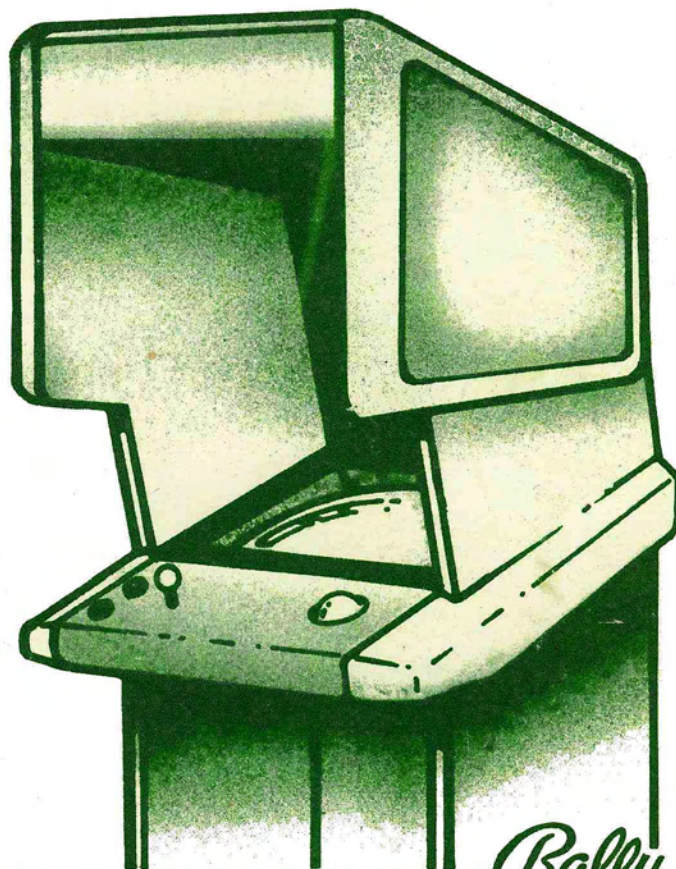


SAC 1A

SERVICE MANUAL



Bally

SENTE™

10601 W Belmont Avenue
Franklin Park, Illinois 60131
U.S.A.

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

FORM-00495-8505

I. 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.

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! To avoid shocks, do not plug in the game until it has been inspected and 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 grounding 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.

. . . When A Game Loses Its Appeal — You Plug A New Cartridge Into Game Frame.

Because different locations require different games, Bally Sente offers a wide selection of interchangeable games — eight entirely different games.

Change Games Fast

With the new **Sente System** there is no need to truck 350-pound games from location to location. In fact, the only "moving parts" are contained in the easy-to-carry SAC PAC™ which makes changing games quick and easy.

SAC PAC game kits include a 14-ounce game cartridge and a bright attract panel that slip quickly into the game frame. And, unlike other systems, the SAC PAC includes a complete new control panel specifically designed for each game. This means that Sente game designers are never limited to create a game around an existing set of controls that cannot be changed.

With the Sente System all you'll need to change a game is an Allen wrench and about 15 minutes.

Each game is designed to create new excitement. New levels of player involvement. With highly detailed graphics and sophisticated sounds.

Game Production

Bally Sente game production will be orchestrated by another Bally subsidiary, **Bally Midway Manufacturing** at its Franklin Park, Illinois, facility near Chicago. Bally Midway has manufactured several of the most successful video games in the industry, including "Pac-Man" and "Ms. Pac-Man" and "Space Invaders".

SAC 1 games which made their world premiere in Chicago are:

- **"Chicken Shift"** in which four fertile hens send their eggs on a harrowing journey down player controlled ramps and tubes on the way to awaiting cartons.
- **"Goalie Ghost"** where the player directs the "split screen" actions of a fast moving goal defender.
- **"Snacks N' Jaxson"** features a ravenous clown who seeks to devour floating foods as they guide around his surrealistic kitchen.
- **"Off The Wall"**, a combination of paddle ball, tennis and ping pong that gives the participant the chance to ricochet the ball around the court and score a point on his opponent.
- **"Stocker"**, a speedy coast to coast highway racing game that gives players the chance to conserve fuel, avoid obstacles and display driving skills and fast reaction times in a cross country race.
- **"Hat Trick Hockey Game"**, each player guides one hockey player over the ice using a joystick for movement and a button to take shots. The joystick is also used to move the players goalie. The game may be played by one or two players. The movement of hockey players over ice is realistically portrayed in the game.
- **"Trivial Pursuit"** this new game is compatible with all Sente Arcade Computer (SAC 1) interchangeable game system offerings.

Technical Troubleshooting

Introduction

The most common problems occur in harness components such as the coin acceptor, player controls, interconnecting wiring, etc. The TV monitor and PCB computer cause their share of problems too, but not as much as the harness and its component parts. TV monitor troubleshooting will not be covered here because it is covered in that section of this manual.

As you already know, the PCB computer is a complex device with a number of different circuits. Some circuits remain basically the same among games, but overall there are a great many differences between them. PCB troubleshooting procedures, therefore, can be lengthy and will differ greatly among games.

General Suggestions

The first step in any troubleshooting procedure is correctly identifying the malfunction's symptoms. This includes not only the circuits or features malfunctioning, but also those still operational. A carefully trained eye will pick up other clues as well. For instance, a game in which the computer functions fail completely just after money was collected may have a quarter shorting the PCB traces. Often, an experienced troubleshooter will be able to spot the cause of the problem even before opening the cabinet.

After all the clues are carefully considered, the possible malfunctioning areas can be narrowed down to one or two good suspects. Those areas can be examined by a process of elimination until the cause of the malfunction is discovered.

Harness Component Troubleshooting

Typical problems falling in this category are coin and credit problems, power problems and failure of individual features.

NO GAME CREDIT

For example, your prospective player inserts his quarter and is not awarded a game. The first item to check is if the quarter is returned. If the quarter is returned, the malfunction most certainly lies in the coin acceptor itself. First, use a set of test coins (both old and new) to ascertain that the player's coin is not undersize or underweight. If your test coins are also returned, coin acceptor servicing is indicated. Generally, the cause of this particular problem is a maladjusted magnet gate. Normally, this will mean slightly closing the magnet gate a little by turning the adjusting screw out a bit (see section on coin acceptor for more details).

If the quarter is not returned and there is no game credit, the cause of the malfunction may be in one of several areas. First try operating the coin return button; if the coin is returned, the problem is most likely in the magnet gate. Enlarge the gap according to the coin acceptor service procedures. If this does not cure the problem, remove the coin acceptor, clean it and perform the major adjustment procedure.

If the trapped coin is not returned when the wiper lever is actuated, you may have an acceptor jammed by a slug, gummed up with beer, a jammed coin chute, or mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If so, simply remove the slug 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 as indicated in the coin acceptor service procedures.

If the coin is making its way through the acceptor (that is, falling into the coin box), yet there is still no game credit, you either have a mechanical failure of the coin switch or electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are the make/break variety of micro switch, which is checked by testing for continuity between the NO, NC, and C terminals. When not actuated, the NC and C terminals should be continuous and the NO terminal open. When operated, the NO and C terminals should close and the NC should be open. If the coin switch checks out, examine the connections to the terminals to make sure there is good contact. If necessary, use the continuity tester and check from the terminal lug on the switch to the associated PCB trace. This will tell you if there is a continuous line all the way to the credit circuit.

If the coin switch wires do not check out, the problem is in the computer — most likely in the coin and credit circuitry.

If you do get game credit when a coin is deposited, but the game will not start when the start switch is pressed, you may have a problem in the start switch, the interconnecting wiring or in the computer. First check the switch. If the switch is OK, proceed to check the wiring. Again, make sure you go from the terminal lug on the switch to the PCB trace. This way, you will check the terminal contact as well as PCB edge connector contact. If the wiring is continuous, proceed to check the PCB credit circuit. If not, check each section of the wiring, until the discontinuity is located. If the wiring is OK, the problem must lie in the computer.

Transformer and Line Voltage Problems

Your machine must have the correct line voltage to operate properly. If the line voltage drops too low, a circuit in the computer will disable game credit. The point at which the computer will fail to work will vary some from game to game, but no game will work on line voltage that drops below 105 VAC.

Low line voltage may have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies. Peak usage times occur mainly at dawn or dusk, so if your machine's malfunction seems to be related to the time of day, this may be a factor. A large load connected to the same line as the game (such as a large air conditioner or other device with an exceptionally large motor) may drop the line voltage significantly when starting up. This drop can result in an intermittent credit problem. In addition, poor connections in the location wiring, plug, or line cord may also cause a significant drop in power. Cold solder joints in the game's harness, especially in areas like the transformer connections, interlock switch, or fuse block, may also produce the same results, although probably on a more permanent basis.

Sometimes location owners (especially in bars) replace light switches with dimmer rheostats, and the game is sometimes on the same line. Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned.

In any case, the way to check for correct line voltage is with your VOM. Set the VOM to 250 VAC and stick the probes in the wall receptacle. If it's OK here, check the transformer primary connections. If you do not get 117 VAC, examine the solder joints on the transformer, fuse block, and interlock switch. If you do get 117 VAC, the problem must be either in the transformer, harness connections, or in the PCB power supply.

If you suspect the transformer, check its secondaries with the VOM set to 50 VAC and correlate the readings with the legend on the side of the transformer. The transformer must also be correctly grounded, so check the ground potential as well, especially if there is a hum bar rolling up or down the TV screen.

HARNESS PROBLEMS

Other harness problems include blowing fuses and malfunctioning controls. The repeating blown-fuse problem can sometimes be quite exasperating to solve, for short circuits have the tendency to occur in areas almost impossible to find. First, try inserting a new fuse, as old fuses age and blow without cause. If the new one also blows, you definitely have a short.

The best way to approach this problem is by turning the power off and disconnecting devices that may be causing the problem, such as the TV, transformer, and PCB. Disconnect the devices by pulling off their connectors, but do not allow them to touch. If necessary, insulate them with small pieces of electrical tape. Then, connect your VOM across the terminals of the fuse block (all electrical power shut off), and set it to one of the resistance scales. This will save blowing a fuse each time you want to check the circuit.

If the VOM reveals that disconnecting the devices removed the short, reconnect the devices one by one until the short returns. The last device connected is the one that is at fault. If the VOM reads a short even after the devices are disconnected, the fault must lie in the harness itself, and only patient exploration will reveal its location. First, carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting connections or burned insulation. If necessary, use the VOM to check each suspected wire.

MALFUNCTIONING CONTROLS

One of the most common problems here is a bad potentiometer. Typically, a bad pot will cause the image to jump as it reaches a certain point. The only cure for this one is to install a new pot.

If a feature that is operated by a switch (for example, joysticks, foot pedals, control panel buttons) does not operate at all, check the switch with a VOM or continuity tester to verify its operation. If the switch does not check out, replace it. If the switch is OK, you should suspect the input to the switch from the PCB. In this case, get out the harness and logic schematics and check to see what kind of input it is. In many cases, the input will be +5 VDC. If so, use the VOM to check its presence. Normally, the switch is used to pull a +5 VDC line LOW to GND or to pull a LOW line HIGH. If the PCB output is missing, check the wire length from the PCB. If you find the signal at the PCB trace, the wire length or connection is at fault. If not, begin exploring the PCB using the logic schematics.

CONVERSION PROCEDURE FOR SAC 1A OR SAC 1

To Change Attract (Header) Art

1. Remove bolts holding in Attract Retainer located at top front of cabinet. Remove Attract Retainer.
2. Slide Attract Glass up and out of cabinet.
3. Remove old Attract Art and replace with new Attract Art.
4. Slide Attract Glass containing new art back into cabinet.
5. Replace and secure Attract Retainer.
6. Clean front of Attract Glass.

* To Change Control Panel Insert Assembly (SAC 1A or SAC 1)

1. Power off SAC 1A (SAC 1) unit using switch at rear of cabinet.
2. Unlock Coin Mech door and reach through to unlatch large front door from inside cabinet.
3. Unlatch two (2) clamps locating inside the cabinet at each end of Control Panel.
4. Disconnect the Control Panel Insert Assembly harness from the main harness of SAC 1A (SAC 1) unit.
5. **SAC 1A Unit:** Swing out Control Panel on its hinge.
SAC 1 Unit: Lift Control Panel up, slide to right and pull down to remove. Carefully pull Control Panel harness wiring out of opening at rear of Control Panel tray.
6. Remove bolts and nuts securing the old Control Panel Insert Assembly to the Control Panel. Remove old Insert Assembly.
7. Install new Control Panel Insert Assembly by reversing this procedure.
8. Power on SAC 1A (SAC 1) unit using switch at rear of cabinet.
9. Play game to check if all switches and controls are working properly.

To Change Game Cartridge

1. Power off SAC 1A (SAC 1) unit using switch at rear of cabinet.
2. Unlock Coin Mech door and reach through to unlatch large front door from inside cabinet.
3. Find Game Cartridge On/Off Switch located at bottom front right of Electronic Chassis just inside large front door (this switch may be used to power unit on and off in place of switch at rear of cabinet).
4. Turn Game Cartridge On/Off Switch off to permit Game Cartridge to slide out of Electronic Chassis.
5. Slide old Game Cartridge out of chassis.
6. Slide new Game Cartridge between runners to plug into the Main PC Board. Be sure Game Cartridge is securely plugged in. ROMs on the Game Cartridge should be facing to the left as you look into the cabinet.
7. Turn Game Cartridge On/Off Switch back on (this also locks cartridge into place).
8. Check game option switch settings.
9. Close and latch large front door.
10. Close and lock Coin Mech door.
11. Power on SAC 1A (SAC 1) unit using switch at rear of cabinet.
12. Play game to test if unit is working properly.

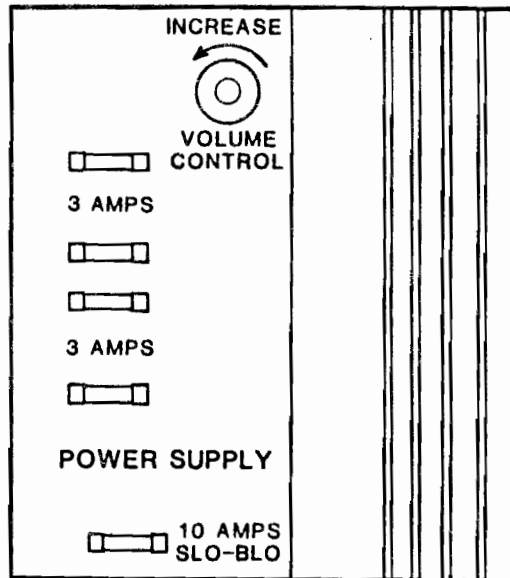
BE SURE TO SAVE GAME CARTRIDGE, CONTROL PANEL INSERT, AND ATTRACT (HEADER FOR REUSE).

* If new Control Panel Insert Assembly is included with your kit.

CAUTION : BEFORE SERVICING TURN OFF A.C. POWER SWITCH AT TOP LEFT REAR OF CABINET.

TO SERVICE CONTROL SHELF - UNLATCH 2 CLAMPS ON EACH SIDE OF CABINET.

FOR ACCESS TO VOLUME CONTROL AND FUSES -
REMOVE 2 SHIPPING SCREWS FROM HAND PULL BRK'T AND PULL CHASSIS OUT TO ITS STOP.
THIS WILL EXPOSE THE VOLUME CONTROL AND FUSES.



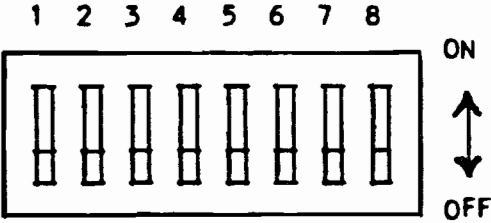
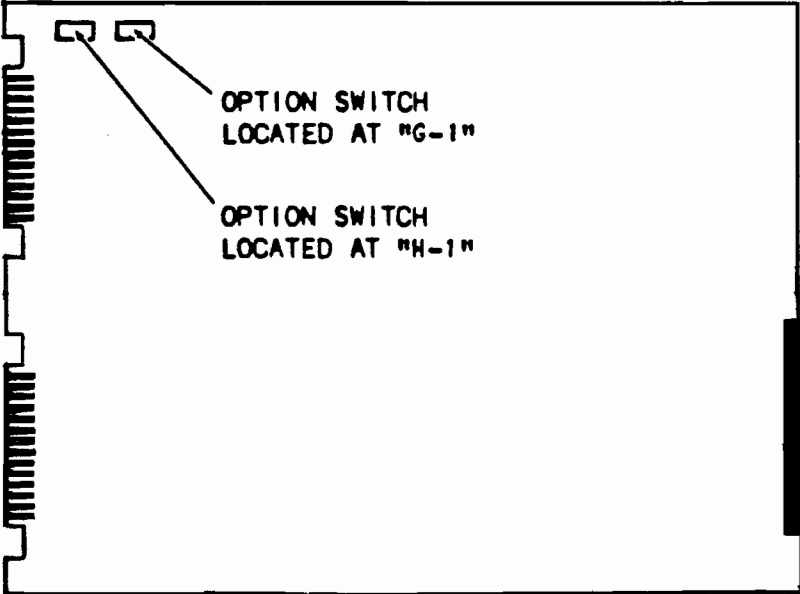
TO REMOVE ELECTRONIC CHASSIS FROM CABINET -
1. DISCONNECT ALL CABLES CONNECTED TO CHASSIS FROM CABINET & CONTROL SHELF.
2. LIFT CHASSIS OVER STOP BRK'T AND SLIDE OFF SHELF.
RETURN CHASSIS IN REVERSE ORDER.

CAUTION : WHEN RETURNING CHASSIS TO ITS PROPER PLACE, BE SURE LINE CORD IS NOT PINCHED IN REAR OF CABINET.

SWITCH SETTINGS FOR SAC 1 GAMES

CHICKEN SHIFT
GOALIE GHOST
HAT TRICK
OFF THE WALL
SNACKS 'N JAXSON
SNAKEPIT
TRIVIAL PURSUIT

C. P. U. BOARD REFERENCE DRAWING



GIMME A BREAK
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF							BONUS AT 12 BALLS
ON	OFF							BONUS AT 10 BALLS
OFF	ON							* BONUS AT 8 BALLS
ON	ON							BONUS AT 6 BALLS
		OFF	OFF					14 INITIAL SHOTS
		ON	OFF					* 12 INITIAL SHOTS
		OFF	ON					10 INITIAL SHOTS
		ON	ON					8 INITIAL SHOTS
				OFF				1 or 2 PLYR/CRDT
				ON				* 1 PLAYER/CREDIT
					OFF			UPRIGHT CABINET
					ON			COCKTAIL CABINET
						OFF		* KEEP 5 HI SCORES
						ON		KEEP ALL HI SCORES
							OFF	NO ATTRACT SOUNDS
							ON	* ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
ON	ON							FREE PLAY
OFF	ON							* 1 COIN/1 CREDIT
ON	OFF							1 COIN/2 CREDITS
OFF	OFF							2 COINS/1 CREDIT
		ON	ON	ON				* NO BONUS COINS
		OFF	ON	ON				2 COINS ADDS 1 BONUS COIN
		ON	OFF	ON				3 COINS ADDS 1 BONUS COIN
		OFF	OFF	ON				4 COINS ADDS 1 BONUS COIN
		ON	ON	OFF				4 COINS ADDS 2 BONUS COINS
		OFF	ON	OFF				5 COINS ADDS 1 BONUS COIN
		ON	OFF	OFF				5 COINS ADDS 2 BONUS COINS
		OFF	OFF	OFF				5 COINS ADDS 3 BONUS COINS
					ON			* LEFT COIN MECH X 1
					OFF			LEFT COIN MECH X 2
						ON	ON	* RIGHT COIN MECH X 1
						OFF	ON	RIGHT COIN MECH X 4
						ON	OFF	RIGHT COIN MECH X 5
						OFF	OFF	RIGHT COIN MECH X 6

* = RECOMMENDED SETTINGS

SNAKEPIT
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
OFF	OFF			XX	XX		BONUS AT 40,000
ON	OFF			XX	XX		BONUS AT 30,000
OFF	ON			XX	XX		BONUS AT 20,000
*ON	ON			XX	XX		BONUS AT 10,000
		OFF	OFF	XX	XX		5 LIVES
		*ON	OFF	XX	XX		4 LIVES
		OFF	ON	XX	XX		3 LIVES
		ON	ON	XX	XX		2 LIVES
				XX	XX	*OFF	EASY
				XX	XX	ON	HARD
				XX	XX		NO ATTRACT SOUNDS
				XX	XX		*ON ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
OFF	OFF	XX	XX	XX	XX	XX	1 COIN/1 PLAY
OFF	ON	XX	XX	XX	XX	XX	1 COIN/2 PLAYS
ON	OFF	XX	XX	XX	XX	XX	2 COINS/1 PLAY
ON	ON	XX	XX	XX	XX	XX	FREE PLAY
		XX	XX	XX			*ON KEEP ALL HIGH SCORES
		XX	XX	XX			OFF KEEP 5 HIGH SCORES

* = RECOMMENDED SETTINGS

**HAT TRICK
Option Switch Settings**

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF	OFF	XX	XX	XX	XX		TIME GAME - 3:00
ON	OFF	OFF	XX	XX	XX	XX		TIME GAME - 2:45
OFF	ON	OFF	XX	XX	XX	XX		TIME GAME - 2:30
ON	ON	OFF	XX	XX	XX	XX		TIME GAME - 2:15
*OFF	OFF	ON	XX	XX	XX	XX		TIME GAME - 2:00
ON	OFF	ON	XX	XX	XX	XX		TIME GAME - 1:45
OFF	ON	ON	XX	XX	XX	XX		TIME GAME - 1:30
ON	ON	ON	XX	XX	XX	XX		TIME GAME - 1:15
			XX	XX	XX	XX	*OFF	NO ATTRACT SOUNDS
			XX	XX	XX	XX	ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF		XX	XX	XX	XX	XX	1 COIN/1 PLAY
OFF	ON		XX	XX	XX	XX	XX	1 COIN/2 PLAYS
ON	OFF		XX	XX	XX	XX	XX	2 COINS/1 PLAY
ON	ON		XX	XX	XX	XX	XX	FREE PLAY
		*OFF	XX	XX	XX	XX	XX	1 or 2 PLAYER/CREDIT
		ON	XX	XX	XX	XX	XX	1 PLAYER/CREDIT

* = RECOMMENDED SETTINGS

GOALIE GHOST
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF	OFF	XX	XX	XX	XX		TIME GAME - 2:30
*OFF	ON	OFF	XX	XX	XX	XX		TIME GAME - 2:00
OFF	OFF	ON	XX	XX	XX	XX		TIME GAME - 1:30
OFF	ON	ON	XX	XX	XX	XX		TIME GAME - 1:15
ON	OFF	OFF	XX	XX	XX	XX		21 POINT GAME
*ON	ON	OFF	XX	XX	XX	XX		15 POINT GAME
ON	OFF	ON	XX	XX	XX	XX		11 POINT GAME
ON	ON	ON	XX	XX	XX	XX		9 POINT GAME
			XX	XX	XX	XX	OFF	NO ATTRACT SOUNDS
			XX	XX	XX	XX	ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF		XX	XX	XX	XX	XX	1 COIN/1 PLAY
OFF	ON		XX	XX	XX	XX	XX	1 COIN/2 PLAYS
ON	OFF		XX	XX	XX	XX	XX	2 COINS/1 PLAY
ON	ON		XX	XX	XX	XX	XX	FREE PLAY
		*OFF	XX	XX	XX	XX	XX	1 or 2 PLYR/CRDT
		ON	XX	XX	XX	XX	XX	1 PLAYER/CREDIT

* = RECOMMENDED SETTINGS

SNACKS'N JAXSON
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF			XX	XX	XX		BONUS AT 30,000
ON	OFF			XX	XX	XX		BONUS AT 25,000
*OFF	ON			XX	XX	XX		BONUS AT 20,000
ON	ON			XX	XX	XX		BONUS AT 15,000
		OFF	OFF	XX	XX	XX		5 NOSES
		ON	OFF	XX	XX	XX		4 NOSES
		*OFF	ON	XX	XX	XX		3 NOSES
		ON	ON	XX	XX	XX		2 NOSES
				XX	XX	XX	OFF	NO ATTRACT SOUNDS
				XX	XX	XX	*ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF	XX	XX	XX	XX	XX		1 COIN/1 PLAY
OFF	ON	XX	XX	XX	XX	XX		1 COIN/2 PLAYS
ON	OFF	XX	XX	XX	XX	XX		2 COINS/1 PLAY
ON	ON	XX	XX	XX	XX	XX		FREE PLAY
		XX	XX	XX			*ON	KEEP ALL HIGH SCORES
		XX	XX	XX			OFF	KEEP 5 HIGH SCORES

* = RECOMMENDED SETTINGS

CHICKEN SHIFT
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
XX	XX	OFF	XX	XX	XX	XX		3 LIVES
XX	XX	*ON	XX	XX	XX	XX		2 LIVES
XX	XX		XX	XX	XX	XX	OFF	NO ATTRACT SOUNDS
XX	XX		XX	XX	XX	XX	ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF	XX	XX	XX	XX	XX	XX	1 COIN/1 PLAY
OFF	ON	XX	XX	XX	XX	XX	XX	1 COIN/2 PLAYS
ON	OFF	XX	XX	XX	XX	XX	XX	2 COINS/1 PLAY
ON	ON	XX	XX	XX	XX	XX	XX	FREE PLAY

* = RECOMMENDED SETTINGS

**TRIVIAL PURSUIT
Option Switch Settings**

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
XX	XX	OFF	OFF	XX	XX	XX		6 MISSES
XX	XX	ON	OFF	XX	XX	XX		5 MISSES
XX	XX	OFF	ON	XX	XX	XX		4 MISSES
XX	XX	*ON	ON	XX	XX	XX		3 MISSES
XX	XX			XX	XX	XX	OFF	NO ATTRACT SOUNDS
XX	XX			XX	XX	XX	ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF	XX	XX	XX				1 COIN/1 PLAY
OFF	ON	XX	XX	XX				1 COIN/2 PLAYS
ON	OFF	XX	XX	XX				2 COINS/1 PLAY
ON	ON	XX	XX	XX				FREE PLAY
		XX	XX	XX	OFF			DISABLE SND DWNTD
		XX	XX	XX	*ON			ENABLE SND DWNTD
		XX	XX	XX		OFF		DISABLE SOUND TEST
		XX	XX	XX		*ON		ENABLE SOUND TEST
		XX	XX	XX			*OFF	KEEP 10 HIGH SCORES
		XX	XX	XX			ON	KEEP 5 HIGH SCORES

* = RECOMMENDED SETTINGS

STOCKER
Part No. M051-00B96-A007
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
XX	XX			XX	XX	*OFF	6 NORMAL GAME ENDING
XX	XX			XX	XX	ON	3 TICKETS PER GAME
				XX	XX		NO MUSIC IN ATTRACT MODE
				XX	XX		MUSIC IN ATTRACT MODE

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
*OFF	*OFF	XX	XX	XX			1 COIN/ 1 CREDIT
OFF	ON	XX	XX	XX			1 COIN/ 2 CREDITS
ON	OFF	XX	XX	XX			2 COINS/ 1 CREDIT
ON	ON	XX	XX	XX			FREE PLAY

* INDICATED FACTORY RECOMMENDED SETTINGS

**OFF THE WALL
Option Switch Settings**

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
XX	XX	XX	XX	XX	XX	XX	OFF	NO ATTRACT SOUNDS
XX	XX	XX	XX	XX	XX	XX	*ON	ATTRACT SOUNDS

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
OFF	OFF		XX	XX	XX	XX	XX	1 COIN/1 PLAY
OFF	ON		XX	XX	XX	XX	XX	1 COIN/2 PLAYS
ON	OFF		XX	XX	XX	XX	XX	2 COINS/1 PLAY
ON	ON		XX	XX	XX	XX	XX	FREE PLAY
		*OFF	XX	XX	XX	XX	XX	1 or 2 PLYR/CRDT
		ON	XX	XX	XX	XX	XX	1 PLAYER/CREDIT

* = RECOMMENDED SETTINGS

STOCKER
Part No. 020-8013-01-0A
Option Switch Settings

G1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
XX	XX	XX	XX	XX	XX	OFF		* NORMAL
XX	XX	XX	XX	XX	XX	ON		3 TICKETS ENDS GAME
XX	XX	XX	XX	XX	XX		OFF	NO ATTRACT MUSIC
XX	XX	XX	XX	XX	XX		ON	* MUSIC IN ATTRACT

H1

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
ON	ON							FREE PLAY
OFF	ON							* 1 COIN/ 1 CREDIT
ON	OFF							1 COIN/ 2 CREDITS
OFF	OFF							2 COINS/ 1 CREDIT
		ON	ON	ON				* NO BONUS COINS
		OFF	ON	ON				2 COINS ADDS 1 BONUS COIN
		ON	OFF	ON				3 COINS ADDS 1 BONUS COIN
		OFF	OFF	ON				4 COINS ADDS 1 BONUS COIN
		ON	ON	OFF				4 COINS ADDS 2 BONUS COINS
		OFF	ON	OFF				5 COINS ADDS 1 BONUS COIN
		ON	OFF	OFF				5 COINS ADDS 2 BONUS COINS
		OFF	OFF	OFF				5 COINS ADDS 3 BONUS COINS
					ON			* LEFT COIN MECH X 1
					OFF			LEFT COIN MECH X 2
						ON	ON	* RIGHT COIN MECH X 1
						OFF	ON	RIGHT COIN MECH X 4
						ON	OFF	RIGHT COIN MECH X 5
						OFF	OFF	RIGHT COIN MECH X 6

* = RECOMMENDED SETTINGS

II. CONTROL PANEL WIRING

GAME: SENTE 'HAT TRICK' (COCKTAIL)
 SUBJECT: CONTROL PANEL WIRE SEQUENCE

BLUE PLAYER SIDE (1st Player)

<u>P2 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	Common Display Lamps
2	+12VDC Display Lamps
<u>P16</u>	
1	Blue Player Left (1 Player)
2	
3	Blue Player Right
4	Blue Player Up
5	
6	Blue Player Down
7	2 Player Start
8	1 Player Start
9	
10	
11	1 Player LED
12	2 Player LED
<u>P20</u>	
1	+5VDC LED
2	Common Ground
3	
4	
5	
6	
7	
8	
9	Blue Player Shoot
10	
11	
12	
13	
14	
15	

RED PLAYER SIDE (2nd Player)

<u>P2 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	Common Display Lamps
2	+12VDC Display Lamps
<u>P16</u>	
1	
2	
3	
4	
5	
6	
7	
8	
9	Red Player Right
10	Red Player Left
11	
12	
<u>P20</u>	
1	
2	Common Ground
3	
4	
5	
6	
7	
8	
9	
10	Red Player Shoot
11	
12	Red Player Up
13	Red Player Down
14	
15	

NOTE - Wire colors are not shown because they may vary from panel to panel.

