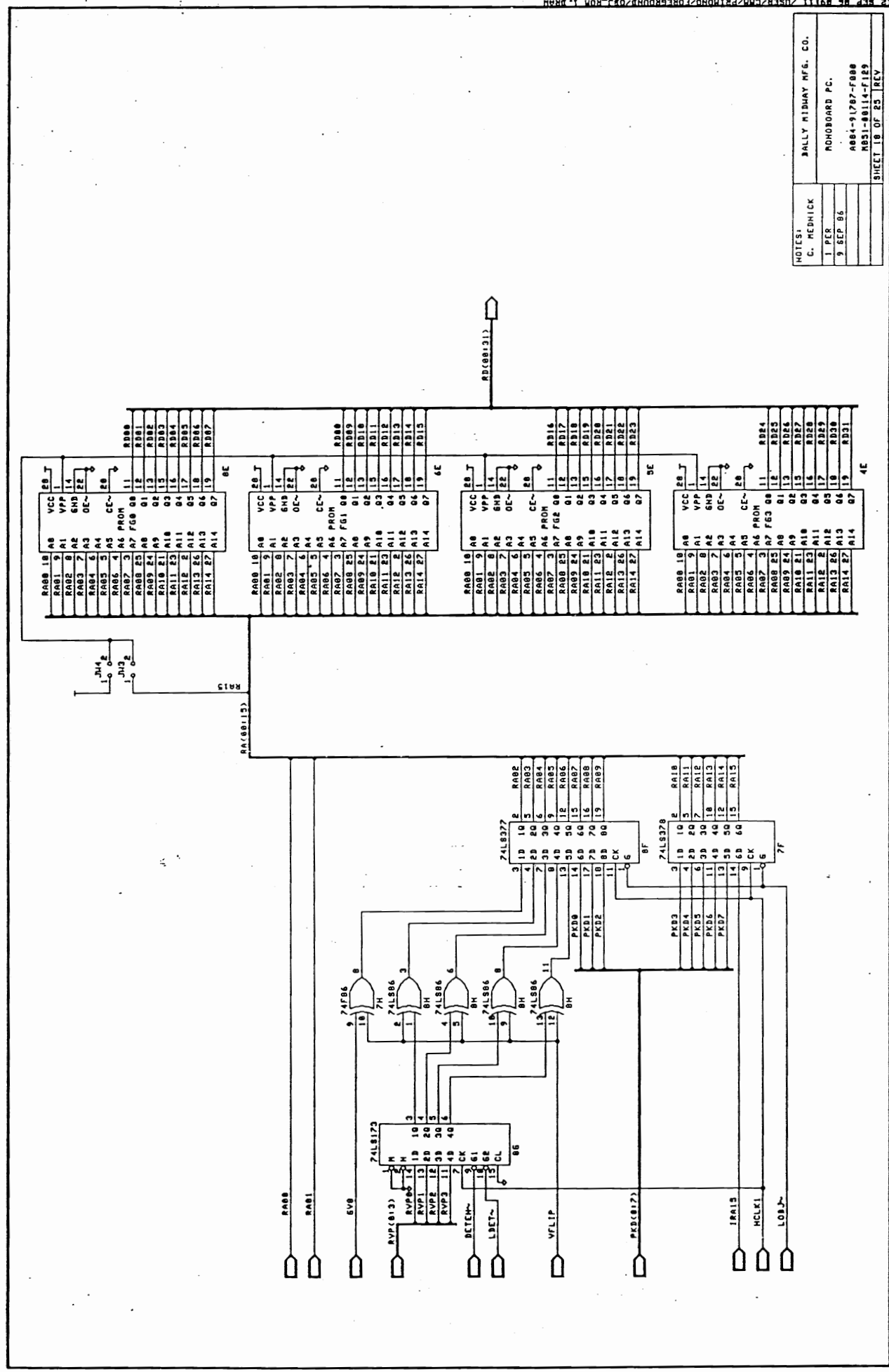
18 SEP 86 09:12 Z052R/CMP/PRIMORD/FOREGROUND/PAC.CHNK.1.DRAW

18 SEP 86 09:12 Z052R/CMP/PRIMORD/FOREGROUND/PAC.CHNK.1.DRAW



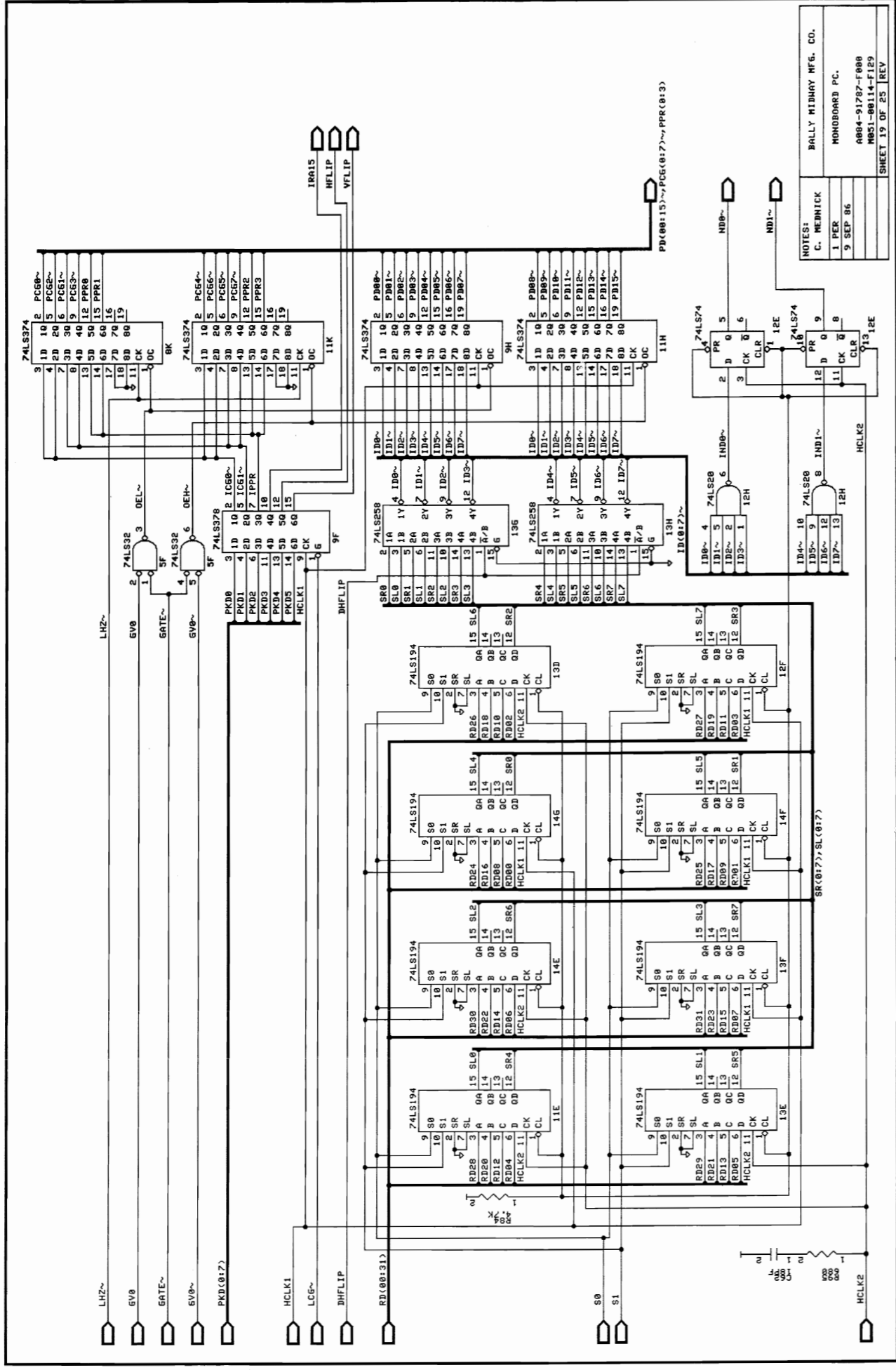
NOTES:  
 C. MEDNICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARD PC.  
 A884-91787-F888  
 M851-88114-F189  
 SHEET 17 OF 85 REV