Resistors to each LED are 150 OHMS 1/4 Watt.

Display lamps GE194 +12VDC.

GAME: SENTE 'TRIVIAL PURSUIT' (COCKTAIL)

SUBJECT: CONTROL PANEL WIRE SEQUENCE

1 & 3 PLAYER SIDE

2 & 4 PLAYER SIDE

P2 CONNECTOR

<u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	Common Display Lamps
2	+12VDC Display Lamps

P15

1	+5VDC 1, 2, 3 & 4 Player
2	
3	
4	
5	
6	
7	4 Player LED
8	
9	

P16

1	
2	ncorrect/Correct Button Lamps
3	
4	
5	
6	
7	1 Player Start
8	2 Player Start
9	3 Player Start
10	4 Player Start
11	1 Player LED
12	2 Player LED

P20

1	
2	Common Panel Switches
3	
4	
5	Common Incorrect/Correct Lamps
6	
7	
8	
9	
10	
11	
12	Incorrect Button Switch (Left Side)
13	Correct Button Switch (Right Side)
14	3 Player LED
15	

P2 CONNECTOR

<u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	Common Display & Incorrect/Correct Lamps
2	+12VDC Display & Incorrect/Correct Lamps

P20

1	
2	Common Incorrect/Correct Switches
3	
4	
5	
6	
7	
8	
9	Incorrect Button Switch (Left Side)
10	Correct Button Switch (Right Side)
11	
12	
13	
14	
15	

NOTE - Wire colors are not shown because they may vary from panel to panel.

Incorrect and correct lamps are G1509 +12VDC.

Resistors at incorrect and correct button lamps are 270 OHMS 5 Watts.

Resistors to each LED are 150 OHMS 1/4 Watt.

Display lamps GE194 +12VDC.

GAME: SENTE 'TRIVIAL PURSUIT' (UPRIGHT)

SUBJECT: CONTROL PANEL WIRE SEQUENCE

P15 CONNECTOR
PIN NUMBERS

FUNCTION

1	+5VDC 1, 2, 3 & 4 Player
2	
3	
4	
5	
6	
7	4 Player LED
8	Incorrect Button Lamp (Left Side)
9	Correct Button Lamp (Right Side)

P16

1	
2	
3	
4	
5	
6	
7	1 Player Start
8	2 Player Start
9	3 Player Start
10	4 Player Start
11	1 Player LED
12	2 Player LED

P20 CONNECTOR
PIN NUMBERS

FUNCTION

1	
2	Ground Players Start Buttons
3	
4	
5	+12VDC Incorrect/Correct Lamps
6	
7	
8	
9	
10	
11	
12	Incorrect Button Switch
13	Correct Button Switch
14	3 Player LED
15	

NOTE - Wire colors are not shown because they may vary from panel to panel.

Incorrect and correct lamps are G1509 +12VDC.

Resistors at incorrect and correct button lamps are 270 OHMS 5 Watts.

Resistors to each LED are 150 OHMS 1/4 Watt.

GAME: SENTE 'OFF THE WALL'
SUBJECT: CONTROL PANEL WIRE SEQUENCE

<u>P15 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	+5VDC LED
2	Trackball PC AN 4 Left Player
3	-12VDC Trackball (Knob) PC
4	Trackball PC AN 5 Left Player
5	Trackball PC AN 6 Left Player
6	Trackball PC AN 7 Left Player
7	
8	
9	
 <u>P16</u>	
1	Right Player Left
2	Common Ground
3	Right Player Right
4	Left Player Left
5	+12VDC Trackball (Knob) PC
6	Left Player Right
7	1 Player Start
8	2 Player Start
9	
10	
11	1 Player LED
12	2 Player LED

NOTE - Wire colors are not shown because they may vary from panel to panel.

Resistors to each LED are 150 OHMS 1/4 Watt.

Trackball (Knob) Interface Board Part No. PC 006-8004-10.

GAME: SENTE 'HAT TRICK' (UPRIGHT)

SUBJECT: CONTROL PANEL WIRE SEQUENCE

P16 CONNECTOR

PIN NUMBERS

FUNCTION

1	Blue Player Up (Left Side)
2	
3	Blue Player Down
4	Blue Player Right
5	
6	Blue Player Left
7	1 Player Start
8	2 Player Start
9	Red Player Up (Right Side)
10	Red Player Down
11	1 Player LED
12	2 Player LED

P20

1	+5VDC LED
2	Common Ground
3	
4	
5	
6	
7	
8	
9	
10	Red Player Shoot
11	
12	Blue Player Shoot
13	Red Player Right
14	Red Player Left
15	

NOTE - Wire colors are not shown because they may vary from panel to panel.

GAME: SENTE 'GOALIE GHOST'

SUBJECT: CONTROL PANEL WIRE SEQUENCE

P15 CONNECTOR
PIN NUMBERS

FUNCTION

1	
2	Trackball PC AN 4 Lower Player
3	
4	Trackball PC AN 5 Lower Player
5	Trackball PC AN 6 Lower Player
6	Trackball PC AN 7 Lower Player
7	
8	
9	

P16

1	
2	
3	
4	
5	
6	
7	1 Player Start
8	2 Player Start
9	Jump Button Lower Player #1
10	Jump Button Lower Player #2
11	1 Player LED
12	2 Player LED

P20 CONNECTOR
PIN NUMBERS

FUNCTION

1	+5VDC LED
2	Common Ground
3	-12VDC Trackball PC
4	Trackball PC AN 0 Upper Player
5	+12VDC Trackball PC
6	Trackball PC AN 1 Upper Player
7	Trackball PC AN 2 Upper Player
8	Trackball PC AN 3 Upper Player
9	Jump Button Upper Player #1
10	Jump Button Upper Player #2
11	
12	
13	
14	
15	

NOTE - Wire colors are not shown because they may vary from panel to panel.

Resistors to each LED are 150 OHMS 1/4 Watt.

Trackball Interface Board Part No. PC 006-8004-10.

GAME: SENTE 'STOCKER'
SUBJECT: CONTROL PANEL WIRE SEQUENCE

<u>P15 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	+5VDC LED
2	
3	-12VDC Trackball PC (Steering)
4	
5	Trackball PC AN 6
6	Trackball PC AN 7
7	
8	
9	
<u>P16</u>	
1	
2	Common Ground
3	
4	
5	+12VDC Trackball PC (Steering)
6	
7	Player Start
8	Shift High Switch
9	
10	
11	Player LED
12	

NOTE - Wire colors are not shown because they may vary from panel to panel.

Trackball (Steering) Interface Board Part No. PC 006-8004-10.

Resistor to each LED are 150 OHMS 1/4 Watt.

Sensor Board Part No. PC A82-90121-000.

GAME: SENTE 'SNAKE PIT'
SUBJECT: CONTROL PANEL WIRE SEQUENCE

<u>P15 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	+5VDC LED
2	Trackball PC AN 4
3	-12VDC Trackball PC
4	Trackball PC AN 5
5	Trackball PC AN 6
6	Trackball PC AN 7
7	Alaron Button Lamp
8	
9	
<u>P16</u>	
1	Player Whip Up
2	Common Ground
3	Player Whip Down
4	Player Whip Right
5	+12VDC Trackball PC & Lamp
6	Player Whip Left
7	1 Player Start
8	2 Player Start
9	Alaron Button Switch
10	
11	1 Player LED
12	2 Player LED

NOTE - Wire colors are not shown because they may vary from panel to panel.

Resistors to each LED are 150 OHMS 1/4 Watt.

Display lamps GE-194 +12VDC.

GAME: SENTE 'SNACKS 'N JAXSON'
SUBJECT: CONTROL PANEL WIRE SEQUENCE

<u>P15 CONNECTOR</u> <u>PIN NUMBERS</u>	<u>FUNCTION</u>
1	+5VDC LED
2	Trackball PC Analog 4
3	-12VDC Trackball PC
4	Trackball PC Analog 5
5	Trackball PC Analog 6
6	Trackball PC Analog 7
7	
8	
9	
<u>P16</u>	
1	
2	Common Ground
3	
4	
5	+12VDC Trackball PC
6	
7	1 Player Start
8	2 Player Start
9	Sneeze Button Switch
10	Sneeze Button Switch
11	1 Player LED
12	2 Player LED

NOTE - Wire colors are not shown because they may vary from panel to panel.

Resistors to each LED are 150 OHMS 1/4 Watt.

GAME: SENTE 'CHICKEN SHIFT'

SUBJECT: CONTROL PANEL WIRE SEQUENCE

P15 CONNECTOR
PIN NUMBERS

FUNCTION

1
2
3
4
5
6
7
8
9

+5VDC LED

Red & Blue Things Button

P16

1
2
3
4
5
6
7
8
9
10
11
12

Blue Things Switch (Left Side)

Common Ground

Red Things Switch (Right Side)

+12VDC Red & Blue Things Button

1 Player Start

2 Player Start

1 Player LED

2 Player LED

NOTE - Wire colors are not shown because they may vary from panel to panel.

Blue & Red Things Button Lamps are G-1509 +12VDC.

Resistors to each LED are 150 OHMS 1/4 Watt.

Resistor Blue & Red Things Buttons are 150 OHMS 2 Watt.

DATE: July 17, 1985
GAME: Sente "GIMMIE A BREAK"
SUBJECT: Control Panel Wire Sequence

P16 CONNECTOR
PIN NUMBERS

FUNCTION

1	
2	Ground (Switches)
3	
4	
5	+12VDC Position Cue Ball Lamp
6	
7	1 Player Start (Straight Pool)
8	2 Player Start (Eight Ball)
9	
10	Position Cue Ball Switch
11	Player 1 LED
12	Player 2 LED

P20

1	+5VDC (LED's)
2	Ground (Track Ball PL)
3	-12VDC
4	Track Ball PC (AN 0)
5	+12VDC
6	Track Ball PC (AN 1)
7	Track Ball PC (AN 2)
8	Track Ball PC (AN 3)
9	
10	
11	
12	
13	
14	Position Cue Ball Lamp
15	

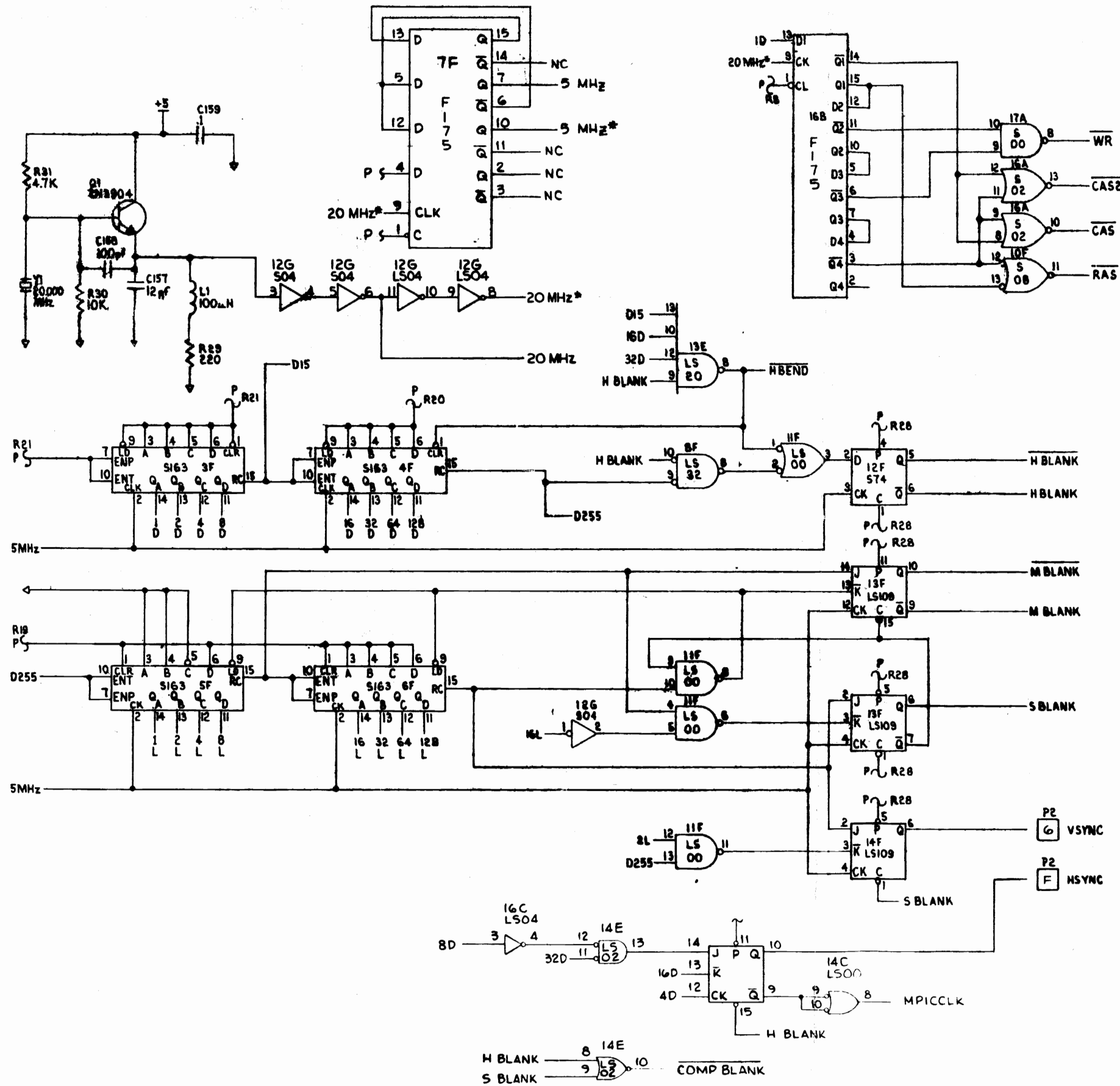
NOTE: Wire colors are not shown because they may vary from panel to Panel. Resistors to each LED are 150 ohms 1/4 watt.

Greg McKay
 Field Service Tech

GM/dlm

III. SCHEMATICS

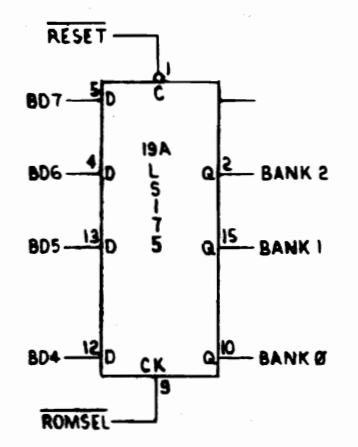
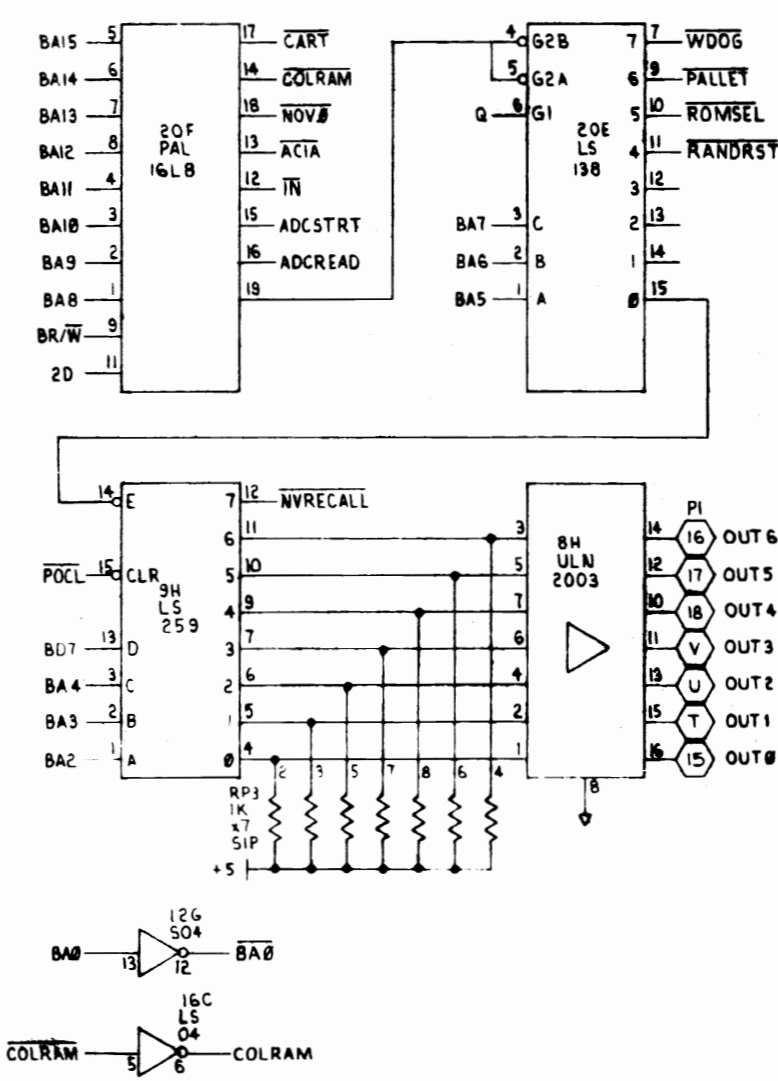
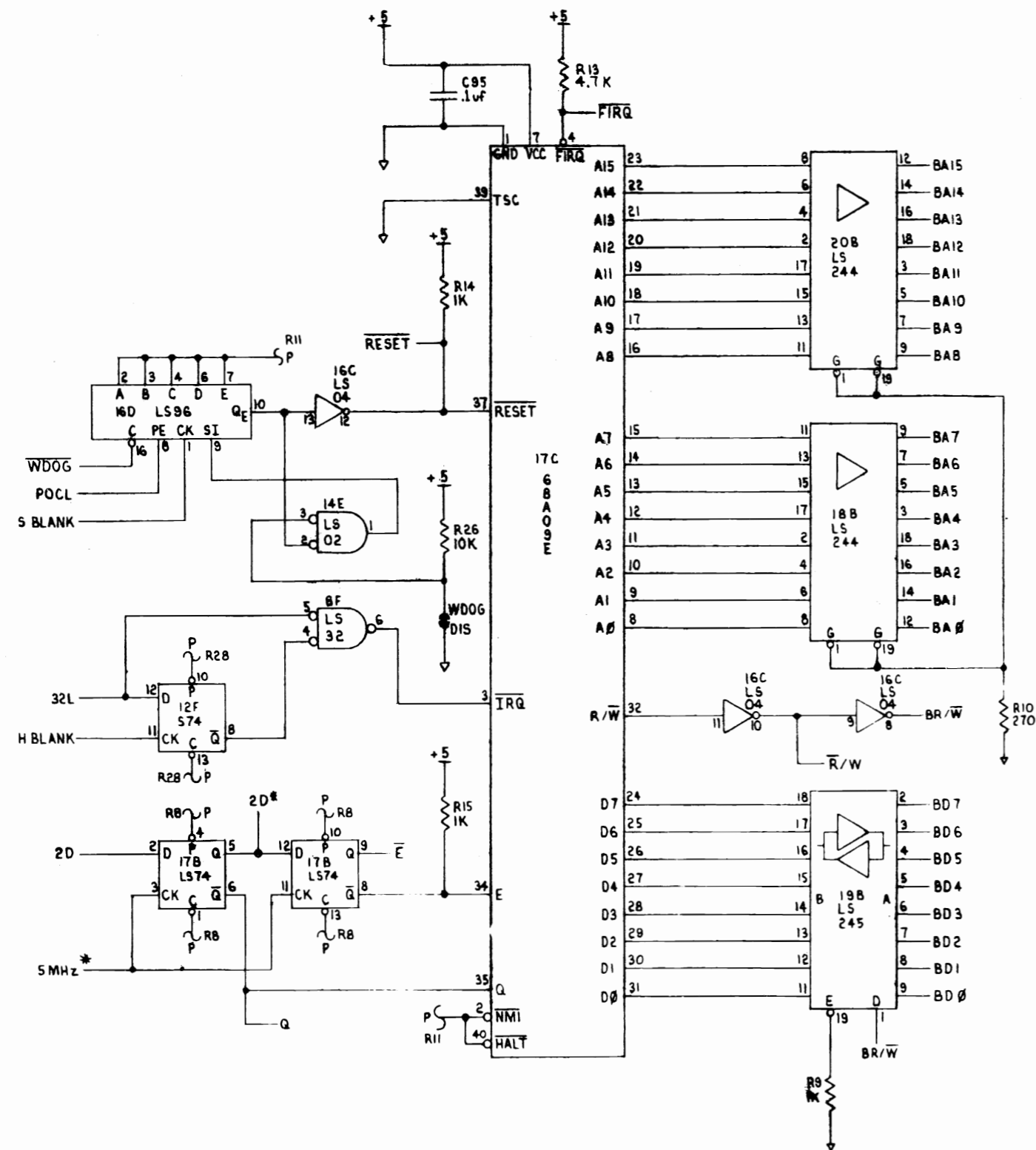
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B	1931		UTP, U16B WAS 74S175; IS 74F175	1/27/01	[Signature]
	1947		UPB, U7E WAS 74S273; IS 74F274	1/27/01	[Signature]
C	1963		ADDED RPI1, TWEU, RPI5, SHT, M15, 4, 7, 8, 10. MODIFIED SHT 1, ZONE C & C7	2/27/01	[Signature]
C1	1990		U15A WAS LS157; IS 5157; U15B WAS LS155; IS LS155; ADDED U20A & U16c	9/15/01	[Signature]