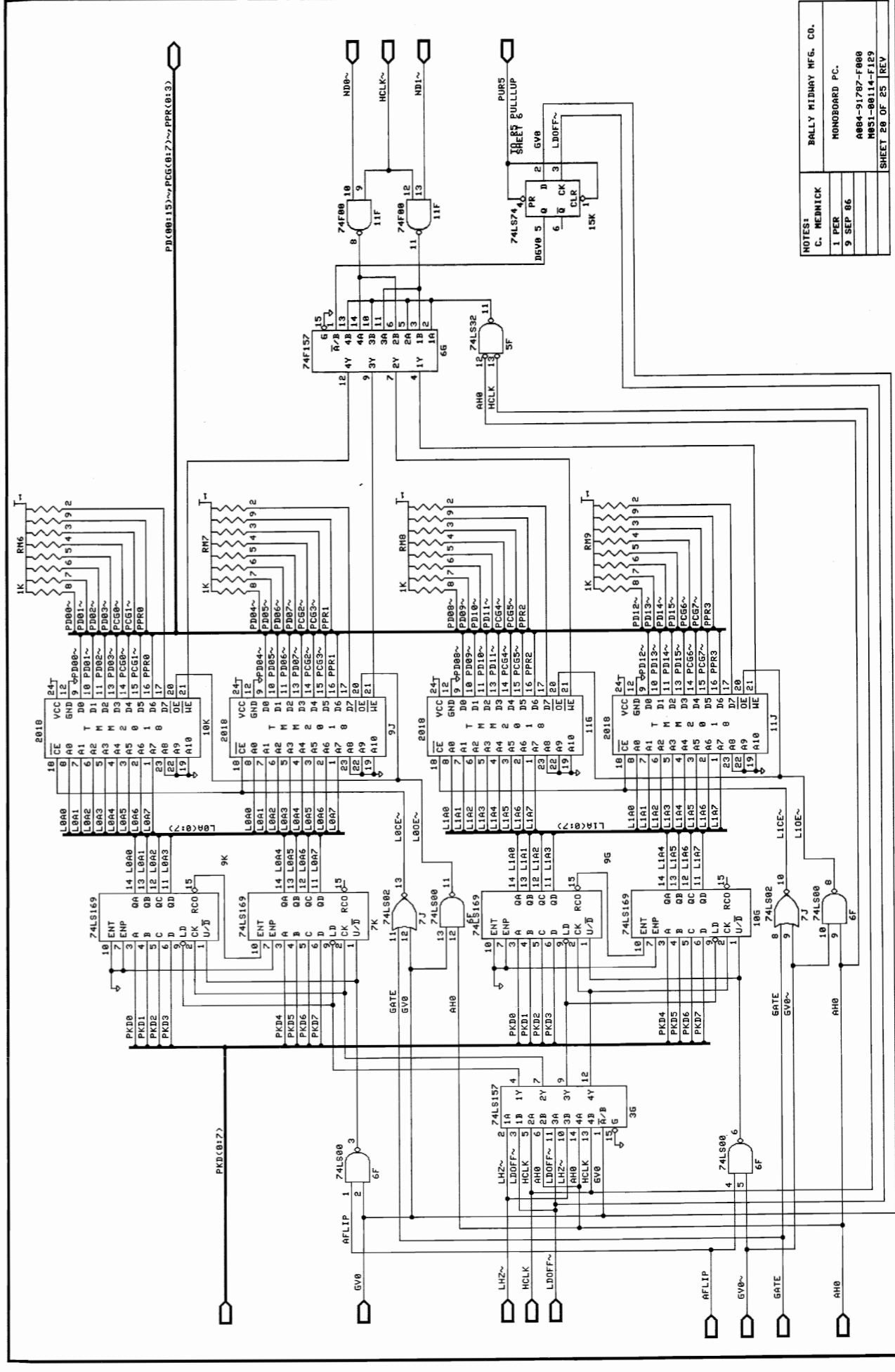


NOTES:  
 C. MEDNICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARD PC.  
 A884-91787-F888  
 M851-88114-F189  
 SHEET 18 OF 85 REV

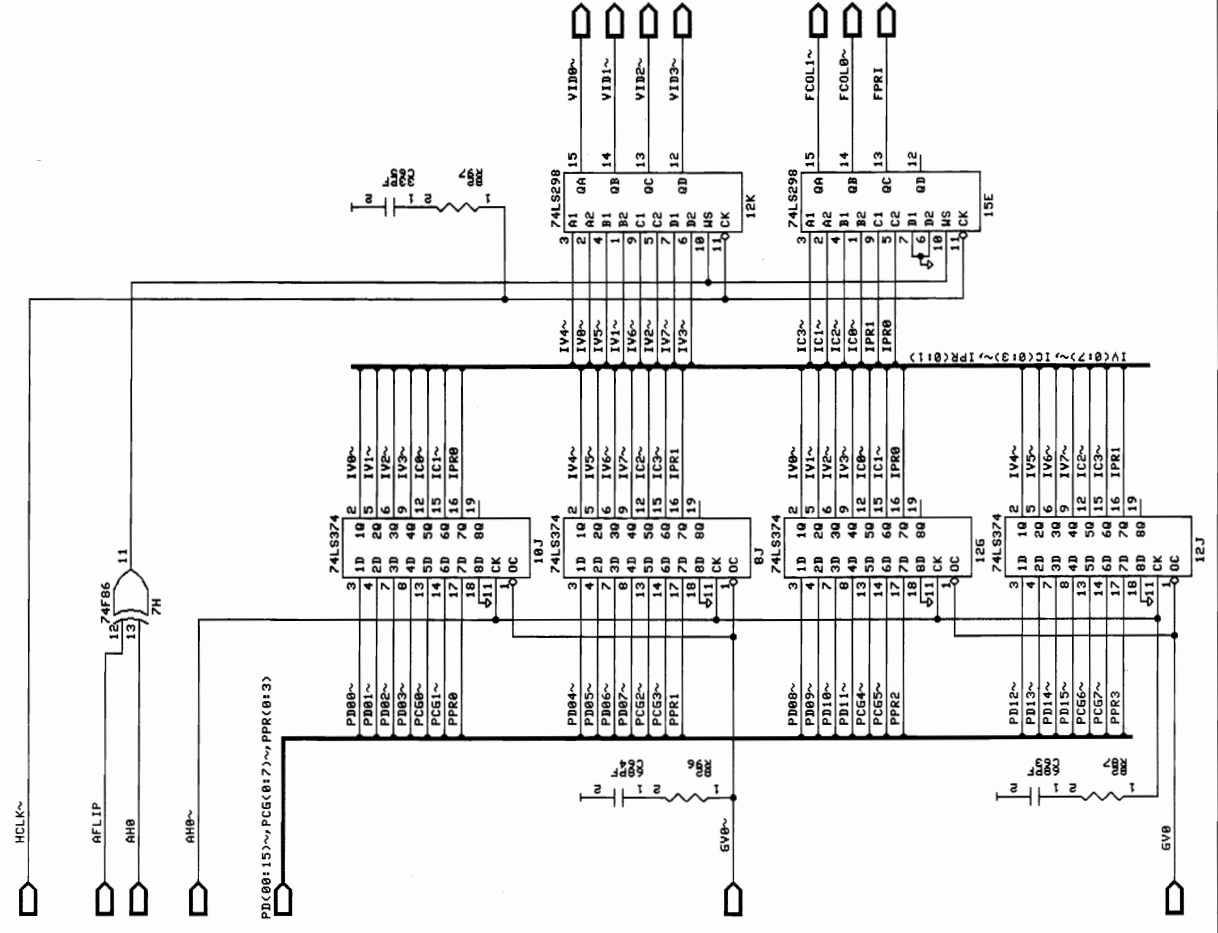


NOTES:  
 C. WEINICK  
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 9 SEP 86  
 MONOBOARD PC.  
 A884-91787-F088  
 M851-88114-F129  
 SHEET 19 OF 25 REV