M051-00C52-C014

MATERIAL		QTY
TITLE		
PCB SCHEMATIC, CPU, SAC-I		
SIZE	DRAWING NO.	REV.
D	00P-6001-01-0C	C1
SCALE	DATE	10

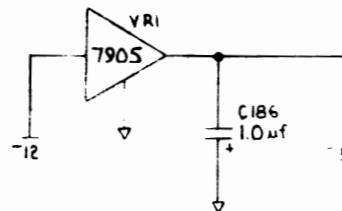
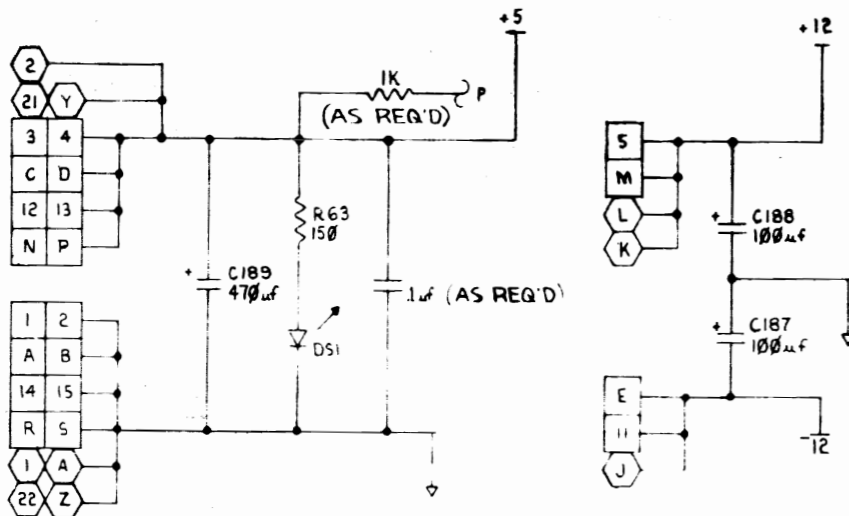
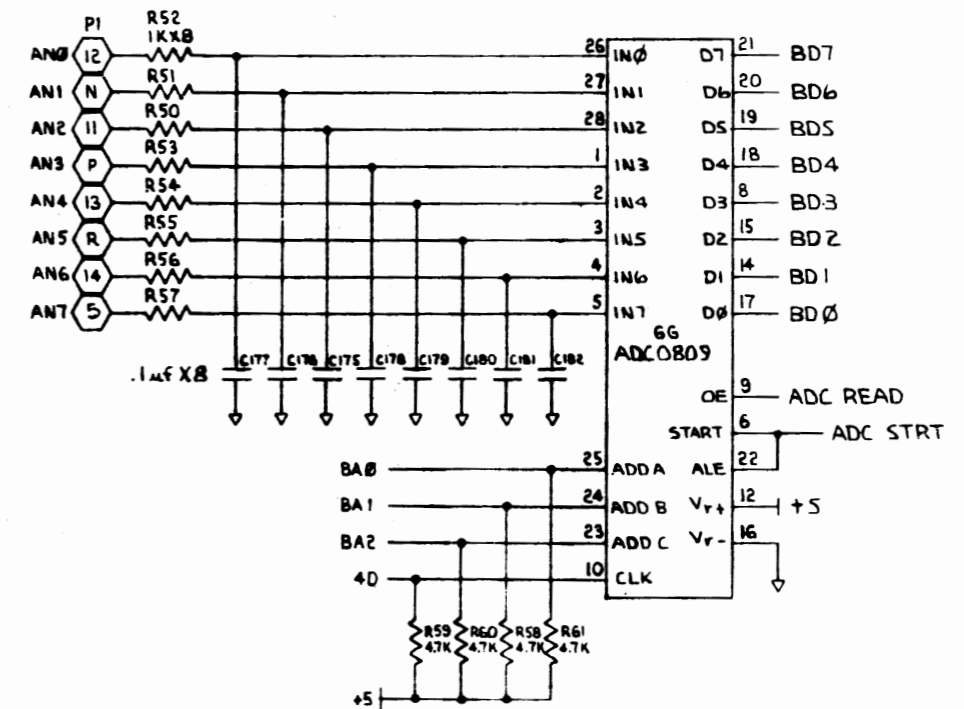
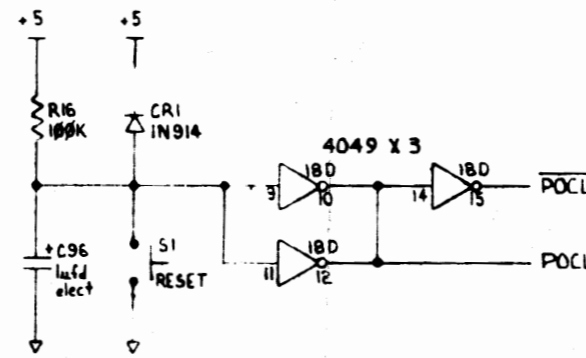
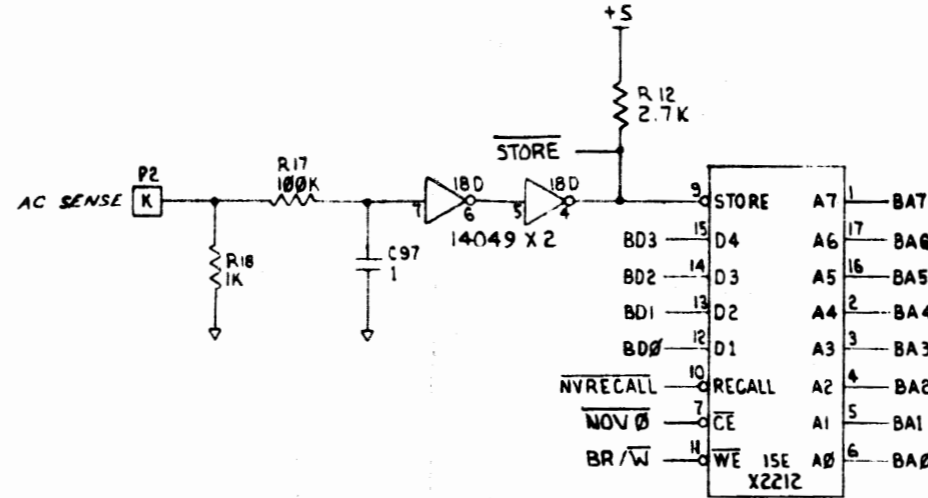
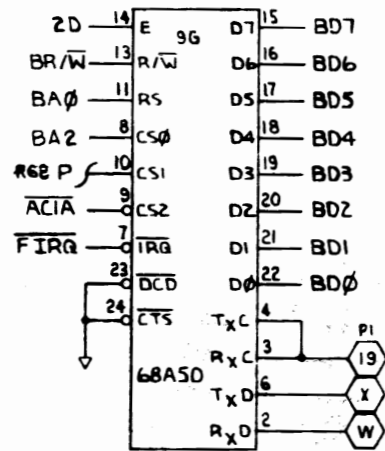
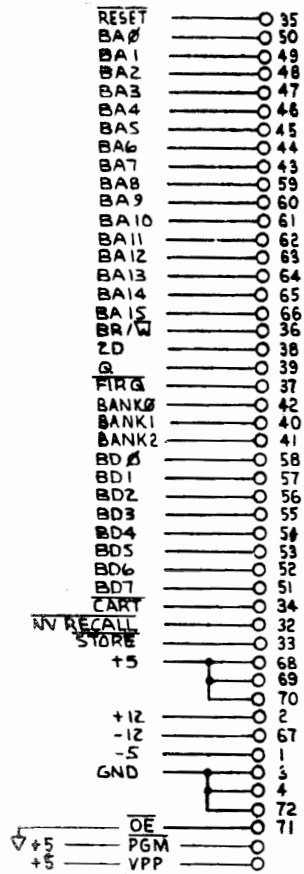
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M051-00C52-C014

MATERIAL	QTY
TITLE PCB SCHEMATIC, CPU, SAC-I	
SIZE D	DRAWING NO. 008-8001-01-0C
SCALE NONE	SHEET 2 OF 10

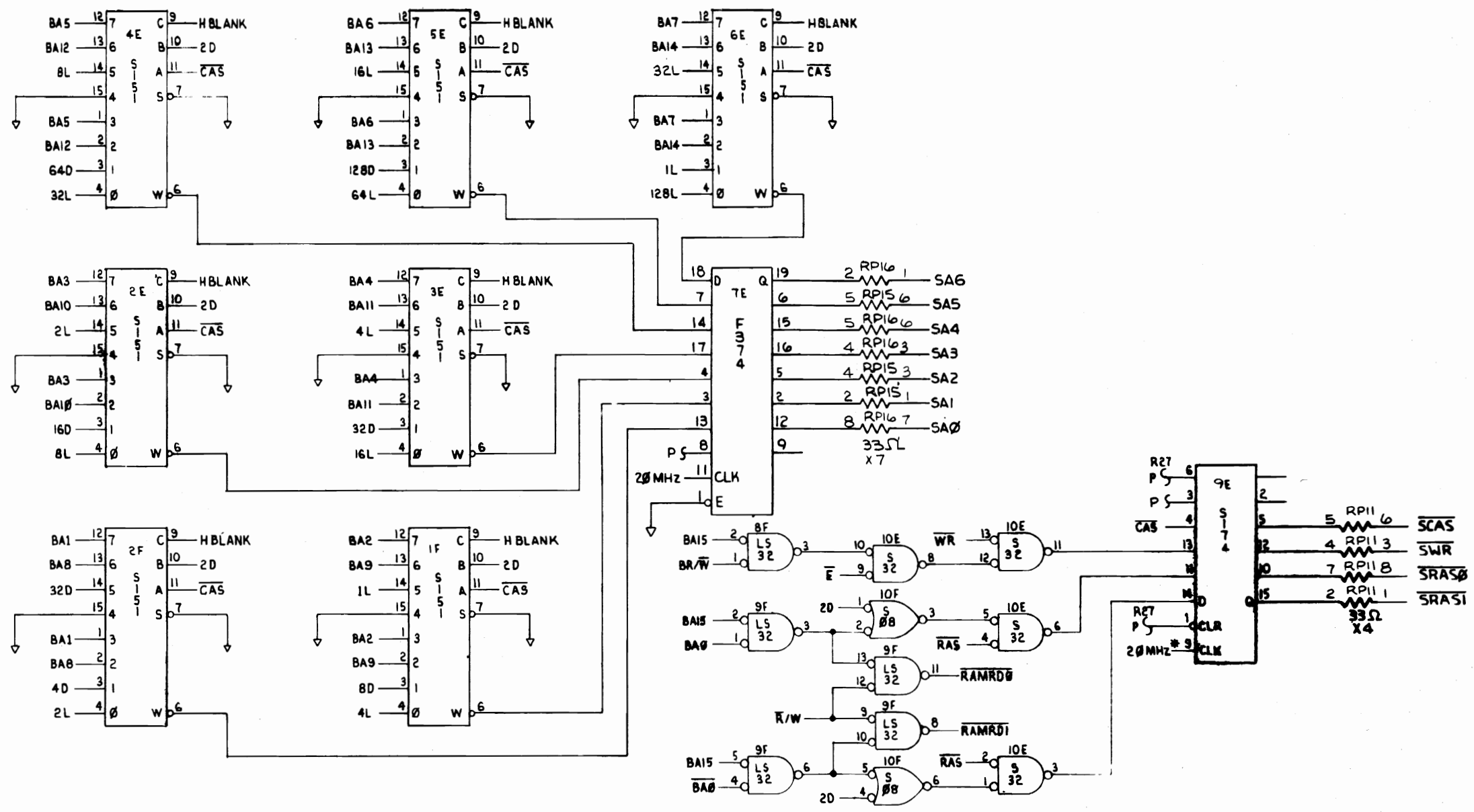
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M051-00052-C014

MATERIAL	QTY
TITLE	
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SIZE	DRAWING NO.
D	008-8001-01-00
SCALE	REV
NONE	CI
SHEET	3 OF 10

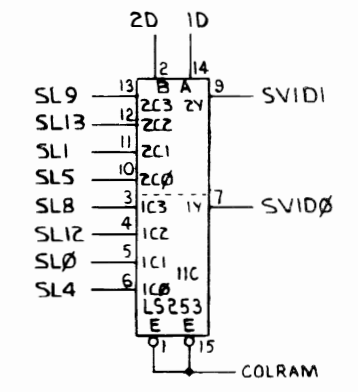
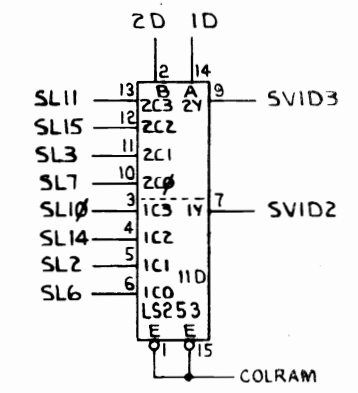
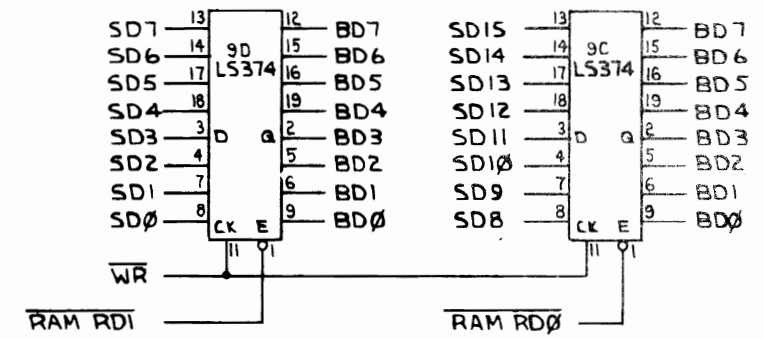
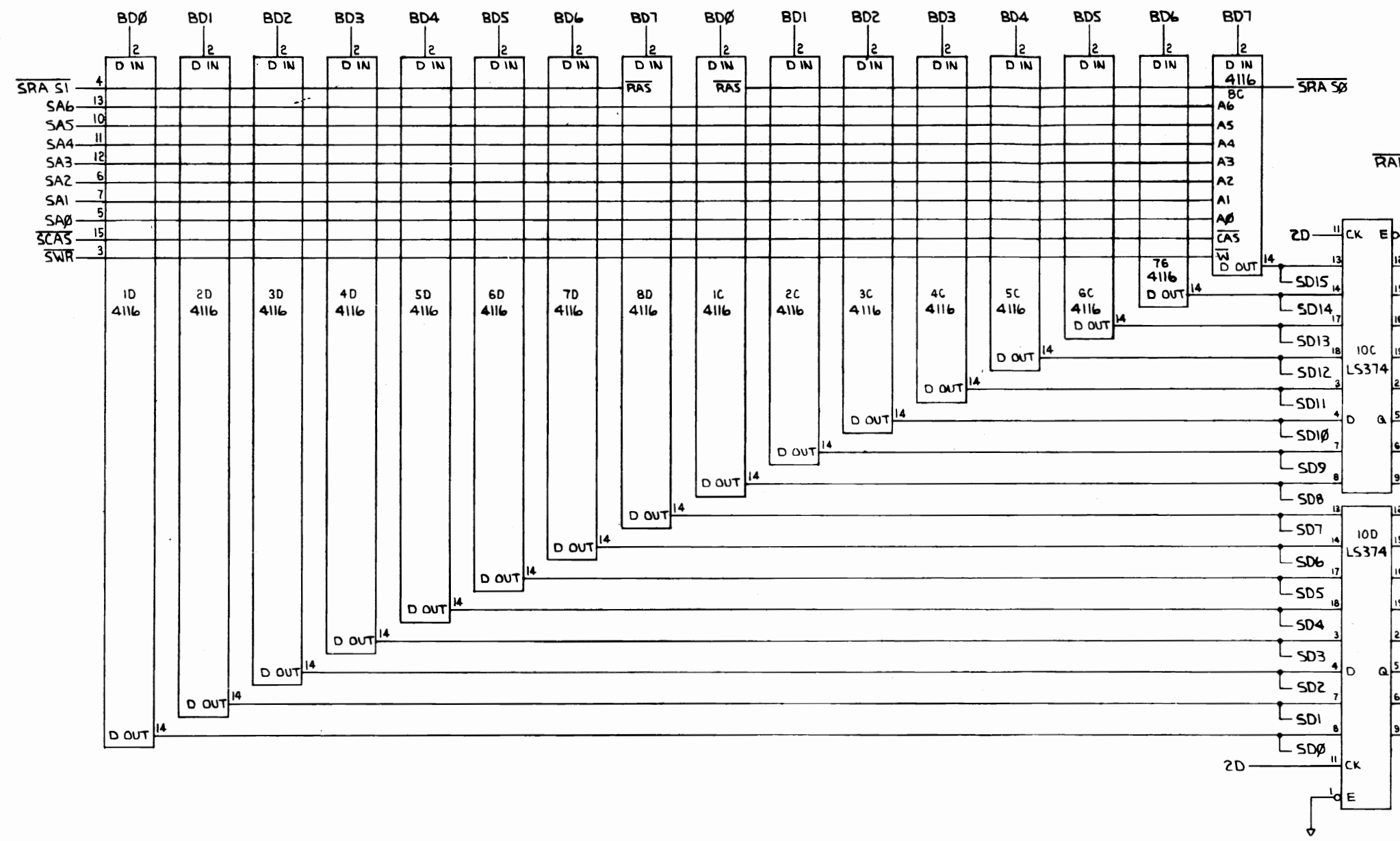
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M051-00052-C014

/MATERIAL		QTY
TITLE		
PCB SCHEMATIC, CPU, SAC-I		
SIZE	DRAWING NO	REV
D	008-8001-01-00	CI
SCALE	NONE	SHEET 4 OF 10

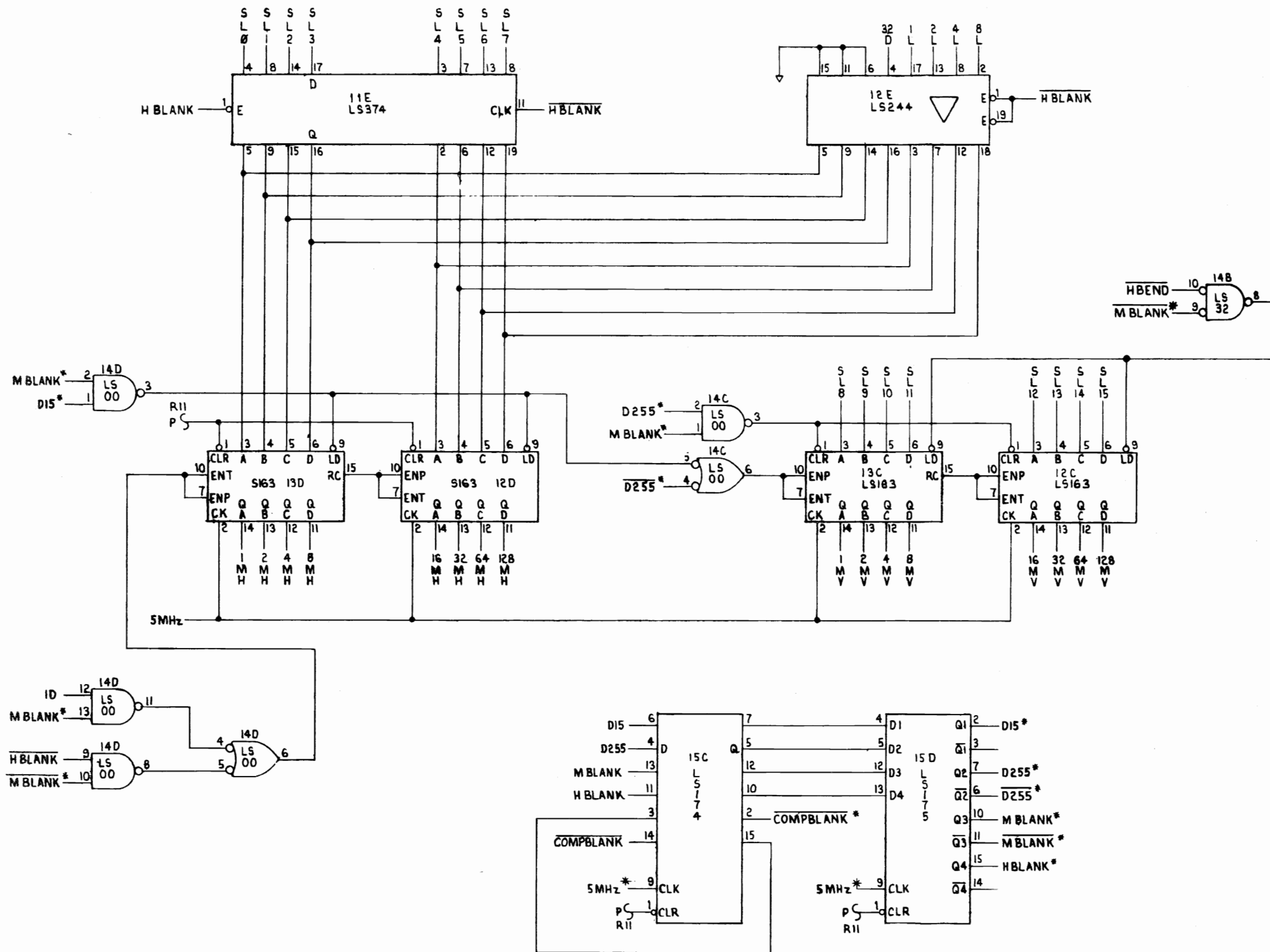
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M051-00052-0014

MATERIAL	QTY
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SIZE D	DRAWING NO. 008-8001-01-00
	REV C1

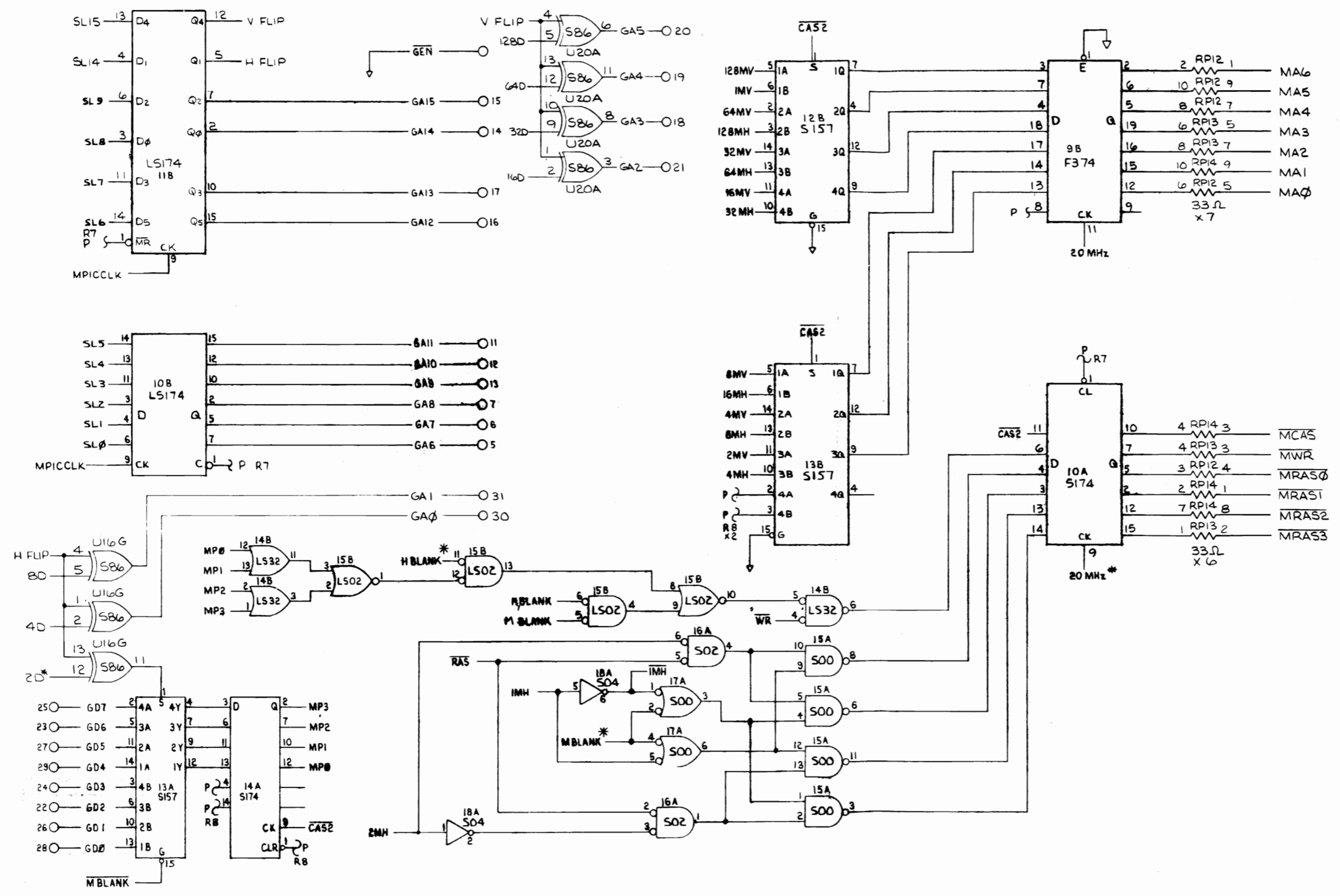
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M051-00C52-C014

MATERIAL		QTY
TITLE PCB SCHEMATIC, CPU, SAC-I		
SIZE D	DRAWING NO. 008-8001-01-0C	REV C1
SCALE NONE	SHEET 6 OF 10	

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED



M051-00C52-C014

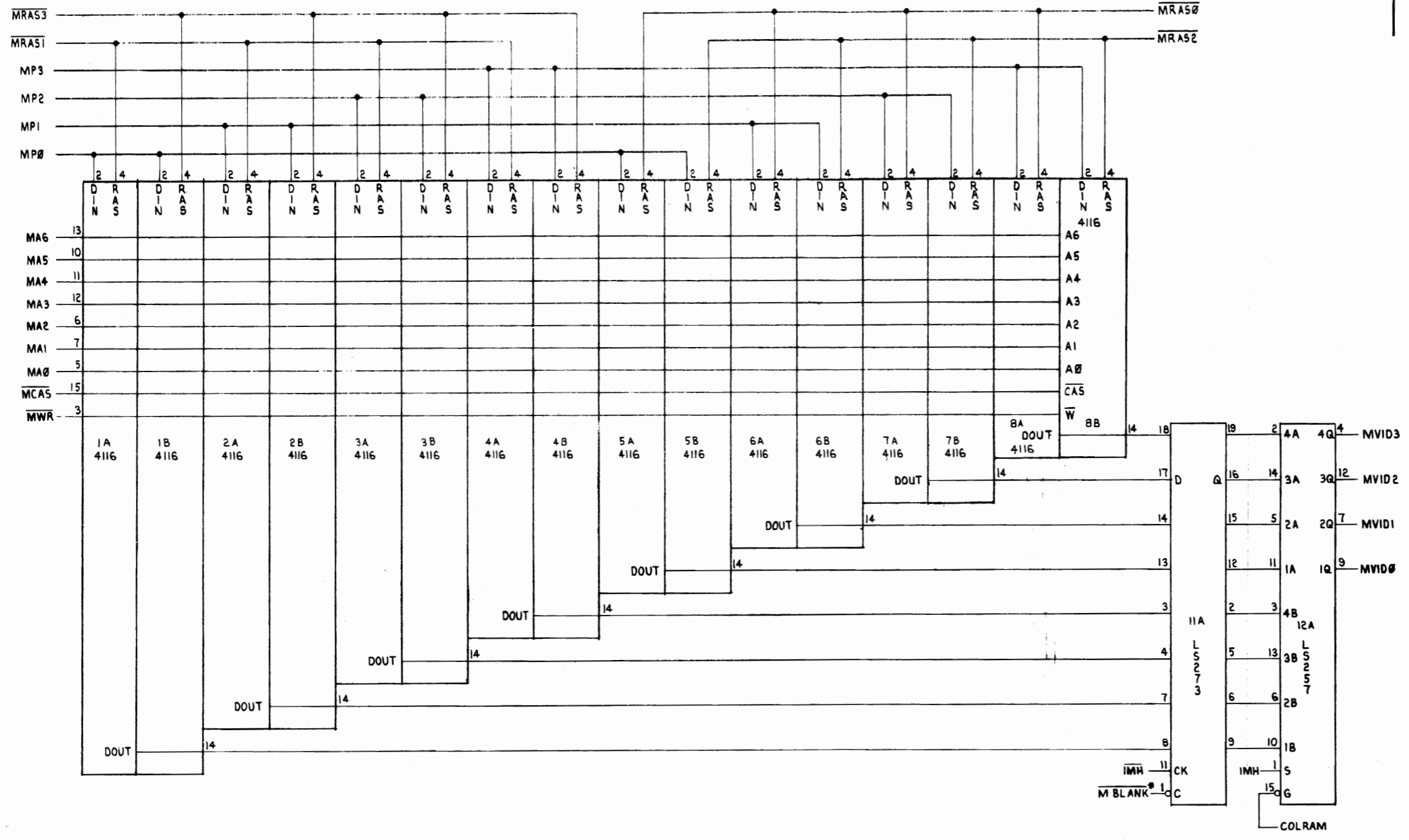
MATERIAL	QTY

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SIZE	DRAWING NO.	REV
D	008-8001-01-OC	CI

SCALE: NCNE SHEET 7 OF 10

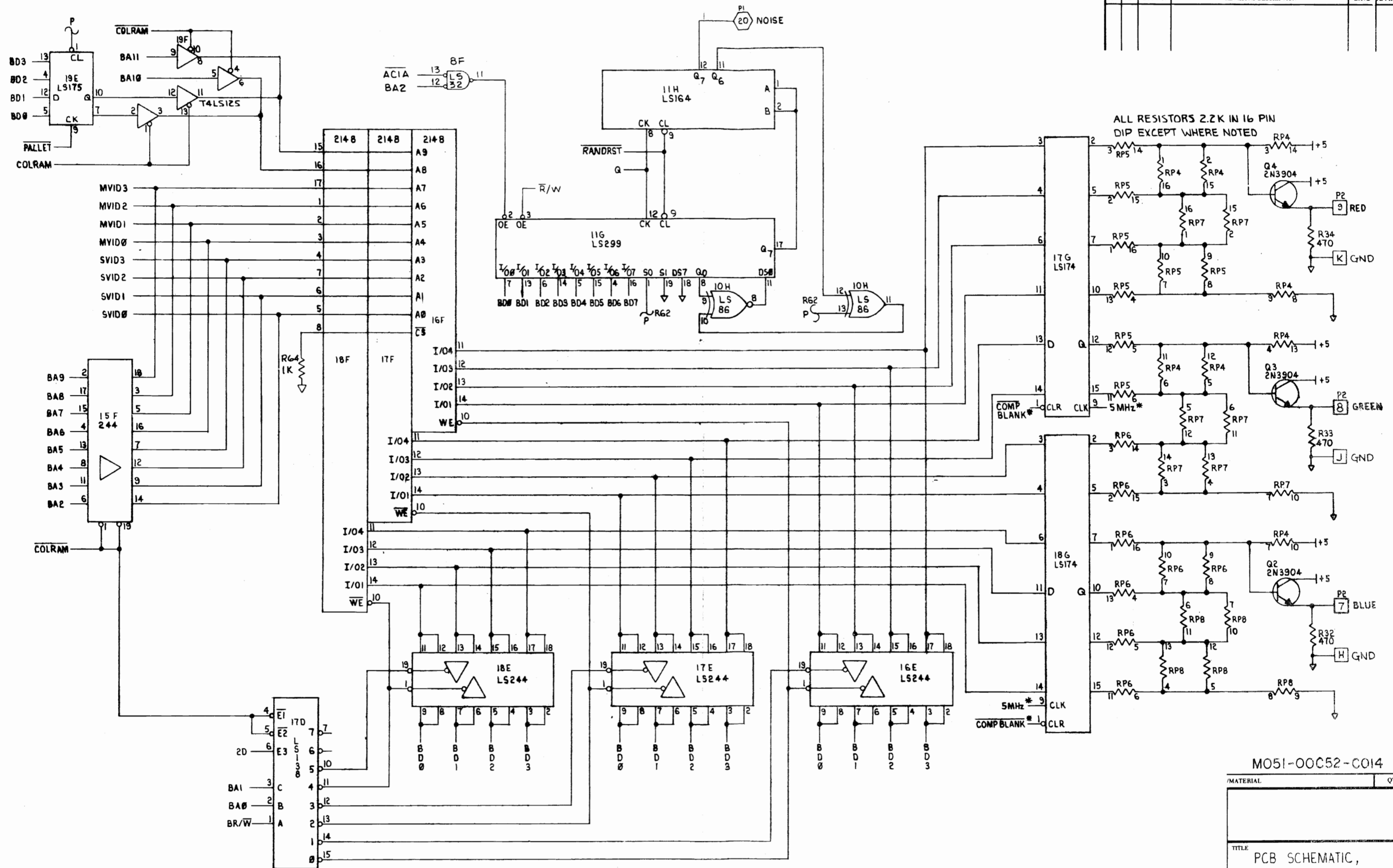
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M051-00C52-C014

MATERIAL		QTY
TITLE PCB SCHEMATIC, CPU, SAC-I		
SIZE D	DRAWING NO. 008-8001-01-0C	REV C1
SCALE NONE	SHEET 8	OF 10

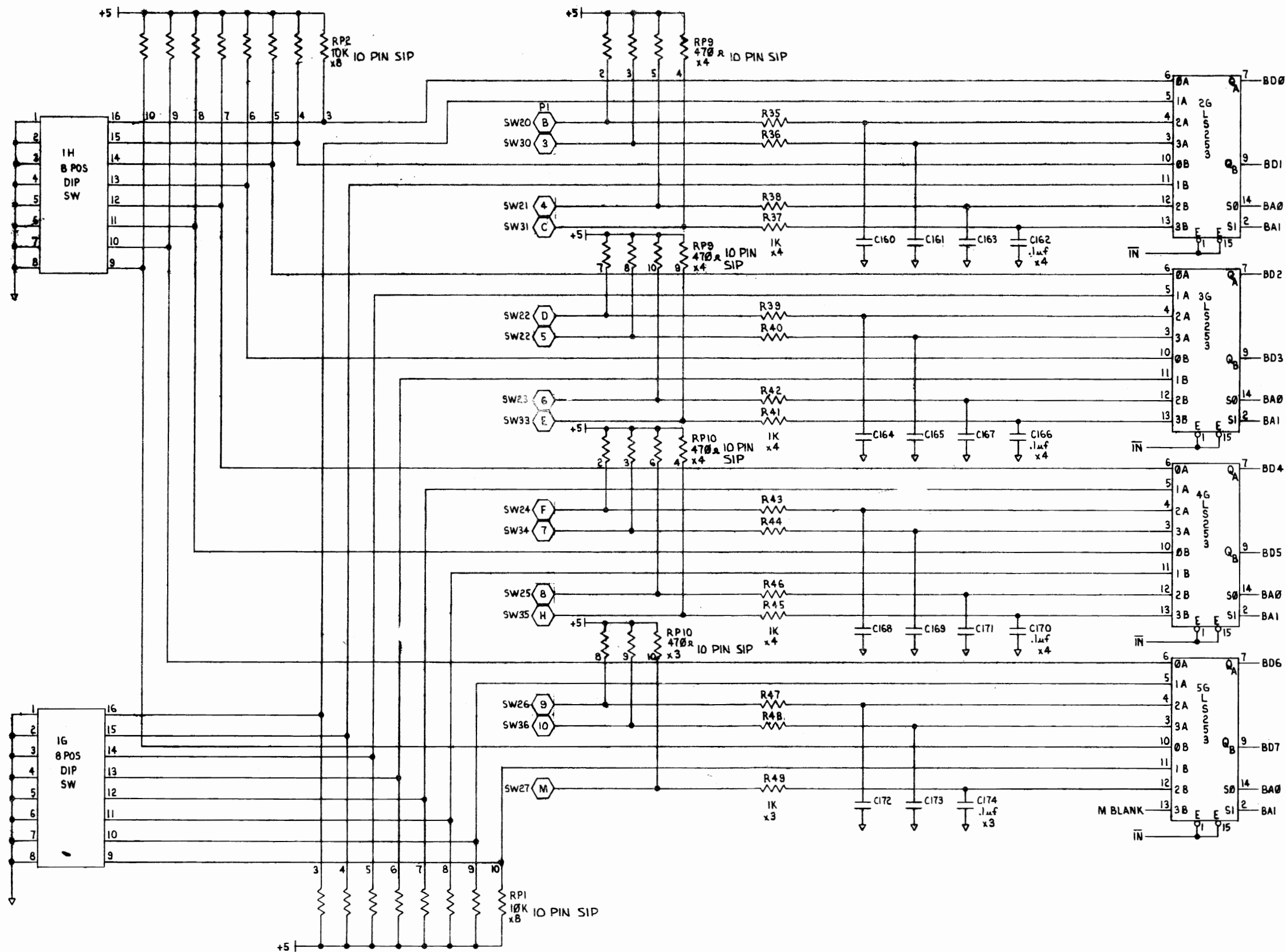
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M051-00C52-C014

MATERIAL		QTY
TITLE		
PCB SCHEMATIC, CPU, SAC-I		
SIZE	DRAWING NO.	REV
D	008-8001-01-0C	CI
SCALE	NONE	SHEET 9 OF 10

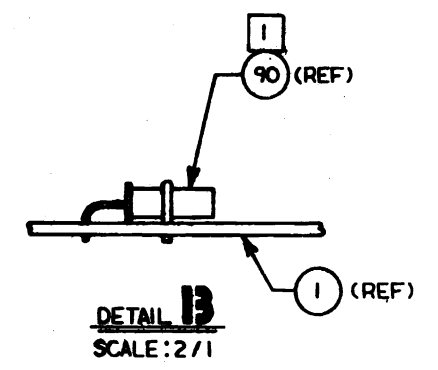
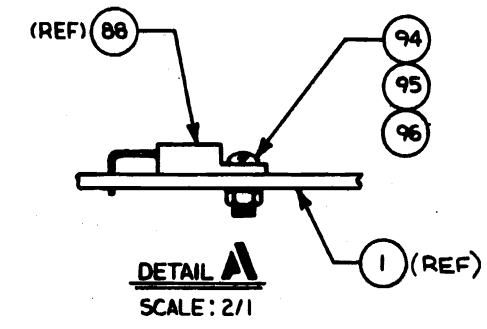
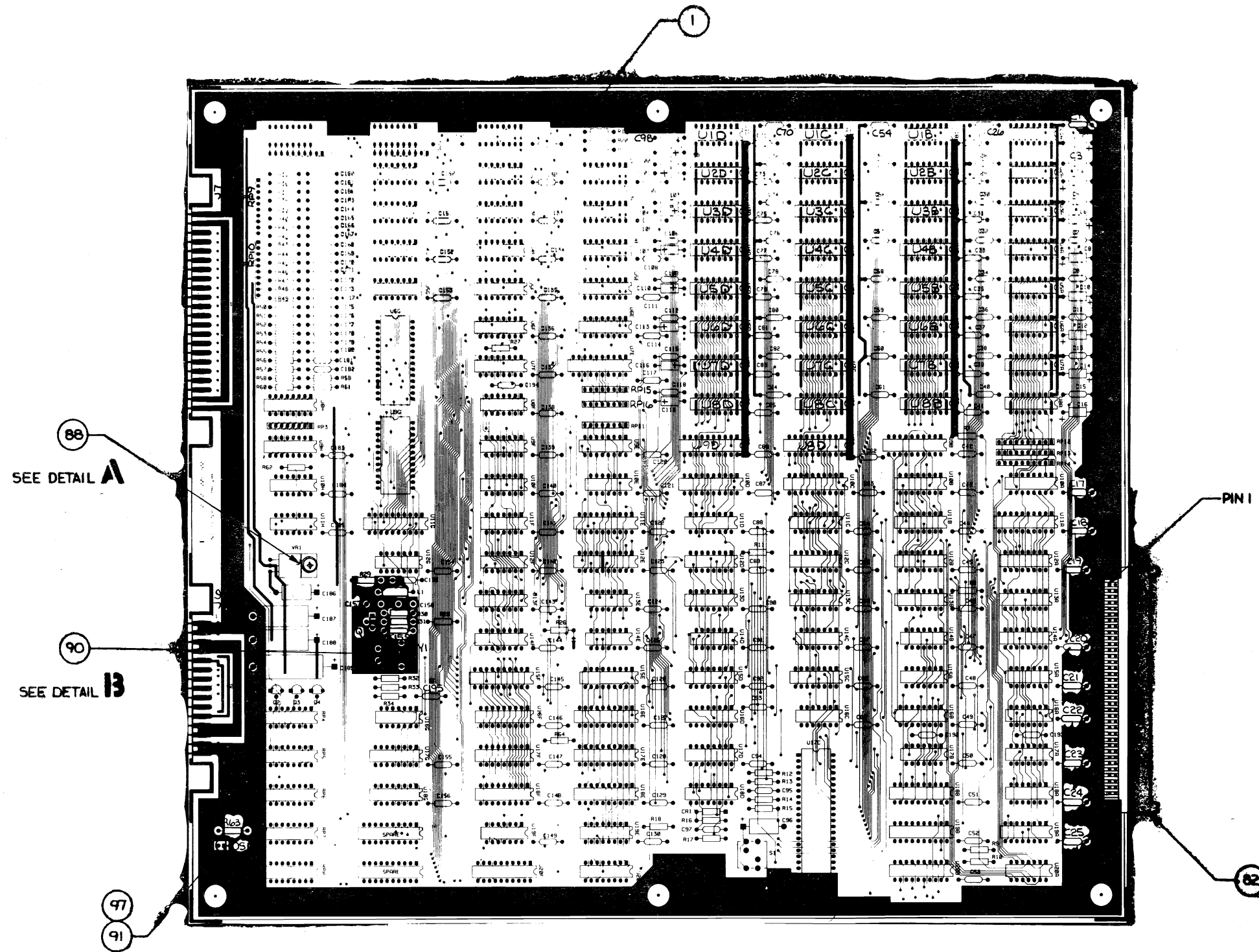
SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED



M051-00C52-C014

/MATERIAL		QTY
TITLE		
PCB SCHEMATIC, CPU, SAC-I		
SIZE	DRAWING NO	REV
D	008-8001-01-0C	CI
SCALE	NONE	SHEET 10 OF 10

SYM	REV	DOC NO.	REVISIONS DESCRIPTION	DATE	APPROVED
C	1963		DELETED C07-8001-10-0A; ADDED C07-8001-10-0C & R011 THRU R015	4/1/63	[Signature]
C1	1990		DELETED ITEM 15, ADDED ITEM 40, CHG QTY ON ITEMS 18, 19 & 53	1/1/63	[Signature]



NOTES: UNLESS OTHERWISE SPECIFIED

- 1 Y1 (ITEM 90) TO HAVE 20 AWG WIRE WRAPPED AROUND BODY AND SOLDERED IN HOLES PROVIDED.

M051-00C52-C013

MATERIAL		QTY
TITLE		
PCB ASSEMBLY CPU, SAC-I		
SIZE	DRAWING NO.	REV
D	006-8001-10-0C	C1
SCALE 1/1 & NOTED		SHEET 1 OF 4

PCB ASSEMBLY, CPU
(006-8001-10-0C) (M051-00C52-C013)
PARTS LIST - SHEET 2 of 4

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
1	1	007-8001-01-0C		PCB, FABRICATION, CPU, SAC-1
2				
3	3	200-0039-01	U11F, 14D, 14C	IC, DIG, TTL, 74LS00, NAND GATE
4	2	200-0040-01	U14E, 15B	IC, DIG, TTL, 74LS02, NOR GATE
5	1	200-0041-01	U16C	IC, DIG, TTL, 74LS04, HEX INVERTER
6	1	200-0042-01	U13E	IC, DIG, TTL, 74LS20, 4-IN NAND
7	3	200-0043-01	U8F, 9F, 14B	IC, DIG, TTL, 74LS32, OR GATE
8	1	200-0044-01	U17B	IC, DIG, TTL, 74LS74, DUAL D F/F
9	1	200-0075-01	U10H	IC, DIG, TTL, 74LS86, QUAD X-OR
10	1	200-0045-01	U16D	IC, DIG, TTL, 74LS96, 5 BIT SHIFT
11	2	200-0046-01	U13F, 14F	IC, DIG, TTL, 74LS109, DUAL JK F/F
12	1	200-0047-01	U19F	IC, DIG, TTL, 74LS125, QUAD BUFFER
13	2	200-0048-01	U17D, U20E	IC, DIG, TTL, 74LS138, 3-8 DECODER
14				
15				
16	2	200-0052-01	U12C, 13C	IC, DIG, TTL, 74LS163, 4 BIT COUNT
17	1	200-0076-01	U11H	IC, DIG, TTL, 74LS164, 8 BIT SHIFT
18	5	200-0053-01	U10B, 11B, 15C, 17G, 18G	IC, DIG, TTL, 74LS174, HEX D F/F
19	3	200-0032-01	U19A, 15D, 19E	IC, DIG, TTL, 74LS175, QUAD D F/F
20	7	200-0055-01	U18B, 20B, 12E, 18E, 17E, 16E, 15F	IC, DIG, TTL, 74LS244, 8TS BUFFER
21	1	200-0056-01	U19B	IC, DIG, TTL, 74LS245, 8 BUS XCVR
22	6	200-0057-01	U11D, 11C, 26, 36, 46, 56	IC, DIG, TTL, 74LS253, DATA SELECT
23	1	200-0078-01	U12A	IC, DIG, TTL, 74LS257, 4 2-1 MUX
24	1	200-0058-01	U9H	IC, DIG, TTL, 74LS259, 8 BIT LATCH
25	1	200-0059-01	U11A	IC, DIG, TTL, 74LS273, OCTAL D F/F
26	1	200-0077-01	U11G	IC, DIG, TTL, 74LS299, 8 BIT SHIFT
27	5	200-0060-01	U10C, 10D, 9D, 9C, 11E	IC, DIG, TTL, 74LS374, OCTAL D F/F
28				
29				
30	2	200-0061-01	U17A, 15A	IC, DIG, TTL, 74S00, NAND GATE
31	1	200-0062-01	U16A	IC, DIG, TTL, 74S02, NOR GATE
32	2	200-0063-01	U12G, 18A	IC, DIG, TTL, 74S04, HEX INVERTER
33	1	200-0064-01	U10F	IC, DIG, TTL, 74S08, AND GATE
34	1	200-0065-01	U10E	IC, DIG, TTL, 74S32, OR GATE
35	1	200-0066-01	U12F	IC, DIG, TTL, 74S74, DUAL D F/F
36	7	200-0067-01	U2E-6E, 1F, 2F	IC, DIG, TTL, 74S151, 8-1 MUX
37	3	200-0068-01	U12B, 13B, 13A	IC, DIG, TTL, 74S157, 4 2-1 MUX
38	6	200-0069-01	U3F, 4F, 5F, 6F, 13D, 12D	IC, DIG, TTL, 74S163, 4 BIT COUNT
39	3	200-0070-01	U9E, 14A, 10A	IC, DIG, TTL, 74S174, HEX D F/F
40	2	200-0082-01	U20A, U16G	IC, DIG, TTL, 74S86, QUAD X-OR
41				
42	1	210-0005-01	U18D	IC, DIG, CMOS, 4049UB, HEX INVERTER
43	1	230-0007-01	U15E	IC, DIG, NOV RAM, X 2212, 256 X 4

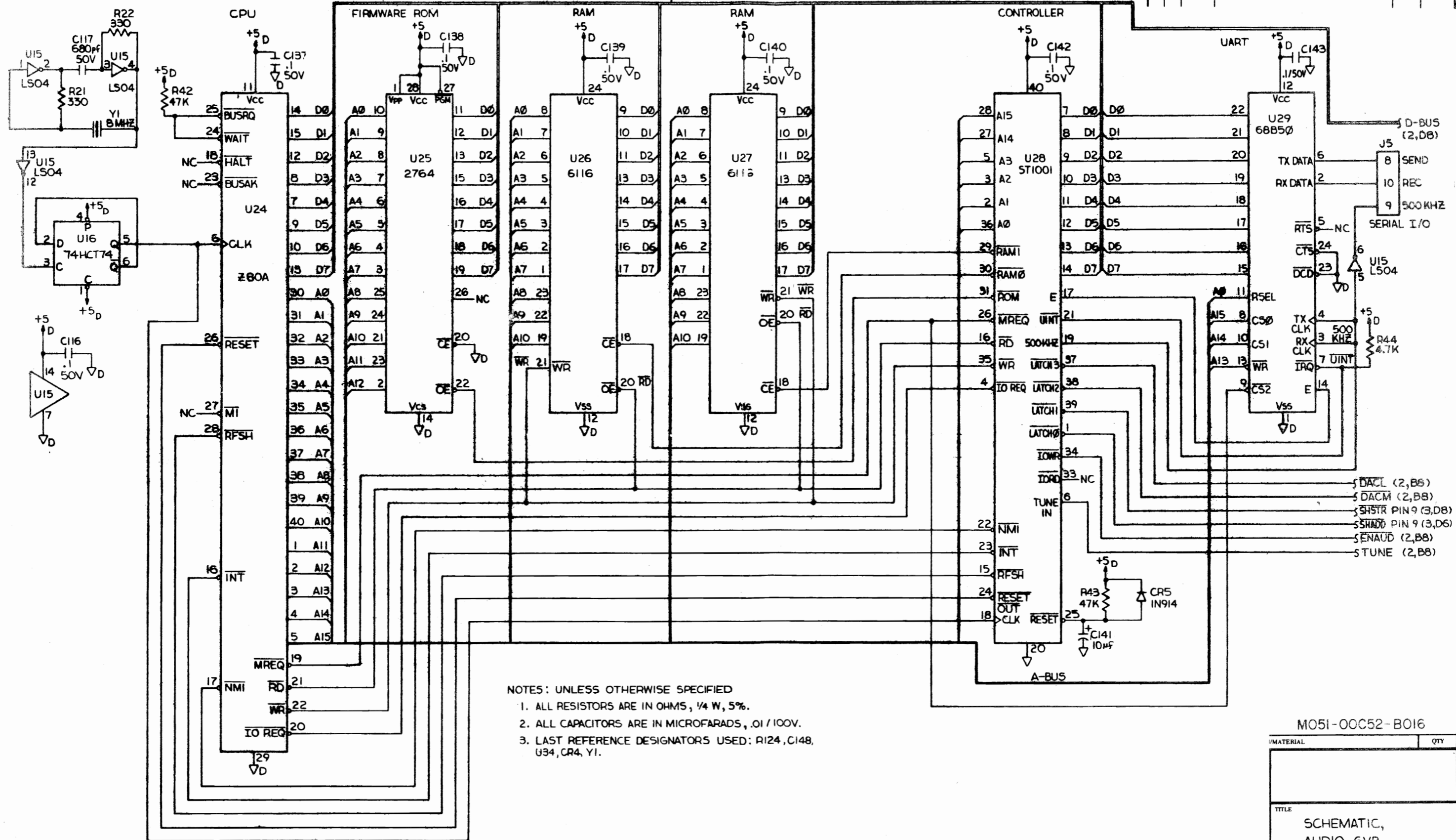
PCB ASSEMBLY, CPU
(006-8001-10-0C) (M051-00C52-C013)
PARTS LIST - SHEET 3 of 4

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
44	3	240-0003-01	U18F, 17F, 16F	IC, DIG, RAM, 2148, 1K X 4, 70NS
45	32	240-0004-01	U1A-BA, 1B-8B, 1C-8C, 1D-8D	IC, DIG, RAM, 4116, 16K X 1, 150NS
46	1	260-0002-01	U8H	IC, DIG, INT, ULN2003, DRIVER
47	1	015-8001-10-0B	U20F	PAL, SAC-1
48	1	250-0010-01	U9G	IC, DIG, MPS, 68B50, ACIA, .75MHZ
49	1	250-0006-01	U17C	IC, DIG, MPU, 68A09E
50	1	260-0030-01	U6G	IC, SP, , ADC 8 BIT, ADC0809
51	1	320-0006-01	C157	CAP, MIC, RAD, 12PF, 500V, 5%
52	1	320-0007-01	C158	CAP, MIC, RAD, 100PF, 500V, 5%
53	172	300-0009-01	C1, 3, 5, 7, 9, 11, 13, 15, 17-95, 97, 98, 100, 102, 103, 105, 106, 108, 109, 111, 112, 114, 115, 117, 118, 120, 121-156, 159-185, 190-195	CAP, CER, AXL, 0.1UF, 50V, 20%
54	2	340-0015-01	C96, 186	CAP, ELEC, AXL, 1.0UF, 63V, 50/-10%
55	2	340-0011-01	C187, C188	CAP, ELEC, AXL, 100UF, 16V, 50/-10%
56	1	340-0018-01	C189	CAP, ELEC, AXL, 470UF, 6.3V, 50/-10%
57	8	310-0013-01	C2, 6, 10, 14, 101, 107, 113, 119	CAP, TAN, AXL, 2.2UF, 10V, 20%
58	8	310-0014-01	C4, 8, 12, 16, 99, 104, 110, 116	CAP, TAN, AXL, 4.7UF, 20V, 20%
59	4	460-0015-01	RP11, RP13, RP15, RP16	RES, PAK, SIP, 8 PIN, 4X, 33 OHM
60	2	460-0016-01	RP12, RP14	RES, PAK, SIP, 10 PIN, 5X, 33 OHM
61				
62	1	400-1500-01	R63	RES, CF, 1/4W, 5%, 150 OHM
63	1	400-2200-01	R29	RES, CF, 1/4W, 5%, 220 OHM
64	3	400-4700-01	R32-34	RES, CF, 1/4W, 5%, 470 OHM
65	37	400-1001-01	R7, 8, 9, 11, 14, 15, 18-21, 27, 28, 35-57, 62, 64	RES, CF, 1/4W, 5%, 1K OHM
66	1	400-2701-01	R12	RES, CF, 1/4W, 5%, 2.7K OHM
67	6	400-4701-01	R13, 31, 58-61	RES, CF, 1/4W, 5%, 4.7K OHM
68	2	400-1002-01	R26, 30	RES, CF, 1/4W, 5%, 10K OHM
69	2	400-1003-01	R16, 17	RES, CF, 1/4W, 5%, 100K OHM
70	5	460-0011-01	RP4-8	RES, PAK, DIP, 16 PIN, 8X, 2.2K OHM
71	2	460-0012-01	RP9, 10	RES, PAK, SIP, 10 PIN, 9X, 470 OHM
72	1	460-0014-01	RP3	RES, PAK, SIP, 8 PIN, 7X, 1.0K OHM
73	2	460-0013-01	RP1, 2	RES, PAK, SIP, 10 PIN, 9X, 10K OHM
74	1	400-2700-01	R10	RES, CF, 1/4W, 5%, 270 OHM
75				
76	1	510-0019-01	U9G	SOCKET, IC, 24P, LOW PROF, PC
77	1	510-0020-01	U6G	SOCKET, IC, 28P, LOW PROF, PC
78	1	510-0021-01	U17C	SOCKET, IC, 40P, LOW PROF, PC

PCB ASSEMBLY, CPU
 (006-8001-10-0C) (M051-00C52-C013)
 PARTS LIST - SHEET 4 of 4

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
79				
80				
81				
82	1	550-0063-01	J22	CONN,AMP 1-102589-7
83	1	500-0016-01	L1	INDUCTOR,FER,AXL,100UH,10%
84	1	100-0002-01	CR1	D10,SI,10MA,75 PIV,IN914
85				
86				
87	4	120-0003-01	Q1,2,3,4	XSTR,SI,NPN,2N3904
88	1	260-0011-01	VR1	IC,LIN,VR,7905,5V NEG
89				
90	1	820-0004-01	Y1	CRYSTAL,20.000MHZ
91	1	840-0036-01	DS1	OPT,DSP,LED,SNG,RED
92	2	570-0036-01	U1G,1H	SW,DIP,8 PST
93				
94	1	801-0440-06-01		SCREW PH PH 4-40 X 3/8"
95	1	812-0440-00-01		NUT,HEX,4-40
96	1	822-0004-00-01		WASHER,SPLIT LOCK #4
97	1	800-00237-01	DS1	SPACER,LED
98				
99				
100				
101				
102	2	200-0079-01	U7F,U16B	IC,DIG,TTL,74F175,QUAD D F/F
103	2	200-0080-01	U7E,U9B	IC,DIG,TTL,74F374,OCTAL D F/F
104				
105				

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED
	B		PCB REDESIGNED FOR ST1001 CHIP		
	B1	1988	ADDED C149		

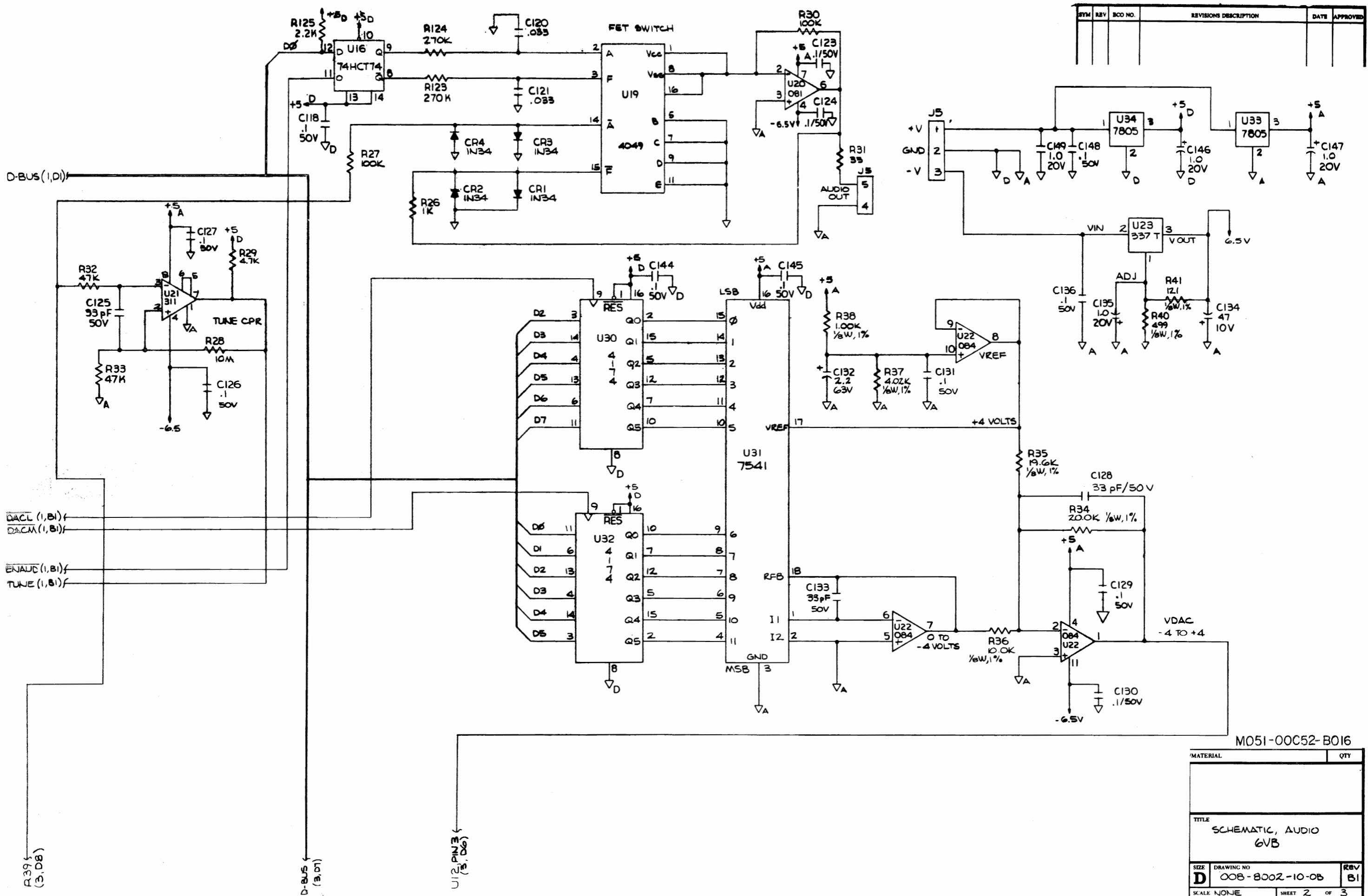


NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5%.
 2. ALL CAPACITORS ARE IN MICROFARADS, .01 / 100V.
 3. LAST REFERENCE DESIGNATORS USED: R124, C148, U34, CR4, Y1.