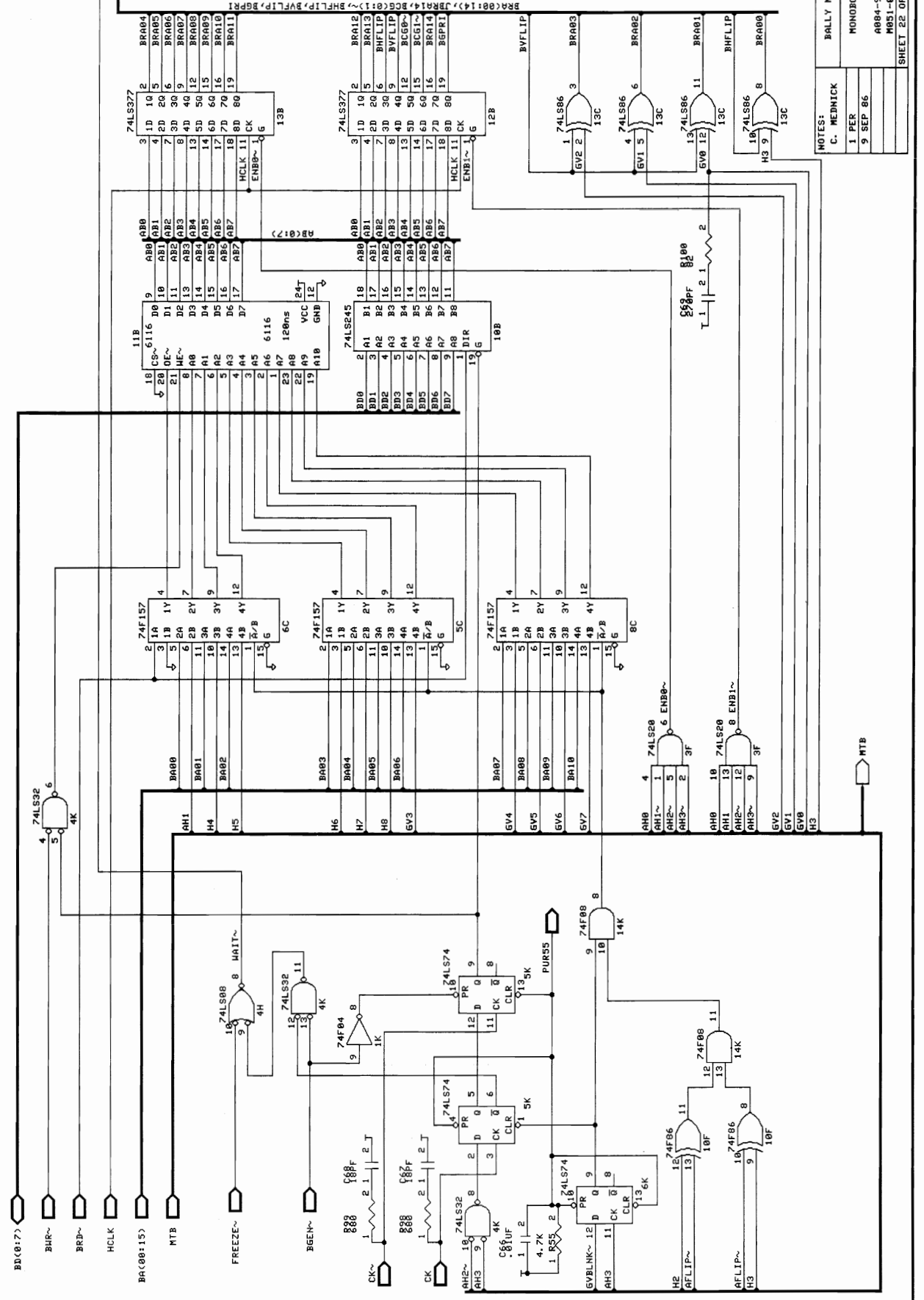


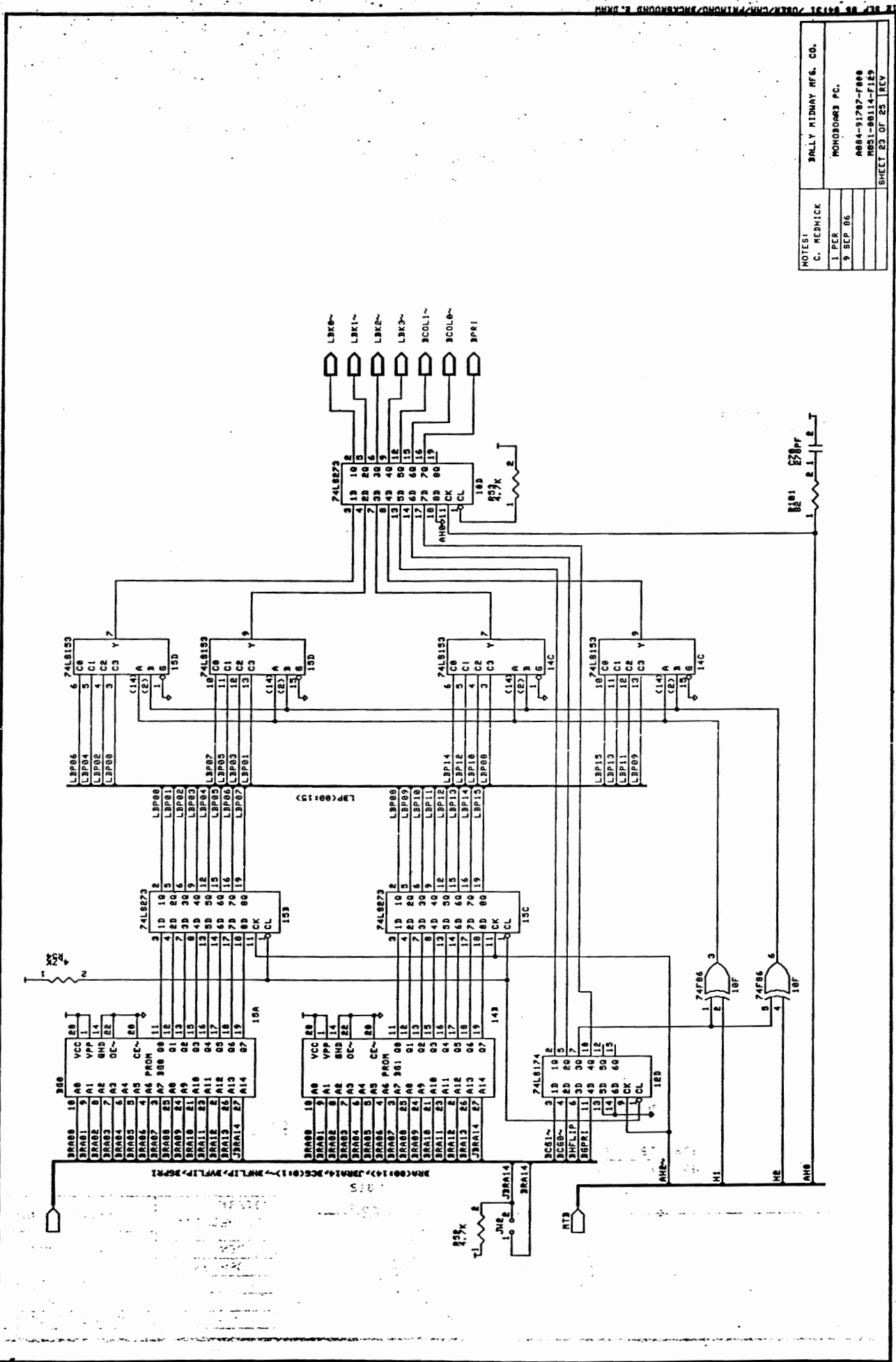
NOTES:  
 C. WEINICK  
 1 PER  
 9 SEP 86  
 MONOBOARD PC.  
 A884-91787-F088  
 M851-88114-F129  
 SHEET 28 OF 25 REV

NOTES:  
 C. MEDNICK  
 MONDBOARD PC.  
 1 PER 86  
 9 SEP 86  
 A884-91787-F088  
 M851-80114-F129  
 SHEET 21 OF 25 REV