M051-00C52-B016

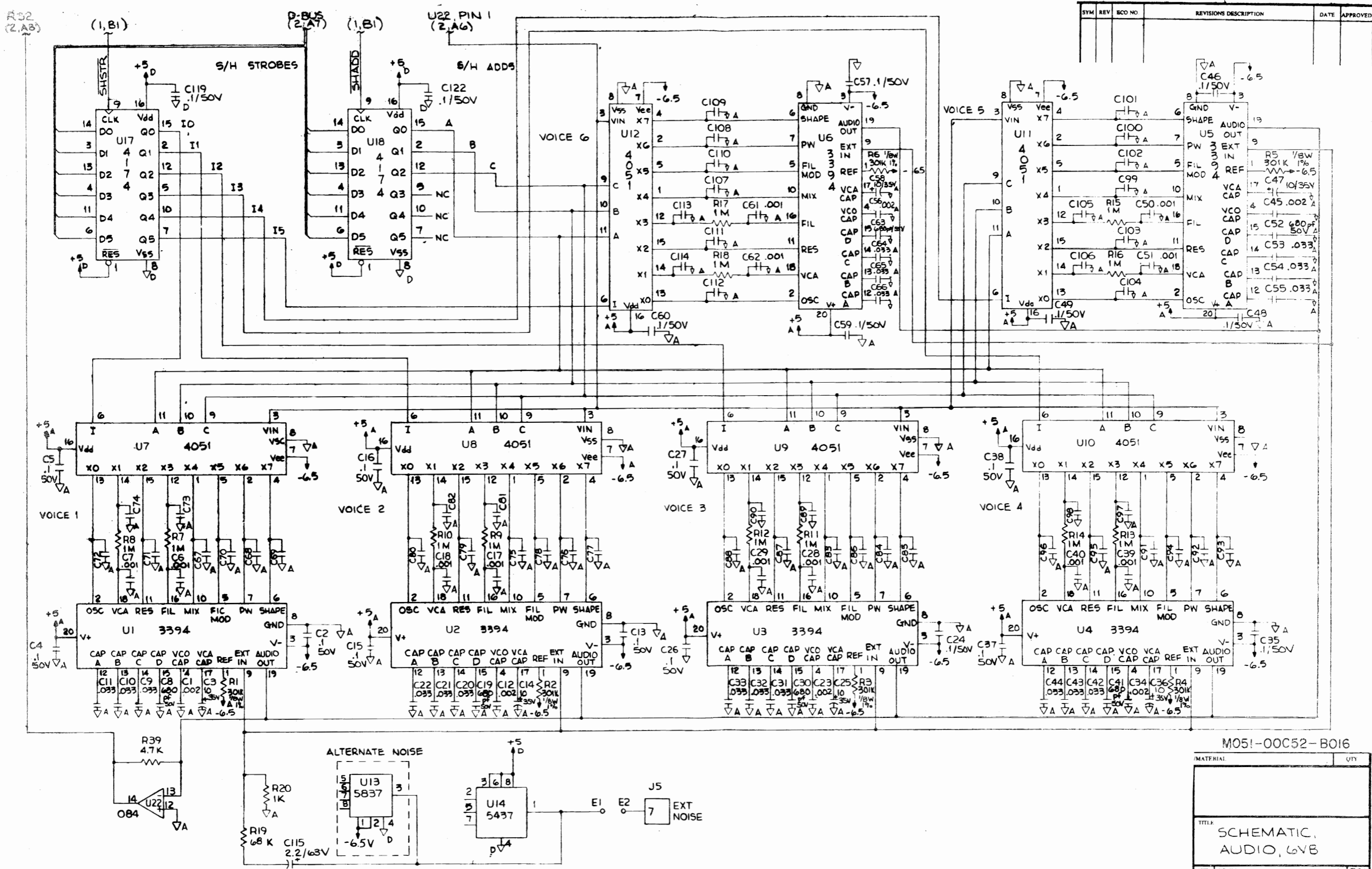
MATERIAL		QTY
TITLE		
SCHEMATIC, AUDIO, 6VB		
SIZE	DRAWING NO.	REV
D	008-8002-10-0B	B1
SCALE	NONE	SHEET 1 OF 3

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED



M051-00C52-B016

MATERIAL		QTY
TITLE		
SCHEMATIC, AUDIO		
6VB		
SIZE	DRAWING NO.	REV
D	00B-8002-10-0B	B1
SCALE NONE	SHEET 2 OF 3	



SYM	REV	ECO NO	REVISIONS DESCRIPTION	DATE	APPROVED

M051-00C52-B016

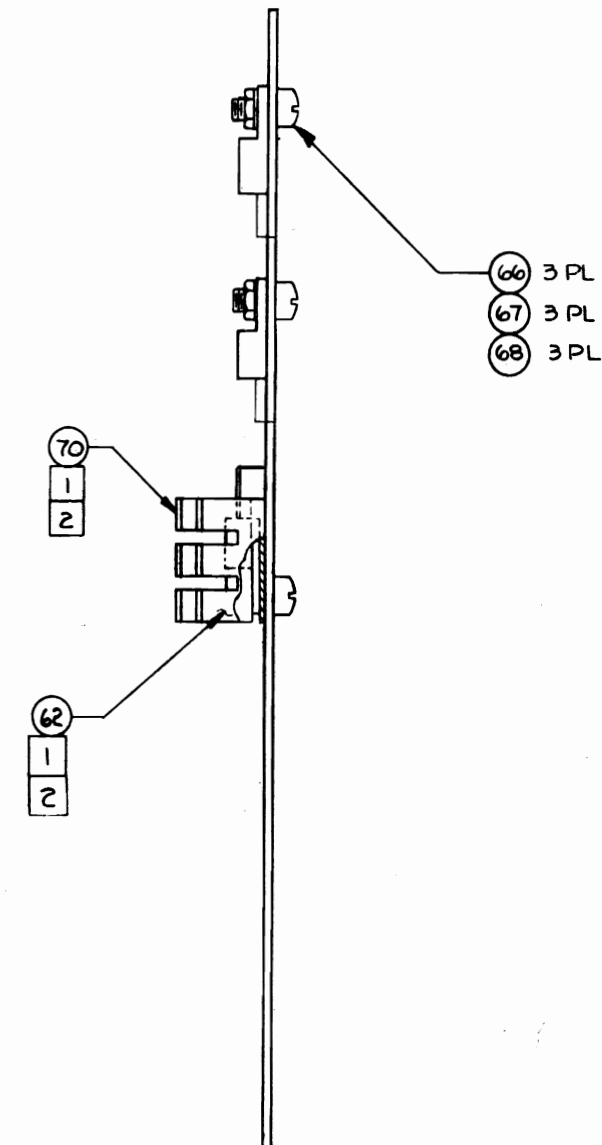
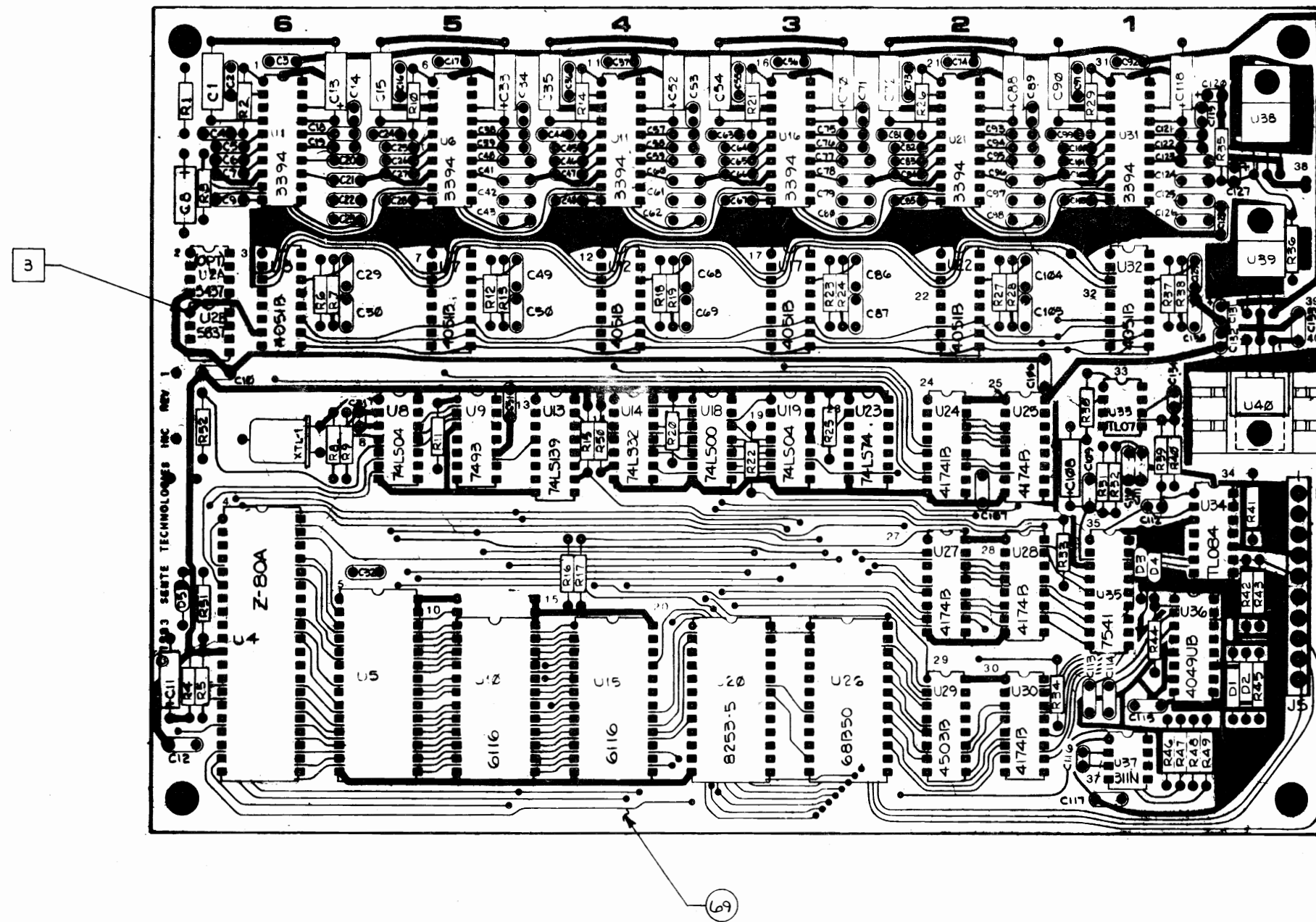
MATERIAL	QTY

TITLE
SCHEMATIC,
AUDIO, 6VB

SIZE	DRAWING NO	REV
D	008-8002-10-0B	B

SCALE NONE SHEET 3 OF 3

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED
	1		PROTOTYPE	11/18/80	[Signature]
A	1892		PRODUCTION RELEASE	11/17/80	[Signature]
1	A	1900	ADDED NOTE 3, REVERSED POLARITY OF C8.	11/20/80	[Signature]
B	1924		ADDED 2 HEATSINKS, ITEMS 62 & 70	11/25/80	[Signature]



NOTES:

- 1 FASTEN U40 (ITEM 53) TO HEATSINK (ITEM 62), HEATSINK (ITEM 70), AND PCB (ITEM 69), WITH HARDWARE (ITEM 66, 67 & 68) BEFORE SOLDERING TO PCB.
- 2 APPLY HEATSINK COMPOUND TO HEATSINK (ITEM 62) & HEATSINK (ITEM 70) PRIOR TO MOUNTING.
- 3 SHORT PIN 1 TO PIN 2 OF U2B, AND MOUNT C8 AS SHOWN TO USE AMI 2688 (5837 EQUIV)

M051-00C52-B015

MATERIAL		QTY
TITLE PCB ASSEMBLY, AUDIO, 6VB		
SIZE D	DRAWING NO. 006-8002-10-0B	REV 0B
SCALE 2:1	SHEET 1 OF 4	

PCB ASSEMBLY, AUDIO 6VB
(006-8002-10-0B) (M051-00C52-B015)
PARTS LIST - SHEET 2 of 4

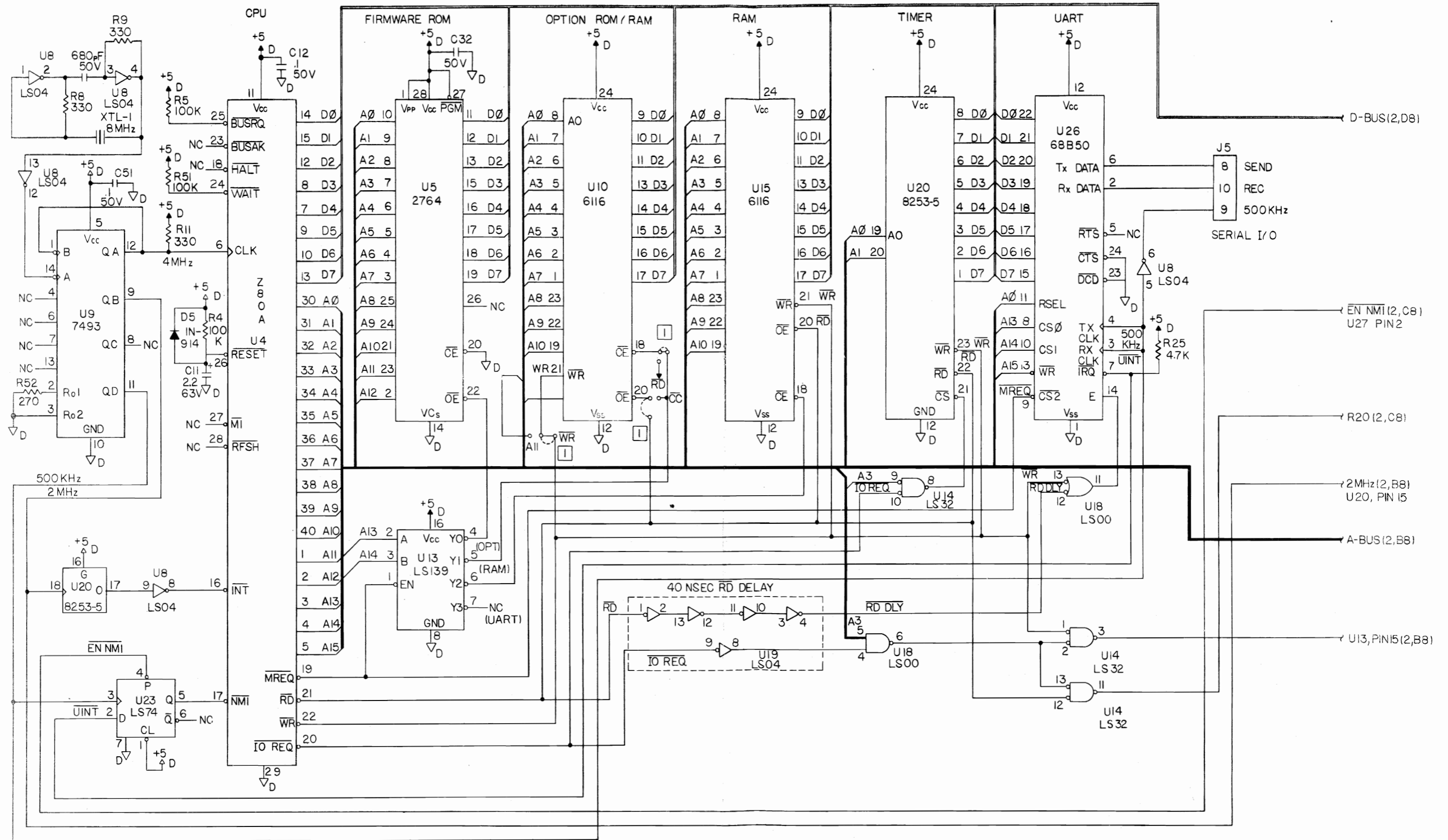
ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
1	2	400-1001-01	R1,R44	RES,CF,1/4W,5%,1K OHM
2	1	400-6802-01	R3	RES,CF,1/4W,5%,68K OHM
3	5	400-1003-01	R4,5,42,45,51	RES,CF,1/4W,5%,100K OHM
4	12	400-1004-01	R6,7,12,13	RES,CF,1/4W,5%,1.0M OHM
5	3	400-3300-01	R8,9,11	RES,CF,1/4W,5%,330 OHM
6	6	400-2001-01	R15,16,17,20,22,50	RES,CF,1/4W,5%,2.0K OHM
7	3	400-4701-01	R25,41,46	RES,CF,1/4W,5%,4.7K OHM
8	2	400-4702-01	R48,49	RES,CF,1/4W,5%,47K OHM
9	1	400-3307-01	R43	RES,CF,1/4W,5%,33 OHM
10	1	401-1005-01	R47	RES,CC,1/4W,5%,10M OHM
11	6	450-3013-01	R2,10,14,21,26,29	RES,MF,1/8W,1%,301K OHM
12	1	450-1962-01	R40	RES,MF,1/8W,1%,19.6K OHM
13				
14	1	450-2002-01	R30	RES,MF,1/8W,1%,20.0K OHM
15	1	450-4021-01	R31	RES,MF,1/8W,1%,4.02K OHM
16	1	450-1001-01	R32	RES,MF,1/8W,1%,1.00K OHM
17	1	450-1210-01	R35	RES,MF,1/8W,1%,121 OHM
18	1	450-4990-01	R36	RES,MF,1/8W,1%,499 OHM
19	1	450-1002-01	R39	RES,MF,1/8W,1%,10.0K OHM
20				
21	12	330-0005-01	C14,18,34,38,53, 57,71,75,89,93,119, 121	CAP,PES,RAD,0.001UF, 100V,10%
22	6	330-0009-01	C1,15,35 54,72,90	CAP,PST,AXL,0.002UF, 100V,5%
23	48	330-0006-01	C2,5,6,7,9,16,23,25, 26,27,28,29,30,36,43, 45,46,47,48,49,50,55, 62,64,65,66,67,68,69, 73,80,82,83,84,85,86, 87,91,98,100,101,102, 103,104,105,126,129, 130	CAP,PES,RAD,0.01UF,100V, 10%
24	20	330-0007-01	C20,21,22,40,41,42, 59,60,61,77,78,79,95, 96,97,113,114,123, 124,125	CAP,PES,RAD,0.033UF,100V 10%
25	3	300-0011-01	C112,116,134	CAP,CER,RAD,33PF,50V,10%
26	7	300-0012-01	C19,31,39,58,76,94, 122	CAP,CER,RAD,680PF,50V,5%
27	25	300-0002-01	C3,4,10,12,17,24,32, 37,44,51,56,63,74,81, 92,99,106,107,109, 110,111,115,117,128, 133	CAP,CER,RAD,0.1UF,50V,20%
28	3	310-0012-01	C127,131,132	CAP,TAN,RAD,1.0UF,25V,20%
29	3	340-0016-01	C8,11,108	CAP,ELC,AXL,2.2UF,63V,50/ 10%

PCB ASSEMBLY, AUDIO 6VB
(006-8002-10-0B) (M051-00C52-B015)
PARTS LIST - SHEET 3 of 4

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
30	6	340-0017-01	C13,33,52,70,88,118	CAP,ELC,AXL,10UF,35V,50/ 10%
31	6	260-0033-01	U1,6,11,16,21,31	IC,SP,SOUND,SYNTH,CEM, 3394
32	5	210-0007-01	U24,25,27,28,30	IC,DIG,CMOS,4174B,HEX D F/F
33	6	210-0006-01	U3,7,12,17,22,32	IC,DIG,CMOS,4051B,8 CHAN MUX
34	1	210-0005-01	U36	IC,DIG,CMOS,4049UB,HEX INVERT
35	1	260-0029-01	U34	IC,LIN,OPAMP,TL084,QUAD, JFET
36	1	260-0031-01	U35	IC,SP,DAC 12 BIT, 7541
37	1	260-0007-01	U37	IC,LIN,COMP,LM311N
38	1	260-0037-01	U33	IC,LIN,OPAMP,TL071,JFET, INPUT
39	1	210-0008-01	U29	IC,DIG,CMOS,4503B,HEX TS BUFFER
40	1	260-0040-01	U2	IC,SP,NOISE SOURCE MM5837
41	1	200-0039-01	U18	IC,DIG,TTL,74LS00,NAND GATE
42	2	200-0041-01	U8,19	IC,DIG,TTL,74LS04,HEX INVERTER
43	1	200-0043-01	U14	IC,DIG,TTL,74LS32,OR GATE
44	1	200-0044-01	U23	IC,DIG,TTL,74LS74,DUAL D F/F
45	1	200-0074-01	U9	IC,DIG,TTL,7493,4 BIT COUNT
46	1	200-0049-01	U13	IC,DIG,TTL,74LS139,2-4 DECODER
47	1	250-0007-01	U4	IC,DIG,MPU,Z-80A
48				
49	2	240-0005-01	U10,15	IC,DIG,RAM,6116,2KX8, 200NS
50	1	250-0008-01	U20	IC,DIG,MPS,8253-5,TIMER
51	1	250-0010-01	U26	IC,DIG,MPS,68B50,ACIA .75MHZ
52	1	260-0027-01	U38	IC,LIN,VR,337T,VARIABLE NEG.
53	1	260-0028-01	U40	IC,LIN,VR,78M05CT,5V POS
54	1	260-0008-01	U39	IC,LIN,VR,7805,5V POS
55	4	100-0006-01	D1,2,3,4	DIO,GR,50MA,75PIV,IN34
56	1	550-0062-01	J5	CONN 10 PIN LOCKING 09-74-1101
57	4	510-0019-01	U10,15,20,26	SOCKET,IC,24P,LOW PRO
58	1	510-0020-01	U5	SOCKET,IC,28P,LOW PRO
59	1	510-0021-01	U4	SOCKET,IC,40P,LOW PRO
60	1	100-0002-01	D5	DIO,S1,10MA,75 PIV,IN914

PCB ASSEMBLY, AUDIO 6VB
 (006-8002-10-0B) (M051-00C52-B015)
 PARTS LIST - SHEET 4 of 4

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
61	1	820-0003-01	XTL-1	CRYSTAL 8.000MHZ
62	1	850-0007-01	HS-1	HEATSINK, THM-6070
63	1	310-0015-01	C120	CAP, TANT, RAD, 47UF, 15V, 20%
64	2	400-2703-01	R33, 34	RES, CF, 1/4W, 5%, 270K OHM
65	1	400-2700-01	R52	RES, CF, 1/4W, 5%, 270 OHM
66	3	801-0632-06-01		SCREW PAN HD-PHIL 6-32X 3/8
67	3	822-0006-00-01		WASHER SPLITLOCK 6
68	3	816-0632-00-01		NUT, HEX, SM PAT, 6-32
69	1	007-8002-01-0A		PCB, FAB, AUDIO, 6VB
70	1	850-0008-01	HS-2	HEATSINK, THM-6071