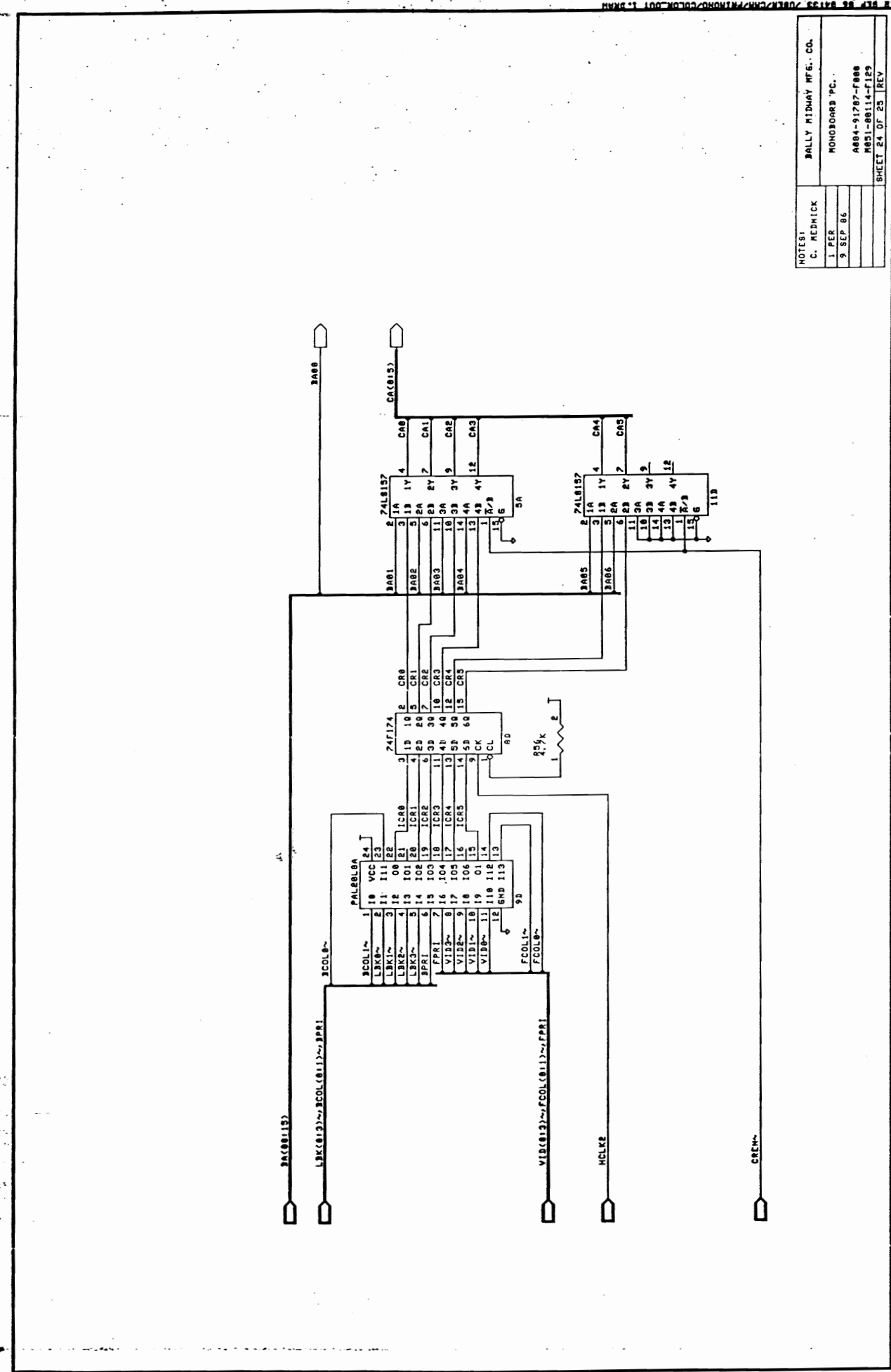
NOTES:  
 C. MEDNICK  
 MONDBOARD PC.  
 1 PER 86  
 9 SEP 86  
 A884-91787-F088  
 M851-80114-F129  
 SHEET 22 OF 25 REV