NOTES: UNLESS OTHERWISE SPECIFIED

1 ALL RESISTORS ARE IN OHMS, 1/4 W, 5%.

2 ALL CAPACITORS ARE IN MICROFARADS, .01/100V.

3 LAST REFERENCE DESIGNATORS USED: R52, C134, U40, D5, XTL-1.

008-8002-10A

Figure 12. Audio Schematic, Sheet 1

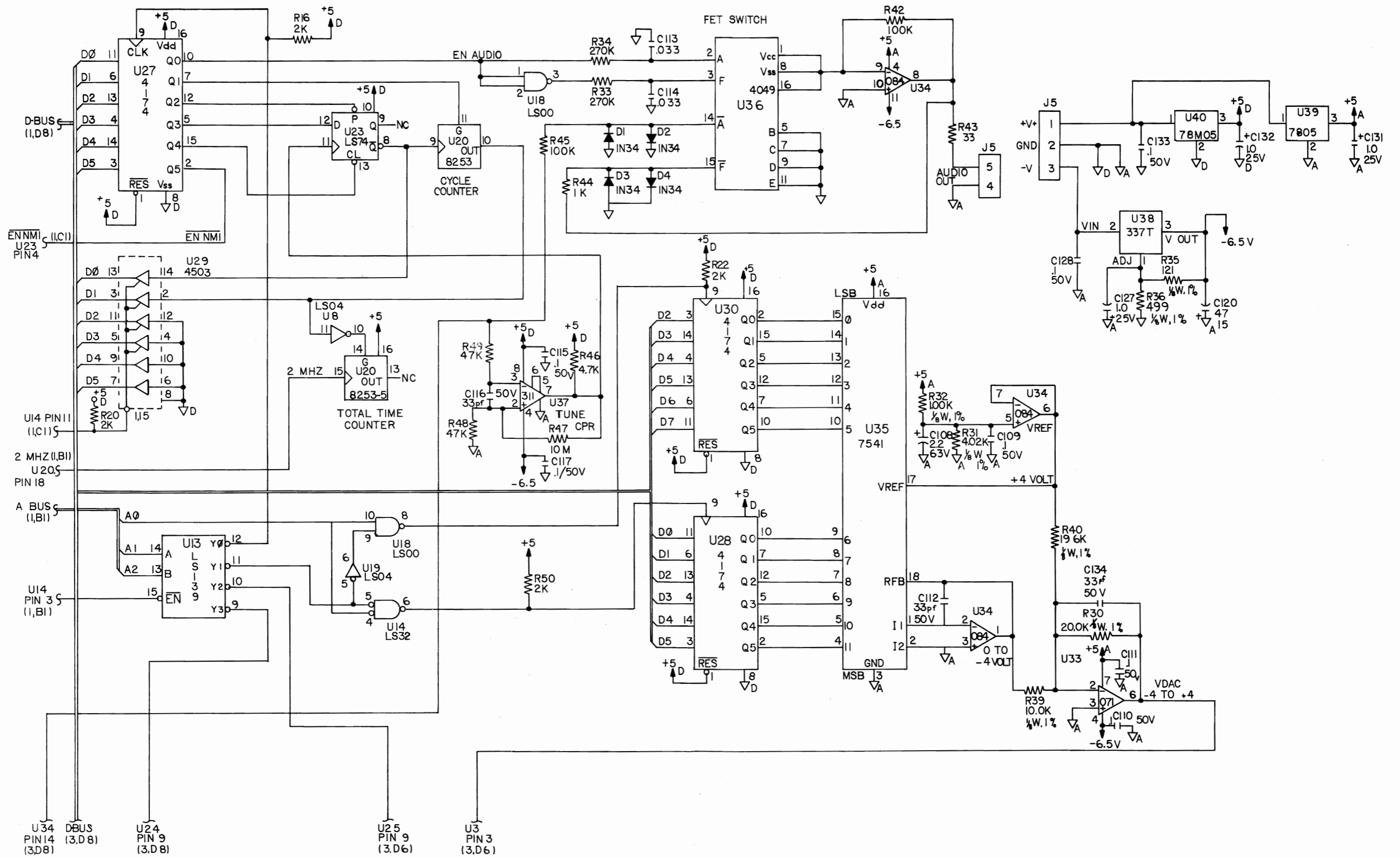


Figure 13 Audio Schematic, Sheet 2

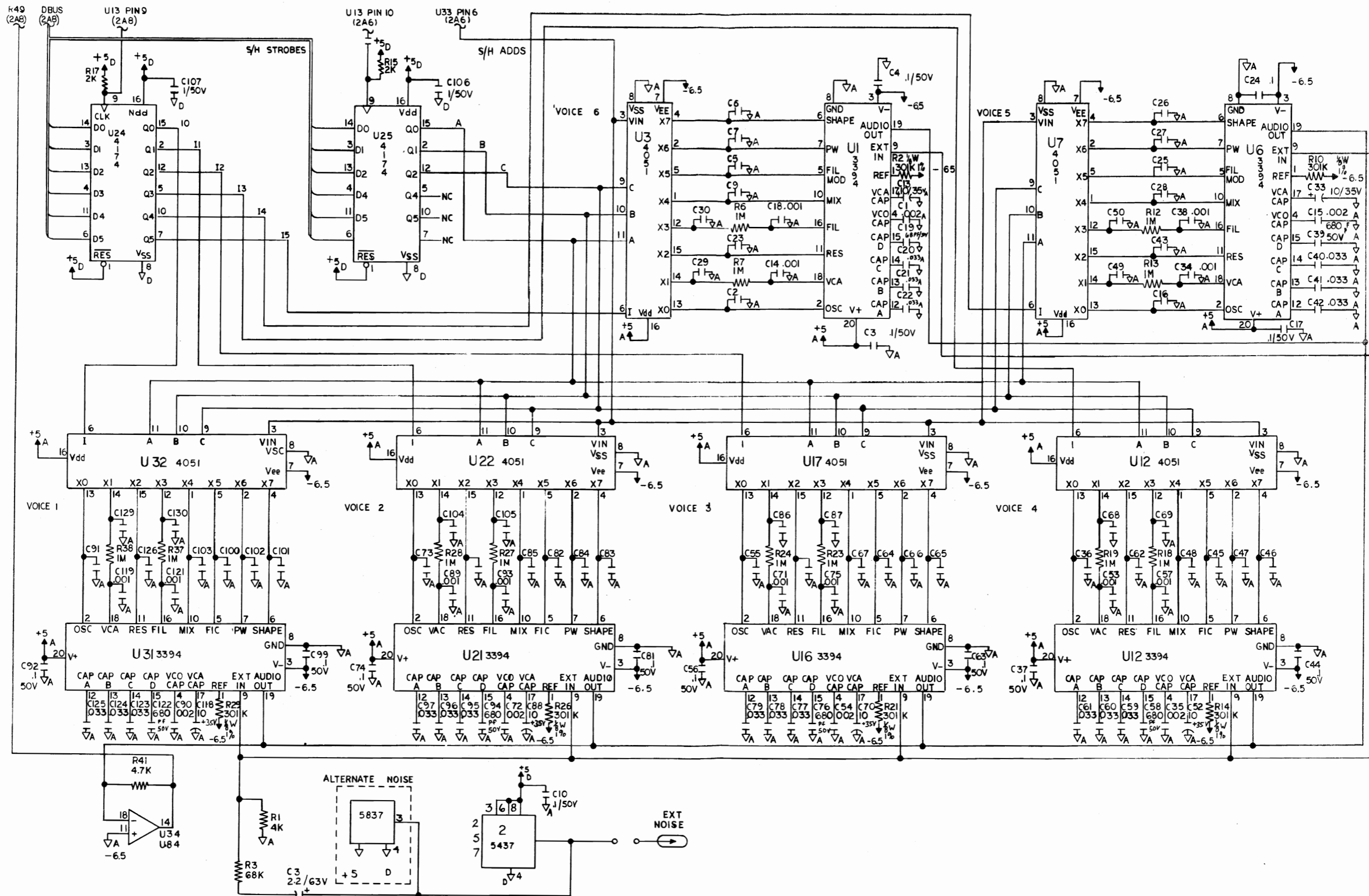
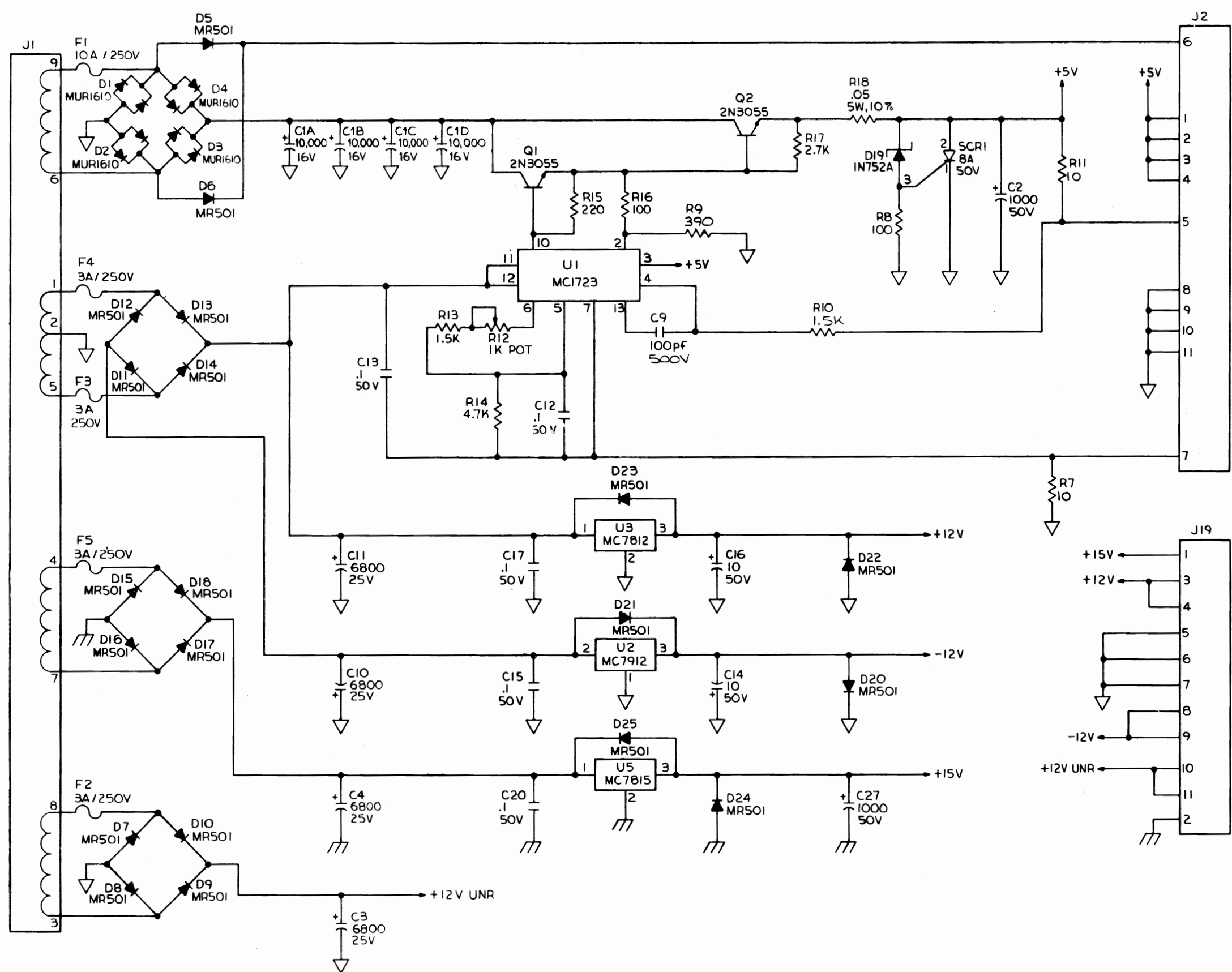


Figure 14 Audio Schematic, Sheet 3

SYM	REV	ECO NO	REVISIONS DESCRIPTION	DATE	APPROVED
A	1984		PRODUCTION RELEASE		
B	1998		RELEASED REDESIGNED PCB		

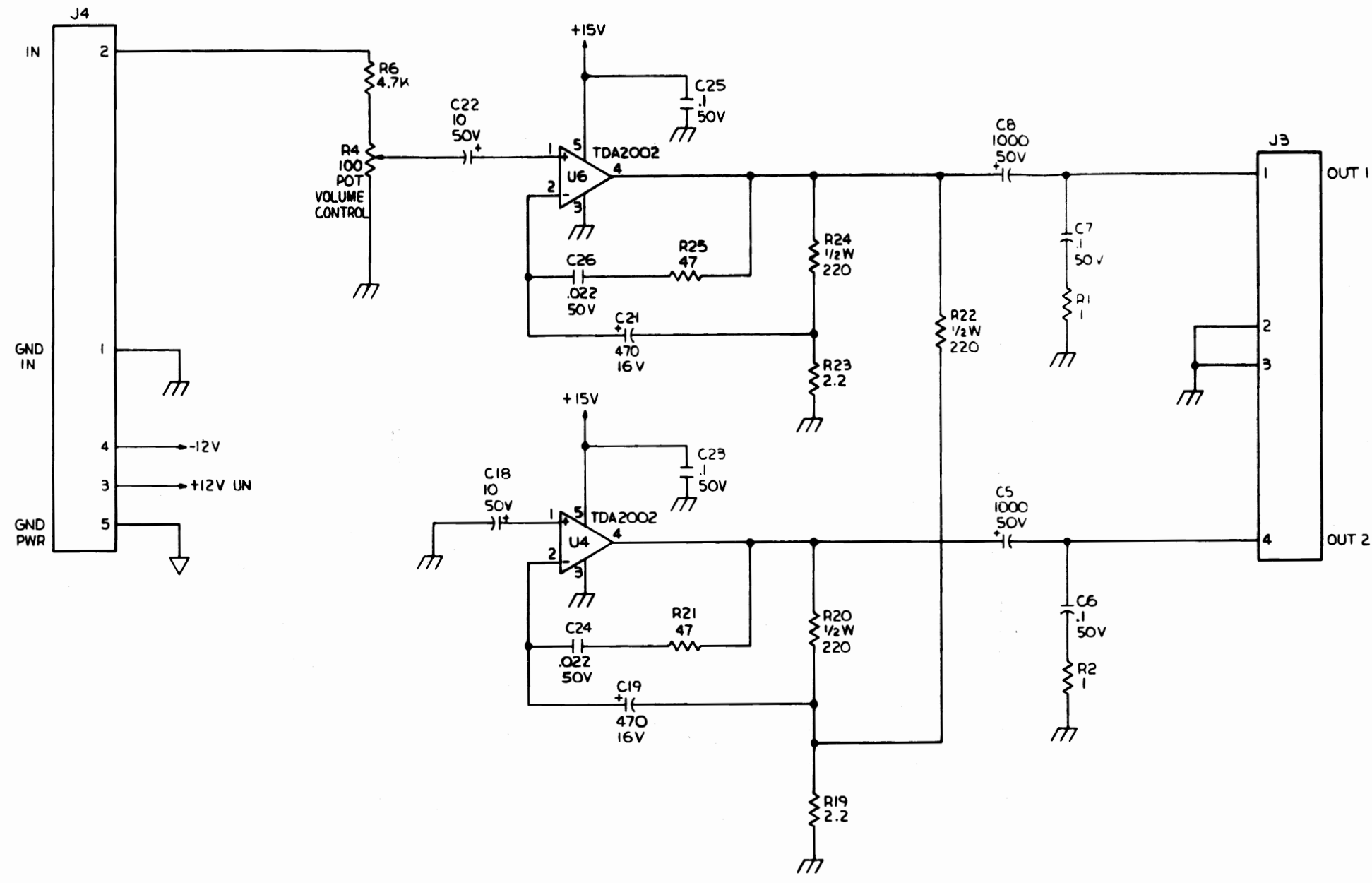


- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
 2. ALL CAPACITORS ARE IN MICROFARADS.
 3. LAST REFERENCE DESIGNATORS USED: R25, C27, D25, U6, Q2, F5, J19, SCRI.
 4. HEAT SINK ATTACHED TO AUDIO GROUND.
 5. = AUDIO GND
 = GND

M051-00C52 - B018

/MATERIAL		QTY
TITLE		
SCHEMATIC, LINEAR POWER SUPPLY		
SIZE	DRAWING NO	REV
D	008-8009-10-08	B
SCALE	NONE	SHEET 1 OF 2

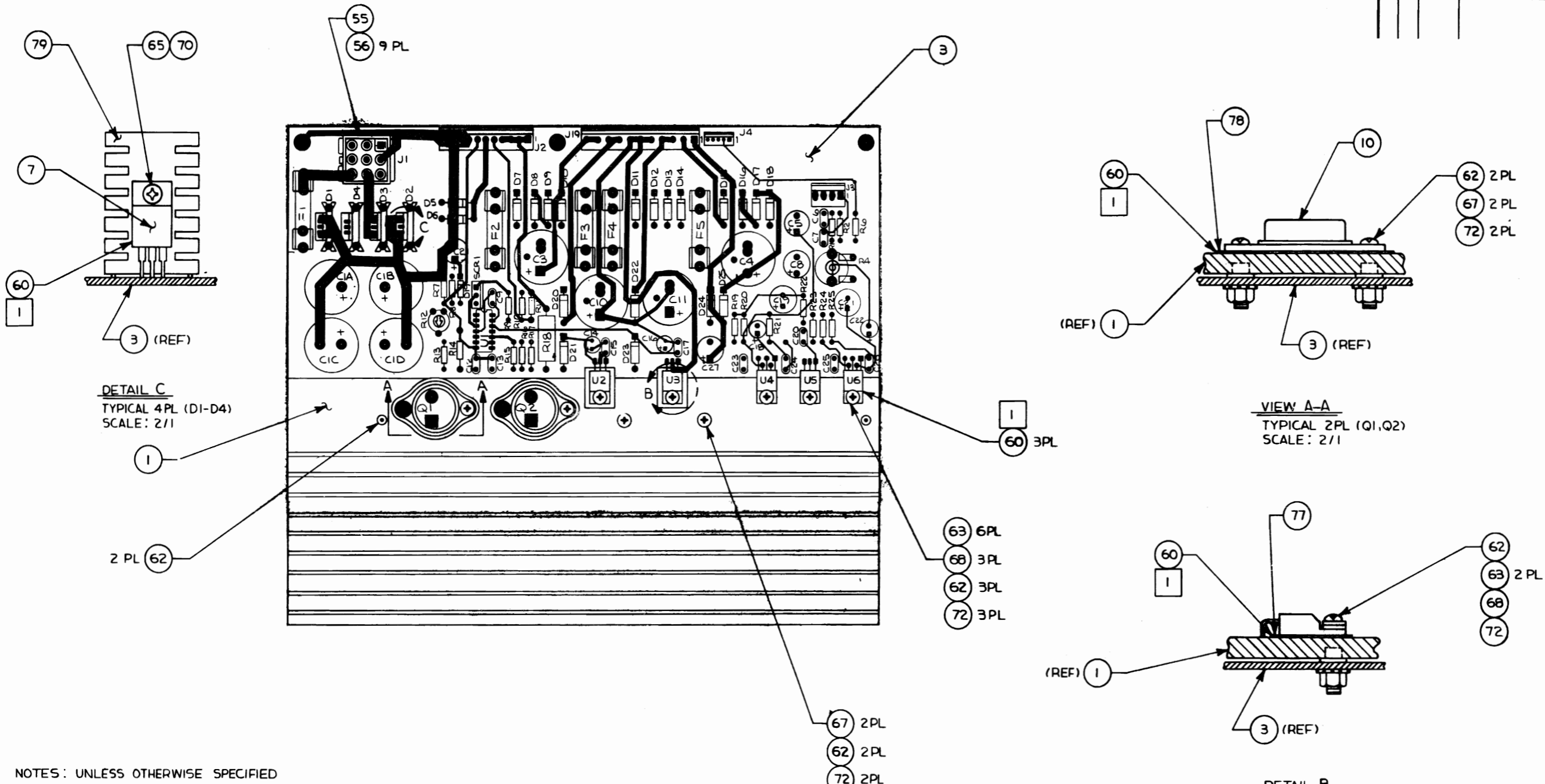
SYM	REV	PLC NO	REVISIONS DESCRIPTION	DATE	APPROVED



M051-00C52-B018

MATERIAL		QTY
TITLE		
SCHEMATIC, LINEAR POWER SUPPLY		
SIZE	DRAWING NO	REV
D	008-8009-10-OB	B
SCALE	SHEET	OF
NONE	2	2

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED
	B	1998	RELEASED REDESIGNED PCB	1/20/01	AC



DETAIL C
TYPICAL 4 PL (D1-D4)
SCALE: 2/1

VIEW A-A
TYPICAL 2 PL (Q1,Q2)
SCALE: 2/1

DETAIL B
TYPICAL 2 PL (U2,U3)
SCALE: 2/1

NOTES: UNLESS OTHERWISE SPECIFIED

1 APPLY HEATSINK COMPOUND (ITEM 60) ON BOTH SIDES OF INSULATOR (ITEM 78) AT Q1 AND Q2, AND ON BOTH SIDES OF INSULATOR (ITEM 77) AT U2 AND U3. APPLY BETWEEN HEATSINK AND COMPONENT AT U4,U5,U6,D1,D2,D3 AND D4.

M051-00C52-8017	
MATERIAL	QTY
TITLE PCB ASSY, LINEAR POWER SUPPLY	
SIZE	REV
D	B
DRAWING NO. 006-8009-10-08	
<small>UNLESS OTHERWISE SPECIFIED</small>	

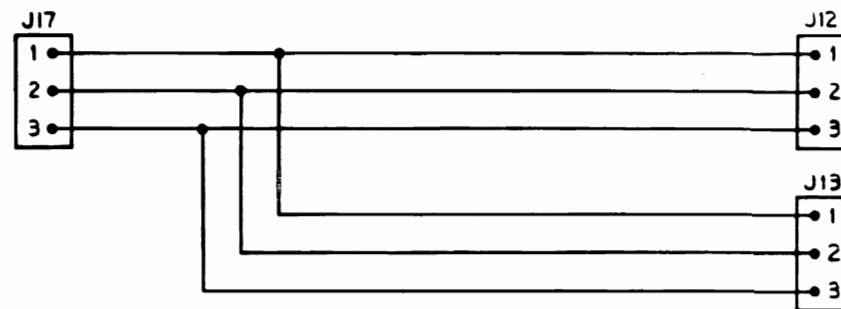
PCB ASSEMBLY, LINEAR POWER SUPPLY
(006-8009-10-0B) (M051-00C52-B017)
PARTS LIST - SHEET 2 of 3

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
1	1	001-8076-01-0B		HEATSINK,E-368/#5555
2				
3	1	007-8009-10-0B		PCB FAB, LINEAR PWR SPLY
4				
5	20	100-0008-01	D5-D18,D20-D25	D10,SI,3A,100 PIV,MR501
6				
7	4	105-0004-01	D1-D4	D10,RECTIFIER,16A, MUR1610 CT
8	1	110-0004-01	D19	D10,ZEN,5.6V,20MA,IN752A
9				
10	2	120-0004-01	Q1,Q2	XSTR,SI,NPN,2N3055
11				
12	1	160-0004-01	SCR1	SCR,8A,50V,C122F1
13				
14	2	260-0039-01	U4,U6	IC,LIN,SP,TDA2002,AUD AMP
15	1	260-0042-01	U2	IC,LIN,VR,MC7912,-12V, 3 POS
16	1	260-0043-01	U3	IC,LIN,VR,MC7812,+12V, 3 POS
17	1	260-0044-01	U5	IC,LIN,VR,MC7815,+15V, 3 POS
18	1	260-0045-01	U1	IC,LIN,VR,MC1723,SI,MONO
19				
20	9	300-0002-01	C6,C7,C12,C13,C15,C17, C20,C23,C25	CAP,CER,RAD,.1MF,50V
21	2	300-0001-01	C24,C26	CAP,CER,RAD,.022UF,50V, 20%
22	1	320-0007-01	C9	CAP,MIC,RAD,100PF,500V, 5%
23				
24	4	340-0026-01	C14,C16,C18,C22	CAP,ELC,RAD,10MF,50V,20%
25	2	340-0027-01	C19,C21	CAP,ELC,RAD,470MF,16V, -10%,+50%
26	4	340-0028-01	C1A,C1B,C1C,C1D	CAP,ELC,RAD,10.000MF,16V +10%,-30%
27	4	340-0029-01	C3,C4,C10,C11	CAP,ELC,RAD,6800MF,25V, -10%,+30%
28	4	340-0030-01	C2,C5,C8,C27	CAP,ELC,RAD,1000MF,50V, 20%
29				
30	2	400-1000-01	R8,R16	RES,CF,1/4W,5%,100 OHM
31	2	400-1008-01	R1,R2	RES,CF,1/4W,5%,1 OHM
32				
33	2	400-1007-01	R7,R11	RES,CF,1/4W,5%,10 OHM
34				
35	1	400-1501-01	R13,R10	RES,CF,1/4W,5%,1.5K OHM
36				
37	1	400-2200-01	R15	RES,CF,1/4W,5%,220 OHM

PCB ASSEMBLY, LINEAR POWER SUPPLY
(006-8009-10-0B) (M051-00C52-B017)
PARTS LIST - SHEET 3 of 3

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
38	2	400-2208-01	R19,R23	RES,CF,1/4W,5%,2.2 OHM
39				
40	1	400-2701-01	R17	RES,CF,1/4W,5%,2.7K OHM
41	1	400-3900-01	R9	RES,CF,1/4W,5%,390 OHM
42	2	400-4701-01	R6,R14	RES,CF,1/4W,5%,4.7K OHM
43	2	400-4707-01	R21,R25	RES,CF,1/4W,5%,47 OHM
44	1	480-0007-01	R12	RES,VAR,STR,TRIM,1K OHM
45	1	480-0008-01	R4	RES,VAR,STR,TRIM,100 OHM
46	3	410-2200-01	R20,22,24	RES,CF,1/2W,5%,220 OHM
47	1	440-0508-01	R18	RES,WW,5W,10%,.05 OHM
48				
49				
50	1	550-0067-01	J3	CONN,PC,4P,M,09-74-1041
51	1	550-0068-01	J4	CONN,PC,5P,M,22-23-2051
52				
53	1	550-0102-01	J2	CONN,PC,11P,M,09-74-1111
54	1	550-0103-01	J19	CONN,PC,11P,M,10-19-1111
55	1	550-0110-01	J1	CONN,PC,9P,PLG,19-09-2099
56	9	550-0111-01	J1	CONN,PIN,M,PC,02-09-8113
57				
58	10	580-0070-01	F1-F5	FUSE,CLIP,PC,1/4"
59				
60	A/R	790-0007-01		THERMAL JOINT COMPOUND
61				
62	13	800-0240-01		BUSHING,INSULATED,NYLON
63	10	800-0241-01	U2-U6	WSHR,RECTANGULAR,METAL,#6
64				
65	4	801-0440-04-01	D1-D4	SCREW,PH,PH,4-40 X 1/4"
66				
67	6	801-0632-08-01	Q1,Q2	SCREW,PH,PH,6-32 X 1/2"
68	5	801-0632-10-01	U2-U6	SCREW,PH,PH,6-32 X 5/8"
69				
70	4	812-0440-00-01	D1-D4	NUT,HEX,4-40
71				
72	11	813-0632-00-01		NUT,HEX,KEP,6-32
73				
74	4	830-0019-01	F2-F5	FUSE,3AG,3A,250V,FAST ACTING
75	1	830-0020-01	F1	FUSE,3AB,10A,250V,SLO-BLO
76				
77	2	850-0009-01	U2,U3	INSULATOR,MICA,TO-220
78	2	850-0010-01	Q1,Q2	INSULATOR,MICA,TO-3
79	4	850-0011-01	D1-D4	HEATSINK,PC MOUNT,VERT, TO-220

SYM	REV	ECO NO.	REVISIONS DESCRIPTION	DATE	APPROVED
	B	1994	DELETED UI.U2.R1 AND J18	10/2/94	[Signature]