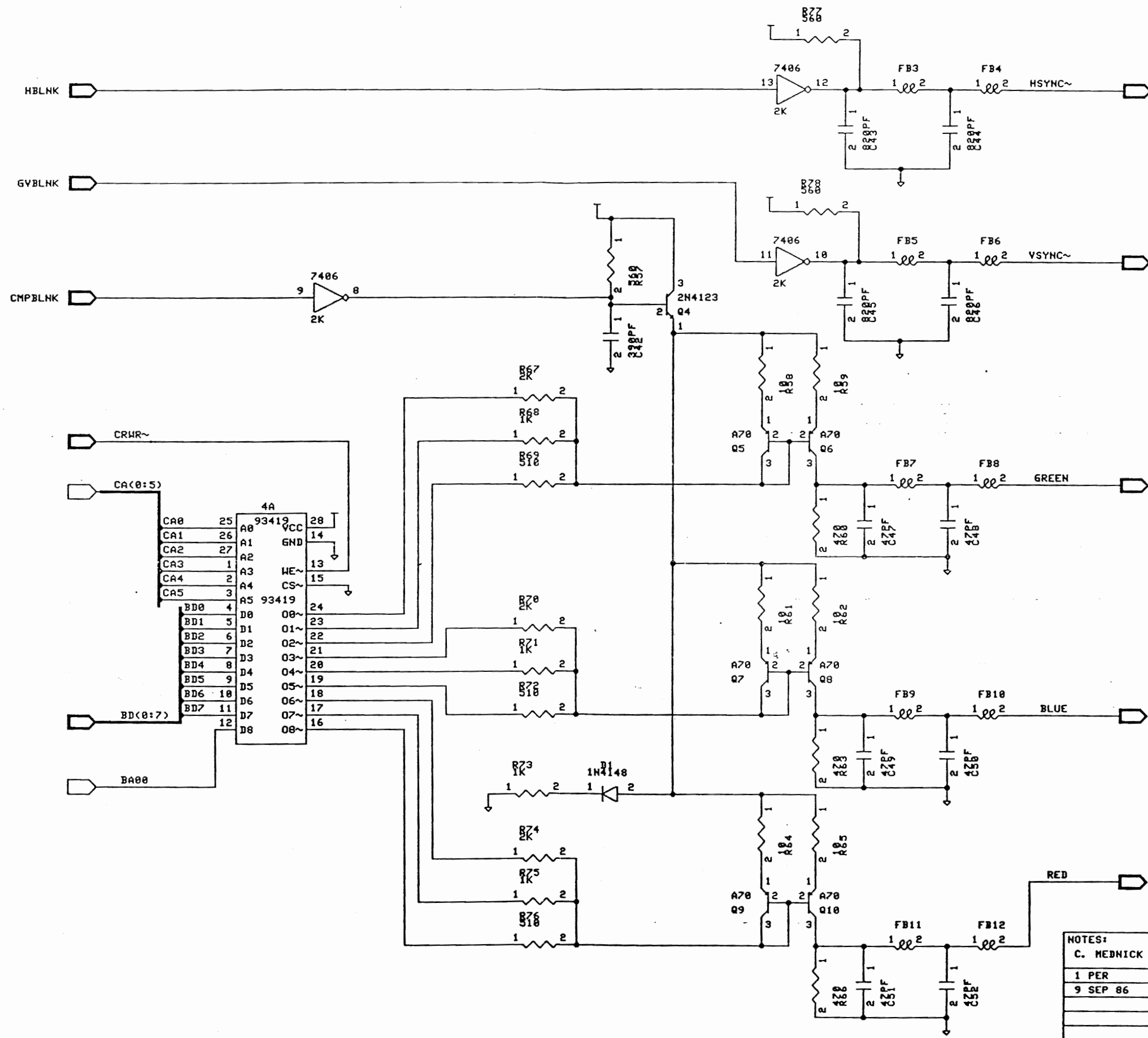
NOTES:  
 C. REDMICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARDS PC.  
 A884-91787-F088  
 M851-88114-F129  
 SHEET 23 OF 25 REV



NOTES:  
 C. REDMICK  
 1 PER  
 9 SEP 86

BALLY MIDWAY MFG. CO.  
 MONOBOARDS PC.  
 A884-91787-F088  
 M851-88114-F129  
 SHEET 24 OF 25 REV



NOTES:	BALLY MIDWAY MFG. CO.
C. MEDNICK	MONOBOARD PC.
1 PER	A004-91787-F000
9 SEP 86	M051-00114-F129
	SHEET 25 OF 25 REV

1E SEP 86 04:35 /USER/CMP/PRTRMONO/COLOR\_OUT 2.DRAW