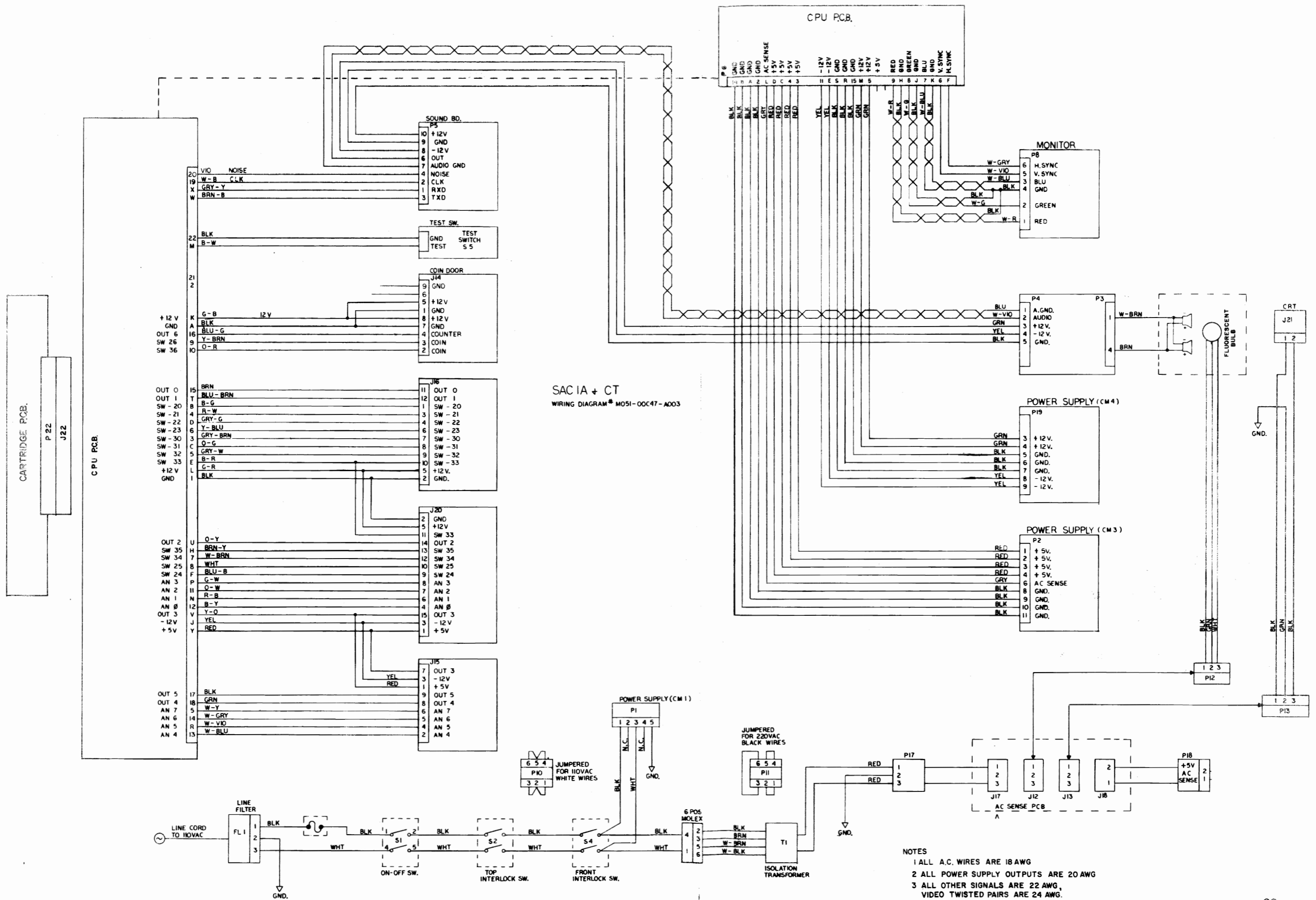


NOTES: UNLESS OTHERWISE SPECIFIED

- I. A. PINS 1 & 3 - AC POWER
- B. PIN 2 - CHASSIS GROUND

M051-00C47-A016

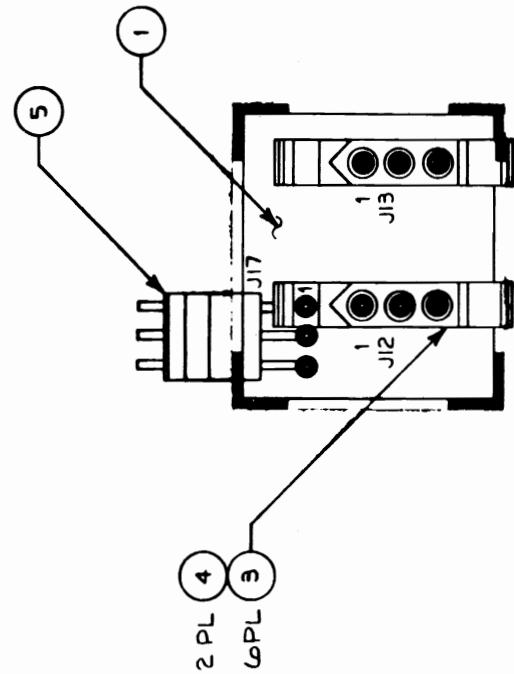
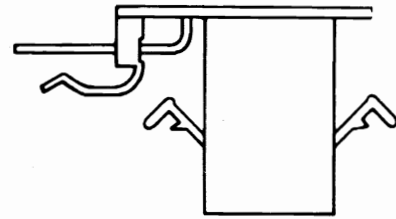
MATERIAL		Q11
TITLE		
SCHEMATIC, AC SENSE		
SIZE	DRAWING NO	REV
C	008-8006-01-0B	B
SCALE	NONE	SHEET 1 OF 1



SAC IA + CT
WIRING DIAGRAM* M051-00C47-A003

- NOTES
- 1 ALL A.C. WIRES ARE 18 AWG
 - 2 ALL POWER SUPPLY OUTPUTS ARE 20 AWG
 - 3 ALL OTHER SIGNALS ARE 22 AWG, VIDEO TWISTED PAIRS ARE 24 AWG.

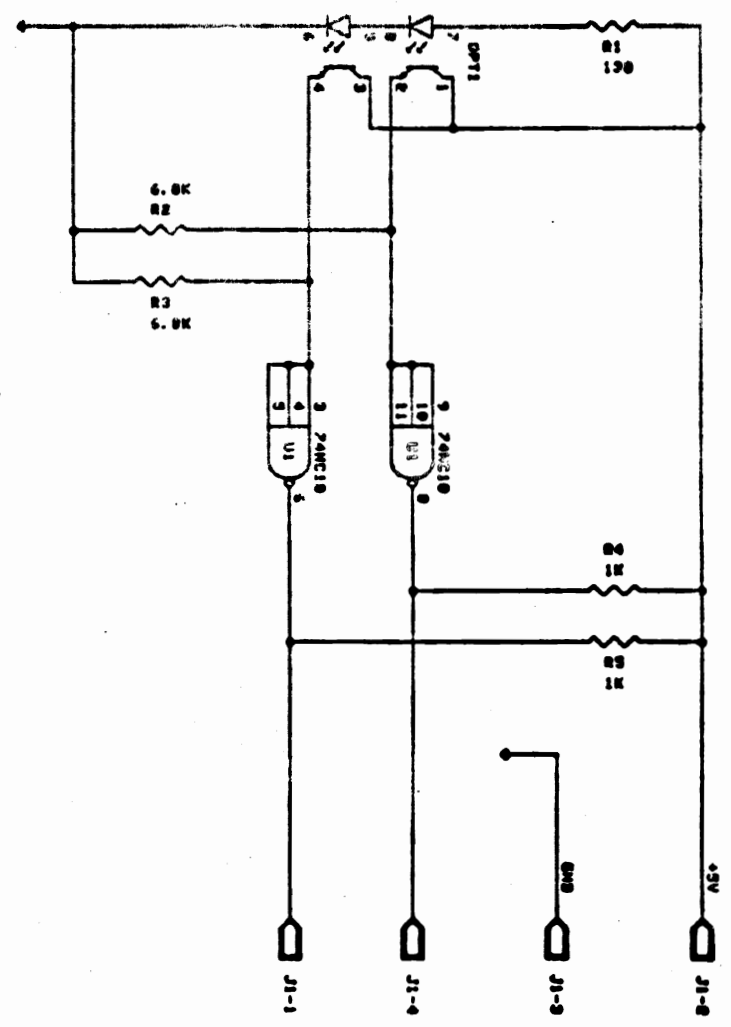
REV	DATE	DESCRIPTION	APPROVED
B	1994	DELETED R1, U1, U2 AND J18	



M051-00C47-A015		QTY
TITLE		
PCB ASSEMBLY, AC SENSE		
SIZE	DRAWING NO.	REV.
C	006-8006-10-0B	B
SCALE 2/1		SHEET 1 OF 2

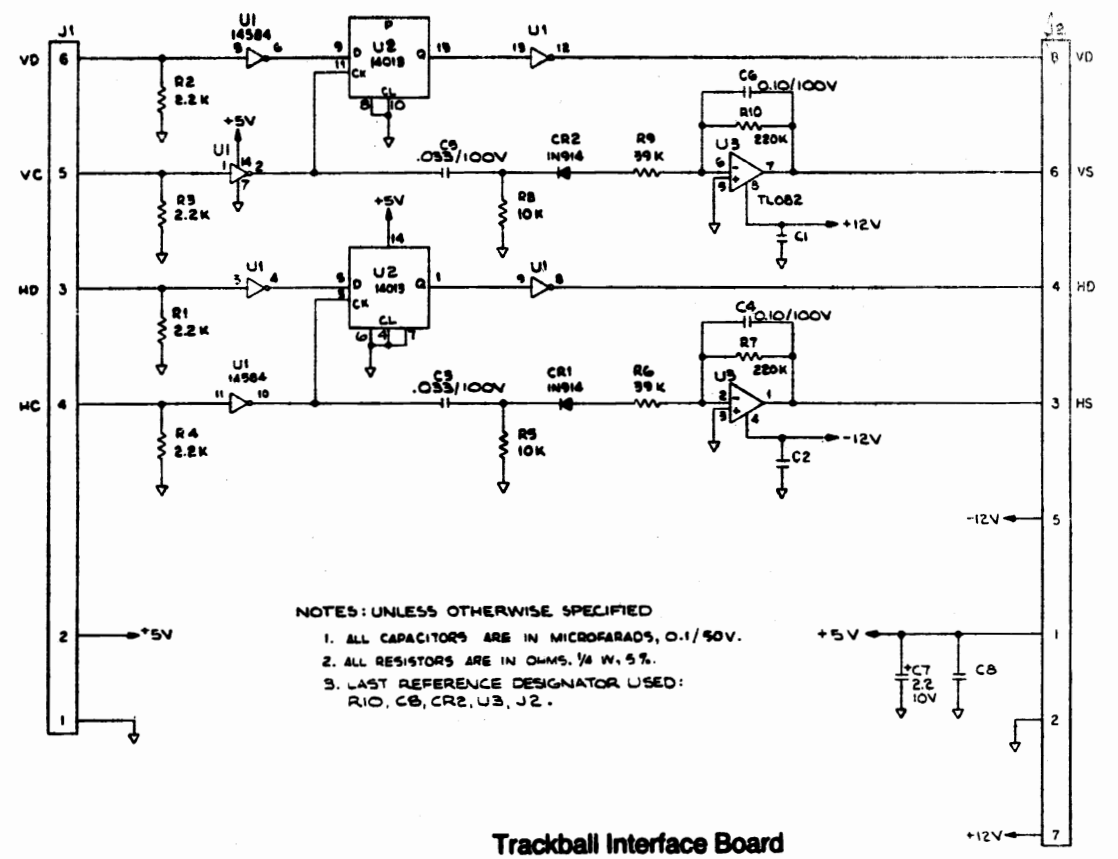
PCB ASSEMBLY, AC SENSE
(006-8006-10-0B) (M051-00C47-A015)
PARTS LIST (Page 2 of 2)

ITEM	QTY.	PART NO.	REFERENCE	DESCRIPTION
1	1	007-8006-01-0B		PCB FAB, AC SENSE
2				
3	6	550-0018-01		CONN,PC,F,PINS,MLX 02-09-1134
4	2	550-0069-01	J12,J13	CONN,PC,3P,F,MLX 03-09-1031
5	1	550-0087-01	J17	CONN,PC,3P,M,MLX 09-75-1038



NOTES:	BALLY MIBWAY WFL CO.
J. ROYSTON	SCHEMATIC
1 FEB	8004-91700-0000
2/27/83	8051-00000-0002
	2002
	SHEET 1 OF 1 REV

12 MAR 83 16:12 / USER/CROW/RRR 3. DRW



Trackball Interface Board

IV. MONITOR

PLEASE NOTE:

THE INFORMATION CONTAINED IN THIS SECTION IS TOLD IN AN EASY TO UNDERSTAND MANNER AND IS INTENDED TO AID THOSE WITHOUT AN ELECTRONICS DEGREE IN TROUBLESHOOTING AND REPAIRING THEIR GAMES T.V. MONITOR.

IF YOU READ THROUGH THIS SECTION AND STILL HAVE QUESTIONS, PLEASE CONTACT YOUR DISTRIBUTOR OR MIDWAY MANUFACTURING COMPANY AT THE TOLL FREE NUMBER PROVIDED WITH YOUR GAMES PAPERS.

OUR STAFF AND OUR DISTRIBUTORS STAND READY TO HELP YOU!

THANK YOU

T.V. Monitor Manual

Introduction: (How to use this section of your manual.)

This section has been designed to simply familiarize you with one of the more mystical components in your game — the T.V. monitor. If you are an electronics technician who is quite knowledgeable on the subject, you may decide to just go to the schematics and start troubleshooting the defective monitor. But if you are like most people, a monitor is a T.V. set, and that means a complex doo-dad that means big buck repairs. This isn't necessarily so. This section of the manual will acquaint you with the monitor and could just help you repair it if you feel adventurous enough to give it a try. If you have any knowledge of electronics, especially the use of a voltmeter, the repairs you can make are astonishing. Just keep in mind that **ELECTRICITY CAN BE VERY DANGEROUS, SO BE CAREFUL!!**

If you want to understand how a monitor works, just read the "THEORY OF OPERATION" subsection. If you wish, you can follow along with the schematics. The information is presented in a very basic manner but a more complete treatment of the subject can be found in the technical sections of bookstores.

If you want to attempt to repair your monitor, it would be a good idea to read this whole section beginning to end before starting. **Pay attention to all warnings**

and take them seriously. The more equipment you have the better, but a low cost Volt-Ohm-Milliameter can often do the trick. Here are the steps to take:

1. Find the symptom that matches the problems your monitor has in the "SYMPTOM — DIAGNOSIS" subsection. The diagnosis tells the circuit or area the problem may be in and possibly even the actual component causing it.
2. Once you have the circuit that is causing the trouble, read the "TROUBLESHOOTING" subsection to learn the procedure for finding the bad part.
3. Next, go to the schematic section and find the schematic that matches your monitor. It may be helpful to read the "DIFFERENCES BETWEEN MONITORS" subsection if you are unsure of which monitor you have. Use the schematic to see what parts are in the offending circuit.

That really is all there is to it. Just remember that there are some bizarre or rare symptoms not covered, or that a monitor may have two or more different problems that only a genius, the experienced, or an experienced genius can figure out. But be patient, follow safety precautions, and remember that there is also literature available from the monitor companies through your distributor or from Bally Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

Symptom Diagnosis

1. Insufficient width or height:

- A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
 - Bad yoke.
 - Bad vertical output section.
 - Open fusible resistor in vertical section.
 - Bad height control.
 - Bad flyback.
- B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
 - Bad yoke.
 - Open width coil.
 - Open part in horizontal output section.

2. Picture spread out too far or crushed in certain areas:

- A. Horizontal or vertical output transistor.
- B. Bad Component in output circuitry.
- C. Vertical linearity or damper control needs adjustment.

3. Line too close with black spacing:

- A. Problem in vertical section causing poor linearity.

4. Poor focus and convergence:

- A. Bad high voltage transformer ("flyback") or control.
- B. Focus voltage wire not connected to neck-board terminal.

5. Colors missing; check:

- A. Interface color transistors.
- B. Color output transistors.
- C. Cracked printed circuit board (neck Board).
- D. Color circuits.
- E. Video input jack.
- F. Defective picture tube.

6. Picture not bright enough:

- A. Weak emission from picture tube.

7. Silvery effect in white areas; check:

- A. Beam current transistors.
- B. Weak picture tube emission.

8. Too much brightness with retrace lines; check:

- A. Beam limiter transistors.
- B. Brightness and/or color blanking control set too high.

9. Increasing brightness causes an increase in size and poor focus.

- A. Weak high voltage rectifier or regulation (high voltage unit).
- B. Bad component in monitor's power supply.

10. Small picture and/or poor focus:

- A. Low B+ voltage (power supply trouble).

11. Vertical rolling:

- A. Vertical oscillator in the IC, vertical sync transistor, or circuit.
- B. No sync from logic board.
- C. Three pin sync. jack is loose or plugged in wrong.

12. Horizontal line across center:

- A. Vertical output circuit is dead (see symptom No. 1. A.).
- B. Vertical oscillator is not putting out the right wave form.

13. Picture bends:

- A. Horizontal sync needs adjusting.
- B. Magnetic or electromagnetic interference.

14. Flashing picture, visible retrace lines:

- A. Broken neck board.
- B. Internal short circuit in the picture tube (arcing).

15. Unsymmetrical picture or sides of picture:

- A. Defective yoke.

16. No brightness, power supply operating — No high voltage for the picture tube; check:

- A. Horizontal oscillator.
- B. Horizontal amplifier and output.
- C. Flyback transformer (high voltage unit).

17. No brightness, high voltage present; check:

- A. Heater voltage to the tube at the neck board.
- B. Screen-grid voltage for the tube.
- C. Focus voltage.
- D. Grid to cathode picture tube bias.

18. No high voltage; check:

- A. For AC input to the "flyback".
- B. Horizontal deflection stages.
- C. Flyback transformer.
- D. Yoke.
- E. Power supply.

19. No horizontal and vertical hold; check:

- A. Sync transistors and circuit.
- B. Wires and jack from logic board to the monitor.

20. Wavy picture — (power supply defect); check:

- A. Transistors, diodes, electrolytic capacitors in the power supply.

21. Moving bars in picture:

- A. Ground connector off between monitor and logic boards.
- B. Defect in the power supply (see wavy picture symptom).

22. Washed out picture (see picture not bright enough):

- A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

23. Monitor won't turn on:

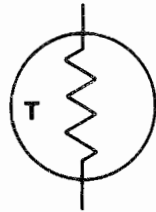
- A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
- B. Shorted horizontal output transistor.

- C. Defective high voltage disabling circuit.
- D. Crack(s) somewhere on main chassis board.

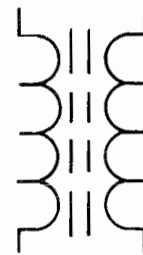
24. Can't adjust purity or convergence:

- A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
- B. Picture tube defective.
- C. Nearby equipment is electromagnetically interfering.
- D. The poles of the earth are pulling off the purity — see "A" above.
- E. Poor focus or width of picture.
- F. Make sure you have the correct CRT number for that brand of monitor.

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



INDUCTOR, COIL, CHOKE
(POLARITY DOESN'T MATTER)



FUSE
(POLARITY DOESN'T MATTER)



ZENER DIODE

(-) CATHODE

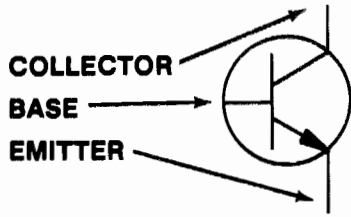
(+) ANODE

CATHODE (-)

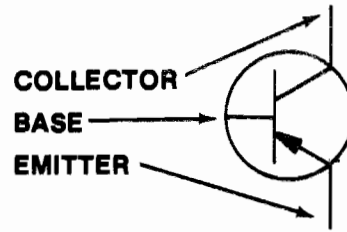
ANODE (+)



DIODE



NPN TRANSISTOR



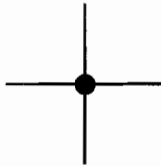
PNP TRANSISTOR



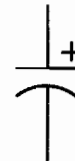
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



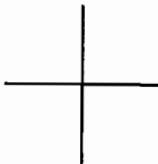
RESISTOR
(POLARITY DOESN'T MATTER)



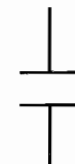
LINES ARE CONNECTED



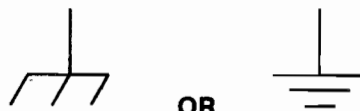
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



GROUND

Troubleshooting

Troubleshooting monitors requires experience, patience, **and luck**. The first step is to match the symptom the monitor displays to the diagnosis next to it in the "SYMPTOM-DIAGNOSIS" subsection. This will pinpoint the circuit the problem is probably in, and often the parts to check. Next, the circuit should be visually inspected to see if there are any parts broken, burned, or if something is there that shouldn't be, like a loose screw, etc. Some parts go bad before others and should be checked first. In fact, following is the general order in which parts usually go bad:

1. Semiconductors (like transistors, diodes, and integrated circuits).
2. Fusible resistors.
3. Electrolytic capacitors.
4. Resistors.
5. Capacitors and coils.

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 23,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors) or ICs, yoke terminals, and other high power components when the monitor is on.

WARNING: That picture tube is a bomb!

When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using **ONE HAND ONLY** (put the other in your pocket) and touching **ONLY** the plastic handle of the screwdriver (**DO NOT TOUCH THE METAL SHAFT**) stick the blade of the screwdriver into the anode hole.

IMPORTANT! The side brackets of the monitor are chassis ground as is the aquadag, the picture tube's dark conductive coating. **BUT**, on the ZENITH MONITOR there are metallic mounting parts which **ARE NOT** chassis ground. Discharging the CRT to these will damage the monitor!

Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very healthy charge for at least a **week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

To maintain the safety and performance of the monitor, always use exact replacement parts. For instance, the wrong components in the power supply can cause a fire, or the wrong color transistor may give a funny color to the picture. Service your monitor on a nonconductive firm table like wood, **NOT METAL**, and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

Observe the picture carefully. Try to vary the appropriate control that would most likely affect your particular symptom. For example, if there is poor brightness or no picture, try turning up the brightness or contrast control. If the controls have no effect at all, chances are there is trouble with the control itself, the circuit it controls, or a nearby circuit that may be upsetting voltages. Go to the list of symptoms and determine with the schematic where the bad circuit is.

CAUTION:

Keep in mind that capacitors hold a charge as can the picture tube (for at least a week and usually longer), and could shock you.

First, check for obvious visual defects such as broken or frayed wires, solder where it is not supposed to be, missing components, burned components, or cracked printed circuit boards. If everything looks good up to this point, make sure that diodes, electrolytic capacitors, and transistors have their leads connected in the right polarity as shown on the schematic and the circuit board.

Turn on the power and measure the voltages at the leads of the active devices such as tubes, transistors, or integrated circuits. Any voltage that does not come within at least 10% to 15% of the voltage specified on the schematic indicates either a problem with that device or a component connected with it in the circuit. The next step is to use the ohmmeter to narrow down the field of possible offenders.

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistently infinite readings indicate an open, and a short is demonstrated by 0-30 ohms on most of these test readings. Finally, place one lead on the collector, then the other on the emitter. No matter which lead is used, there should be infinite resistance. Any lower reading, such as 50 ohms (which is typical on a bad transistor), indicates a short.

This all sounds pretty confusing, but a little experience on a good transistor will make you an expert in no time. Usually, the lowest ohmmeter setting is used for testing transistors. Once in a great while a transistor may check out good on this test, but may actually be "leaky" or break down only on higher voltages. If in doubt, change it. It is also wise to check the transistor out of the circuit just in case some component in the circuit is affecting the ohmmeter reading.

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one

way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

NOTE: DO NOT leave soldering equipment on the leads too long since all semiconductors, especially integrated circuits, are easily destroyed by heat.

Without special equipment, integrated circuits are checked by verifying the proper DC voltage on the pins and the correct AC wave form using an oscilloscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmmeter and should usually be within ten percent of the value stated on them and on the schematic. You may have to desolder one lead from the printed circuit board. If you wreck the foil on the board, carefully solder a small wire over the break to reconnect the conductive foil.

Capacitors are tricky. Their resistance goes up when checked with an ohmmeter which shows a charging action. As they suck up current from the meter, the voltage goes up and so does the resistance. If you are sure a particular circuit is giving you a problem and everything else checks out O.K., Electrolytic capacitors are prime suspects. Substitute a new one and keep your fingers crossed.

Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laboriously analyzing the branches and small circuits that make up these groups. This will help avoid confusion and aid in a basic, concrete, knowledge of what makes up a monitor.

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping

through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

Some circuits receive voltages that are higher than what the power supply should put out. But they come from the flyback transformer which will be discussed later.

THE INTERFACE SECTION OF THE CHASSIS —

The interface section of the chassis is fairly easy to identify. It is right by the place where the video jack(s) from the logic board(s) plug into. There are sets of transistors that receive the separate red, green, blue, and sync information from the cables that come from the logic boards. The circuits jack up the voltage and match impedances, or in other words, prepare the logic board outputs for the circuits that will really amplify them for the output devices such as the yoke in the case of the sync, or the picture tube that shows the colors.

An interesting aside is that our sync is composite negative sync. That means two things:

1. The sync is a negative going wave form.
2. There are two pulses going at different speeds over the same wire:
 - a. Vertical wave forms at 60 times per second (or Hertz) and
 - b. Horizontal wave forms at about 15,750 times per second (Hz).

The sync is amplified by a sync amplifier transistor and sent on its way to the oscillators. The sync or timing information will be explained along with the oscillator shortly.

The color information is sent via wires to the neck board where the main amplification occurs. This will also be discussed later.

VERTICAL AND HORIZONTAL DEFLECTION—

After the sync signal is amplified by the sync amp, it goes to two different sections, the vertical and horizontal circuits. Basically, the sync signals are for timing so the picture doesn't mess up since it is assembled like an orderly jigsaw puzzle, but so fast that you can't see the electron beams for each color painting the picture on the screen. This will all become clear soon. For now, we will follow the 60 cycle component of the sync as it goes on its journey to the deflection yoke.

The 60 cycle pulse goes to the vertical oscillator to make sure this circuit goes back and forth (or oscillates) at 60 times a second. Without this pulse keeping the circuit at the correct speed, it may get lazy and oscillate at 58 cycles or lower, or get ambitious and oscillate at 62 cycles or higher. At the wrong speed, the picture will start to roll up or down.

A Wells Gardner 13" (K4806) or 19" (K4906, K4956) color monitor uses an integrated circuit for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. The Zenith monitor (CD19MXRF06) also uses an IC for the sync processing. Wells Gardner uses HA11423, Electrohome uses HA11244, and Zenith uses 221-175 (their part number). **These ARE NOT interchangeable!** The idea is all the same. The output to the vertical amplifying transistors for all monitors must form a sawtooth wave form, sort of like a bunch of pyramids, racing through the yoke's vertical coils at 60 times a second.

Along the way to the output transistors, the 60 cycle pulse is shaped and amplified to do the job: the yoke magnetically pushes the electron beam to fill the screen out sideways looking at the screen with the greatest length going up and down. Or viewing the screen sitting like a home television set, the amplified vertical output fills the screen up and down. Watching a monitor like this, seeing only a horizontal line means a problem with the vertical coils of the yoke or

anything from the vertical output section on back to the oscillator.

The horizontal section is very similar with a few exceptions. The horizontal wave shape is more like a square and has a frequency of 15,750 cycles a second. Both Wells Gardner and Electrohome use the other side of their respective integrated circuits for the horizontal circuitry. If the oscillator isn't going at the correct speed, the picture may move sideways, start to slant, or tear up with slanted thin figures. With both the vertical and horizontal of all monitors, there are variable resistors that change the speed of the oscillators up and down. This way you have controls that can make the correct frequencies to keep the electronic jigsaw puzzle nicely locked in place. If you're driving in a car and next to you someone else is driving their car at exactly the same speed, it will appear that they are not moving. And this is why the sync frequency and the oscillator's frequency must match, so the picture doesn't appear to move.

The correct wave form is shaped and amplified in the circuitry just like in the vertical section. But the horizontal output transistor is a large power transistor and not only serves to give current to the horizontal yoke windings, it also feeds the flyback transformer.

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

The picture tube needs high voltage to light up, and the power supply can't meet this demand. The flyback transformer receives current alternating at about 15,750 times per second from the horizontal output transistor. The "flyback" jacks up its input voltage and puts out a higher voltage alternating at the same speed. But, in your "flyback" there are diodes that chop up the alternating voltage to make it a smooth DC output just like in the power supply. This is what goes through that thick red wire to your picture tube. **THIS AREA HAS ABOUT 24,000 VOLTS ON IT AND IT CAN KILL YOU!!**

The "flyback" may be dangerous, but it is also generous. It has extra output windings which give voltage to the heater pins of the picture tube, voltage for the vertical deflection circuits, and picture tube screen-grid voltage. So in a way, the high voltage "flyback" is like a second power supply.

COLOR CIRCUITS —

The color circuits are pretty straight forward. The signals go into the interface section where some amplification and impedance matching occurs. These circuits are pretty sparse and simple. Each color just has two transistors and a diode with some resistors and capacitors. From here, the AC color signal is sent by wires to the neck board.

The color output circuits are on the neck board. The color signals going to the transistors are controlled by two variable resistors called drive controls. There are only two, one for the red and one for the green on

Wells Gardner and Electrohome monitors. Zenith monitors have all three: red, blue and green.

The Wells Gardner and Electrohome monitor have another variable resistor in their emitter part of their color output transistors. These "cutoff controls" vary the amount of A.C. signal that the transistor amplifies and sends to the cathodes of the picture tube. The Zenith monitor has its cutoff controls in the interface section to vary the amount of signal going to the output transistors. The more signal, the more color.

If you think this is confusing, here is another little hitch. The Electrohome and Zenith monitors both have the actual A.C. picture information signal going through the emitters of the color output transistors. The Wells Gardner has the A.C. signal going to the base of the transistors. The blanking and beam limiting signals which come from the blanking and beam limiting transistors in the interface section go into the color output transistor base in the Electrohome and Zenith monitors, but enters into the emitter of the Wells Gardner monitor's color output transistor. Should you feel adventurous enough to look at this signal on an oscilloscope, it should look like a square.

The beam limiter helps control the brightness level, and the blanking transistor rapidly turns the picture tube on and off so that retrace lines don't show up on the screen. By turning up the brightness on a good monitor, these four to six retrace lines can be seen slanting diagonally across the picture.

PROTECTION CIRCUIT —

To protect the high voltage section against voltages that are too high coming from the power supply which could cause X-rays to be emitted from the "flyback", a circuit senses the higher power supply voltage and turns off the horizontal oscillator. Since the horizontal oscillator doesn't work, the horizontal output transistor has nothing to feed the "flyback" which in turn has nothing to feed the picture tube. The monitor will be silent, have no picture, and will appear to be off. **But don't be fooled.** There is still that excessive amount of voltage coming from the power supply. To find out, check at pin two of Wells Gardner's IC501 and emitter of X04 for the Electrohome monitor. Check the 95 volt test point (located near the "flyback") for the Zenith monitor. The Wells Gardner monitor doesn't use this circuit, but an open in the horizontal section could cause the monitor to appear off, yet still have power supply voltage flying around. Here are the voltages you should receive:

Wells Gardner = 130VDC
Electrohome = 120VDC
Zenith = 95VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome monitor, The G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

ATTENTION! For information on picture tube replacement types, go to the last section, "PICTURE TUBE INTERCHANGEABILITY".

The picture tube or CRT is an output device. In other words, the end result of the circuit's work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

First, there is the heater. The heater boils off electrons from the cathodes so that they (the electrons) shoot up to the screen to excite the phosphors so that the three phosphors emit three colors of light.

The cathodes are next, and again they emit electrons to turn on the tube phosphors, making it glow. A defective cathode may cause the particular color it handles to be missing.

Next come the grids. The first grid is grounded. The following grid is the screen grid which receives about 300VDC depending on the brightness setting. The next grid closest to the picture tube screen is the focus grid which gets about one fifth the amount of voltage that is applied to the picture tube anode.

After jetting from the cathode through all these grids, the electrons speed through a mask, a sheet of material with tiny holes, and then excite the tiny dots of phosphor in the inside surface of the picture tube screen. The green electron gun (or cathode and circuitry) spits out electrons which head for the green phosphors only. The same goes for the red and blue guns. The way the phosphor light blends determines the color seen. Should these electron beams become too intense, they may burn the phosphor. With the monitor off, this can be seen as a dark permanent image of the video information on the tube screen.

Differences Between Monitors

The easiest way to identify the brand of monitor you are working with is to find the manufacturer's name or model number printed on the chassis or chassis base. But what if the monitor was in a Texas dust storm or buried in volcanic ash and this information is no longer there? Fear not! Each monitor has its own peculiarities and the following should help to identify them:

The **ELECTROHOME** G07-904 (19") and G07-902 (13") have their horizontal and vertical processing IC hidden under a silver can. A shiny metal top behind the "VERTICAL HEIGHT" and "HORIZONTAL FREQUENCY" control prove this is an Electrohome monitor.

The **WELLS GARDNER** K4906 (19") and K4806 (13") have their horizontal and vertical processing IC out in the open directly behind the "VERTICAL HOLD" control.

The **ZENITH** C019MXRF06 (19") monitor has its horizontal and vertical processing IC way in back by the picture tube. The monitor also has large white cables going from the main board to the neck board.

K4906 (1st TYPE) — This monitor's identifying tags have **BLACK** ink printed on a white background. There is **NO** Vertical Damping Control. (This Control would be next to the Vertical Hold Control but this area is jumpered with a small wire instead.

K4906 (2nd TYPE) — This monitor's identifying tags have **RED** ink printed on a white background. There **IS** a Vertical Damping Control next to the Vertical Hold Control. The Damping Control provides a few more lines on the top of the monitor screen (monitor viewed as a normal T.V. would be) for any video game that may need these lines to fit the picture on the screen. Moving the Control may distort the top part of your picture (or the side, depending on the game and how the monitor is mounted) so go ahead and move it if you are having this type of problem. To accommodate this new feature, there are a few circuit changes.

ONE MAJOR DIFFERENCE BETWEEN THESE TWO VERSIONS OF THE K4906 IS THE YOKE. They look the same but notice the part numbers:

K4906 **WITHOUT** the Damper Control: 2021111201

K4906 **WITH** the Damper Control: 2021111258

Since the companies like to change part numbers at the drop of a hat, the best thing to do is to request whatever part number is written on your yoke. If you should get the wrong yoke, the results will be:

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

CONTROLS YOU MAY NOT TOUCH

Basically, on the Electrohome monitor, you can move any control you want **EXCEPT** for the B1 control. This sets the power supply voltage (ideally at 120 VDC) and is located right behind VERTICAL HOLD. The 13" Electrohome **DOES NOT** have this control. It may also be wise not to move the VERTICAL LINEARITY since this distorts the picture and is hard to reset perfectly. If you do move it, turn on the Cross Hatch Test Pattern of your game and try to get the squares to the point where they are equal in size by readjusting this Linearity Control.

On the Wells Gardner monitor, brightness is adjusted by the "BLACK LEVEL" Control which is right next to the Horizontal Frequency Control. Under the Focus Control is the "SCREEN" Control which you **DO NOT** touch. Yes, this control does adjust the brightness,

but it is used to set the CRT bias and is adjusted at the factory. When Wells Gardner sets it, they mark the position with a black mark on the knob. If you move it, be sure to realign the mark and **THEN** set the BLACK LEVEL Control to the brightness you desire. So, other than the SCREEN control, you may adjust any of the controls.

The Zenith monitor has a 95 volt adjustment control. It is green and located behind the jack labeled 3D3. To discourage you from moving it, Zenith has placed a little glue on top of this control.

Parts Interchangeability

Some parts can be interchanged on all of the monitors. Here are the rules:

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT**, be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **MAY BE ABLE** to swap picture tubes between monitors. In the past you could swap any picture tube, but due to rampant engineering changes and new monitor models being introduced, you would need a computer to keep track of what could be swapped. For more information on this subject, go to "PICTURE TUBE INTERCHANGEABILITY".
5. You **CANNOT** change any part that is a **safety part**, one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-902) monitor "flyback" looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

If there is any doubt about what parts can be swapped between each manufacturer's 19 inch and 13 inch models, compare the manufacturer's part number between each one. If they match up, they are the same part.

Picture Tube Interchangeability

13" MONITORS

There are currently two 13" monitors being used: the Wells Gardner K4806 and the Electrohome G07-902. The picture tubes used are NOT interchangeable. The pins on the neck of the CRT will not fit in the socket should you use the wrong CRT.

Here is a chart for all the 13" color monitors Bally Midway uses.

ELECTROHOME	G07-902	—	370ESB22
WELLS GARDNER	K4806	—	370KSB22

The factory recommended CRT type could change in the future for one reason or another, but the listed picture tubes will work. As a matter of fact, you can call another picture tube company to see if they have a replacement number to recommend...but caveat emptor — let the buyer beware.

19" MONITORS

Here it gets a little tricky. All of the picture tubes will fit no matter which is used. But if you use the wrong one, you will have problems with purity and/or dynamic convergence.

Purity trouble means that the color won't be true. If you turn up the color control for one color, instead of seeing that solid color it will show blotches or blobs of other colors on the screen.

Trouble with dynamic convergence means that there will be color fringing around solid lines at the edges of the screen.

The only way to ensure that you avoid these problems is to get the right picture tube or the right substitute.

Here is a list of the 19" monitors and the **CORRECT** CRT numbers.

ALL ELECTROHOME G07-904 —

19VMNP22 RCA
19VMJP22 RAULAND
510UJB22 HITACHI

WELLS GARDNER K4906 —

19VLTP22 RCA
19VMLP22 ZENITH
19VMKP22 PHILLIPS

ZENITH CD19MXRF06 —

19VMLP22 ZENITH
19VLTP22 RCA
19VMKP22 PHILLIPS

NOTES

Monitor Schematics

19" COLOR MONITOR SCHEMATIC DIAGRAM

MODELS 19K4901, 19K4906, 19K4951, 19K4956

Power Supply Voltage and Symbols

Symbol	Voltage	Operating Circuit
	15V	Vert. Osc. Sync Blanking CRT Cut-Off
	130V	Horiz. Osc. Horz. Drive Horz. Output Vert. Output
	175V	Video Output



SERVICE TECHNICIAN WARNING X-RAY RADIATION PRECAUTION:

THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

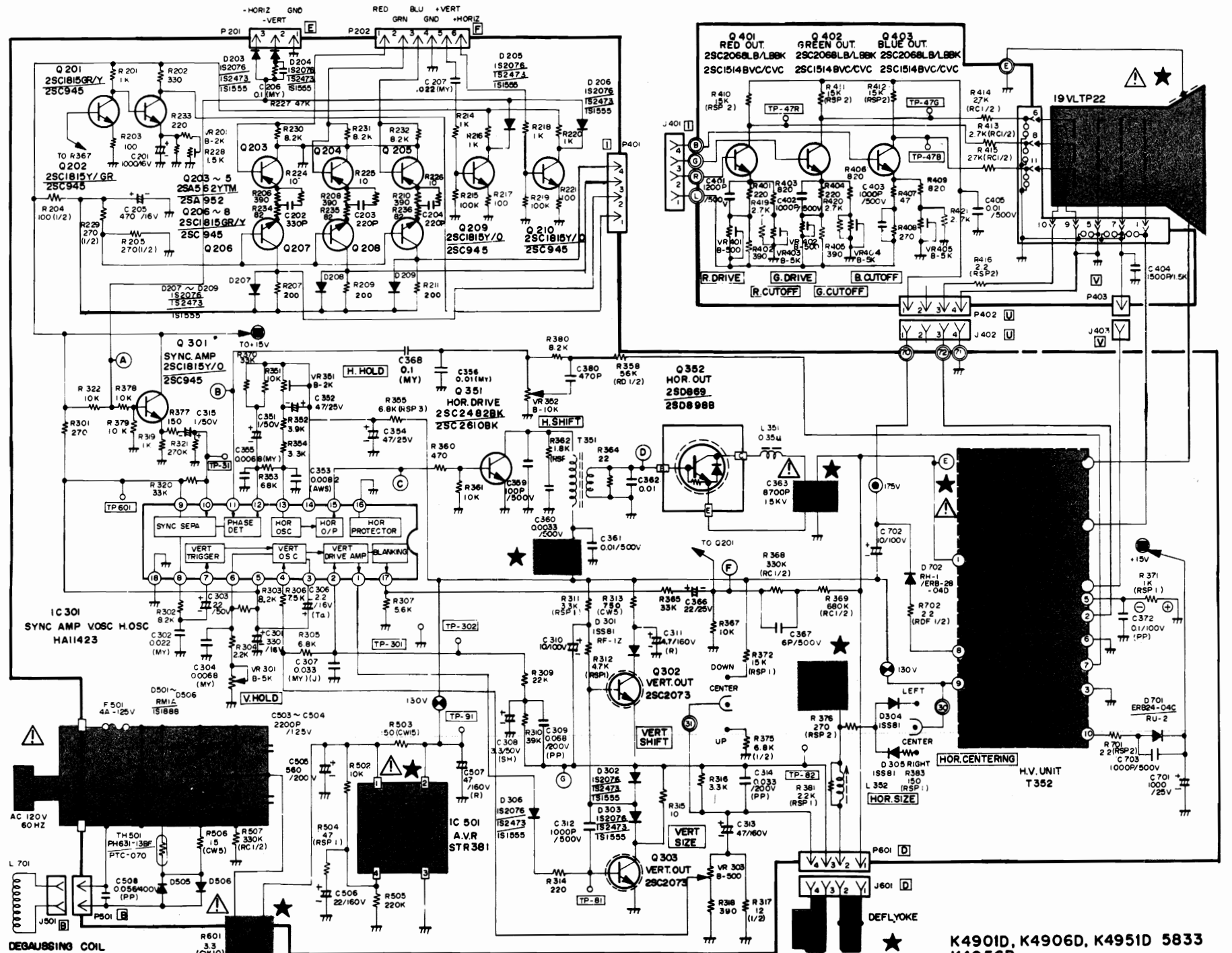
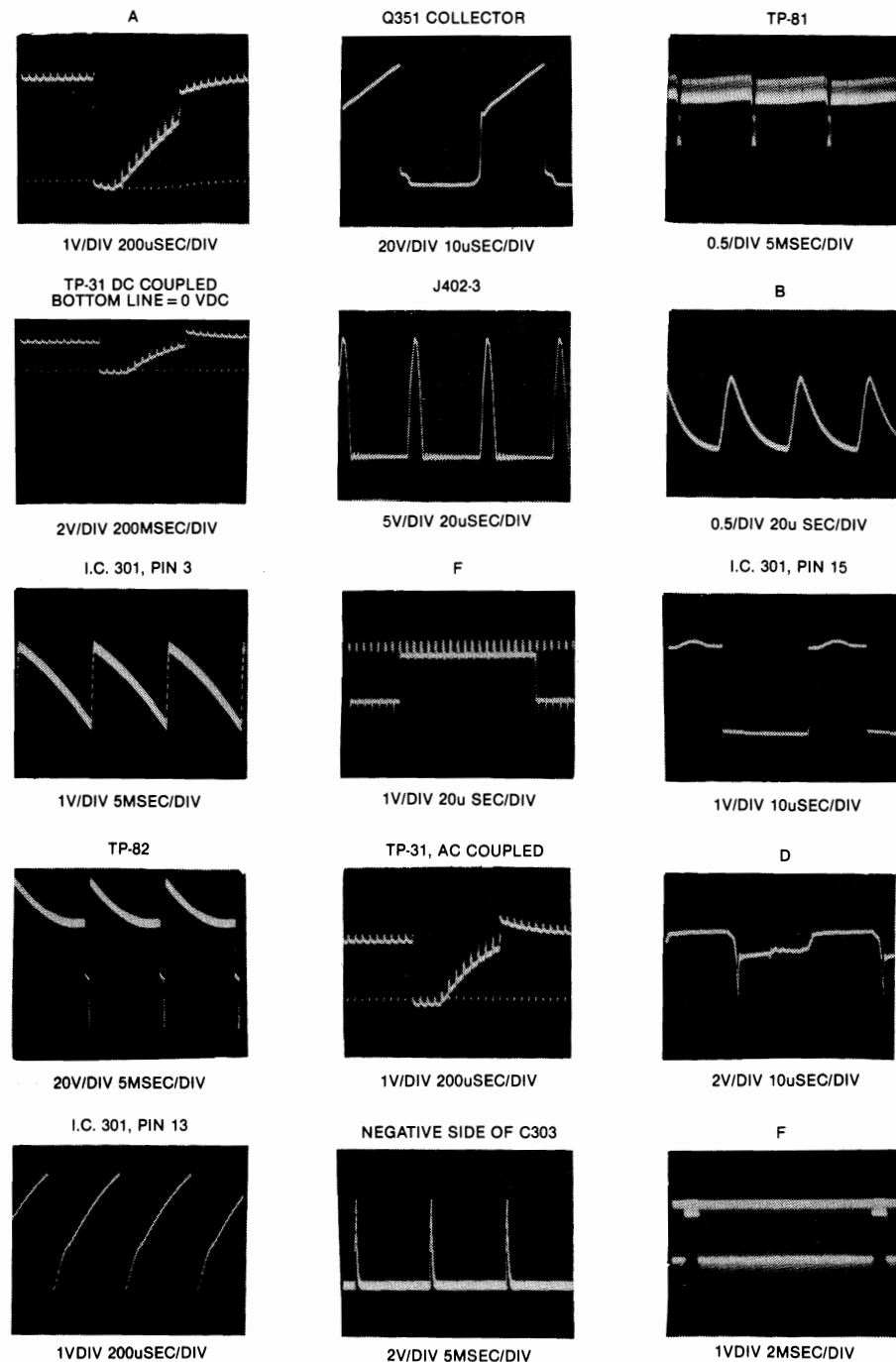


CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

OSCILLOSCOPE WAVEFORM PATTERN

The waveforms shown are as observed on the wide band oscilloscope with the monitor turned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak amplitudes.

If the waveforms are observed on the oscilloscope with a poor high frequency response, the corner 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.



K4901D, K4906D, K4951D 5833
K4956B

REPLACEMENT PARTS LIST

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic, or Δ \star on parts list should be replaced with exact factory replacement parts.

The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

MAIN BOARD

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS					
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	Δ \star R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm-B Semi-Fixed
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm-B Semi-Fixed
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR303	204X2070-055	500 Ohm-B Semi-Fixed
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR351	204X2070-072	2K Ohm-B Semi-Fixed
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR352	204X2070-072	2K Ohm-B Semi-Fixed
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.			
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon			
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon			
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon	C201	203X0014-088	1000 uF, 16V, Electrolytic
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C202	202X7200-064	330 pF, 500V, Ceramic
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C203	202X7200-043	220 pF, 500V, Ceramic
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon	C204	202X7200-043	220 pF, 500V, Ceramic
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon	C205	203X0014-076	470 uF, 16V, Electrolytic
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon	C206	203X1810-149	0.1 uF, 125V Mylar
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon	C207	349X2232-109	.022 uF, 100V Mylar
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon	C301	203X0014-065	330 uF, 50V Electrolytic
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon	C302	203X1600-563	0.033 uF, 50V Mylar
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C303	203X0629-037	3.3 uF, 50V Electrolytic
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon	C304	203X1600-366	0.068 pF, 50V Mylar
R313	204X1450-537	1K Ohm, 5%, 5W Carbon	C306	203X0412-012	2.2 uF, 16V Tantal
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon	C307	203X1600-634	0.033 uF, 50V Mylar
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon	C308	203X0025-174	3.3 uF, 50V Electrolytic
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C309	203X1207-100	0.068 uF, 100V PP
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon	C310	203X0629-061	10 uF, 100V Electrolytic
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon	C311	203X0041-025	10 uF, 160V Electrolytic
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon	C312	202X7050-248	1000 pF, 500V Ceramic
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon	C313	203X0040-052	47 uF, 160V Electrolytic
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon	C314	203X1201-265	0.033 uF, 200V PP
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C315	203X0629-023	1 uF, 50V Electrolytic
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C351	203X0629-023	1 uF, 50V Electrolytic
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon	C352	203X0619-045	47 uF, 25V Electrolytic
R353	203X6501-086	68K Ohm, 5%, 1/4W Carbon	C353	203X1190-015	0.0082 pF, 50V Mylar-PP
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C354	203X0619-045	47 uF, 25V Electrolytic
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide	C355	203X1600-366	0.068 pF, 50V Mylar
R358	203X5601-878	56K Ohm, 5%, 1/2W Carbon	C356	202X7050-483	0.01 uF, 500V Ceramic
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon	C359	202X8065-606	100 pF, 500V Ceramic
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C360	202X7050-366	0.0033 pF, 500V Ceramic
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide	C361	202X7050-483	0.01 uF, 500V Ceramic
\star R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide	C362	202X7203-032	0.01 uF, 50V Ceramic
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon	Δ \star C363	203X1270-911	8700 pF, 1.5 KV PP
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon	\star C365	203X1201-265	0.33 uF, 200V PP
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C366	203X0019-026	22 uF, 25V Electrolytic
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.	C367	202X8065-162	6 pF, 500V Ceramic
			C368	202X7203-032	0.01 uF, 50V Ceramic
			C372	203X1207-125	0.1 uF, 100V PP

RESISTORS (CONT.)

CAPACITORS

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
CAPACITORS (CONT.)					
C380	202X7200-087	470 uF, 500V Ceramic	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
Δ C501	203X1810-149	0.1 uF, 125V Mylar	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
Δ C502	202X7050-282	1500 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
Δ C503	202X7810-214	2200 pF, 125V Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1815GR
Δ C504	202X7810-214	2200 pF, 125V Ceramic	Q210	200X3181-523	Transistor (NPN) 2SC1815GR
C505	203X0220-075	560 uF, 200V Electrolytic	Q301	200X3181-523	Transistor (NPN) 2SC1815GR
C506	203X0040-034	22 uF, 160V Electrolytic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C507	203X0041-057	47 uF, 160V Electrolytic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C701	203X0019-092	1000 uF, 25V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C702	203X0634-061	10 uF, 100V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C703	202X7050-248	1000 pF, 500V Ceramic	IC301	200X2300-033	IC HA11423
			Δ \star IC501	200X2600-183	IC STR381

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
SEMICONDUCTORS					
D203	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D204	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D205	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D206	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D207	201X2010-159	Diode, IS2076-27	Δ \star T352	200X9720-301	HV-Unit M-11
D208	201X2010-159	Diode, IS2076-27			
D209	201X2010-159	Diode, IS2076-27			
D301	201X2010-165	Diode, ISS81			
D302	201X2010-159	Diode, IS2076-27			
D303	201X2010-159	Diode, IS2076-27	Δ F501	204X7120-073	Fuse, 4 Amp. 125V
D304	201X2120-009	Diode, RH-IV	J402	206X5008-632	Recep W Wire 3P-M-BG
D305	201X2120-009	Diode, RH-IV	P201	204X9600-466	Plug, PWB 3P-J
D306	201X2010-159	Diode, IS2076-27	P202	204X9601-477	Plug, PWB 6P-Q
Δ D501	201X3120-216	Diode, RM-1AV	P401	204X9600-298	Plug, PWB 4P-B
Δ D502	201X3120-216	Diode, RM-1AV	P501	204X9600-249	Plug, PWB 2P-B
Δ D503	201X3120-216	Diode, RM-1AV	P601	204X9600-304	Plug, PWB 4P-C
Δ D504	201X3120-216	Diode, RM-1AV	TH501	201X0100-112	Thermistor
D505	201X3120-216	Diode, RM-1AV			
D506	201X3120-216	Diode, RM-1AV			
D701	201X2130-234	Diode, RU-2V			
D702	201X2120-009	Diode, RH-1V			
Q201	200X3181-523	Transistor (NPN) 2SC1815GR	Δ \star 88X0138-506	19VLT22 Pix Tube	
Q202	200X3181-523	Transistor (NPN) 2SC1815GR	205X9800-158	Lateral/Purity Assembly	
Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM	Δ \star 202X1111-201	Yoke Deflection	
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM	204X9301-255	CRT Socket	
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM	291X5004-262	Automatic Degaussing Coil Unit	

MAIN BOARD (CONT.)

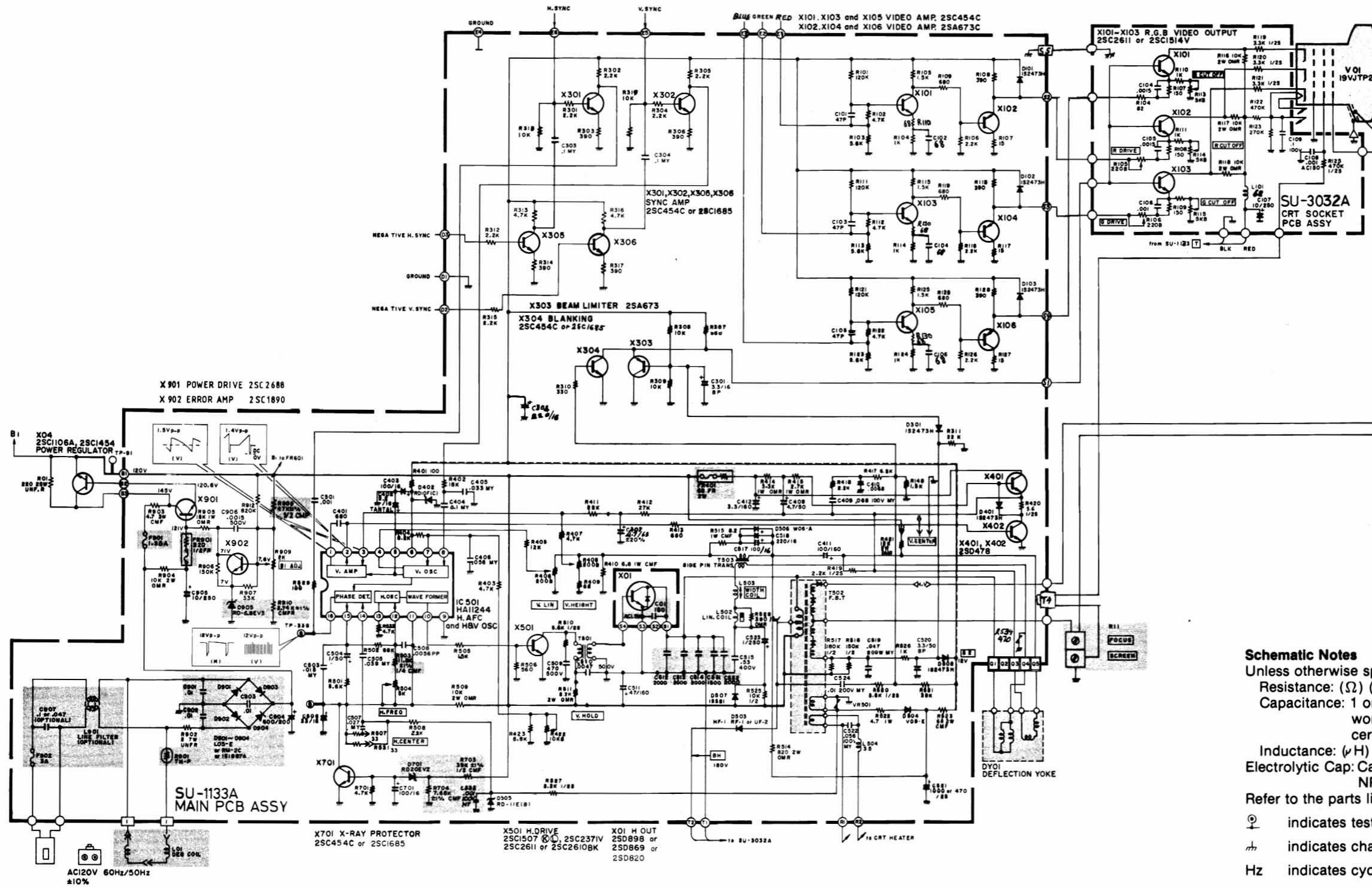
SEMICONDUCTORS (CONT.)

NECK BOARD

CAPACITORS

SEMICONDUCTORS

MISCELLANEOUS



Schematic Notes
 Unless otherwise specified
 Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
 Capacitance: 1 or higher→ (pF), less than 1→ (μF)
 working voltage→ 50 (V)
 ceramic capacitor
 Inductance: (μH)
 Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
 NP → non-polar (or bipolar) electrolytic cap.
 Refer to the parts list for additional component information.

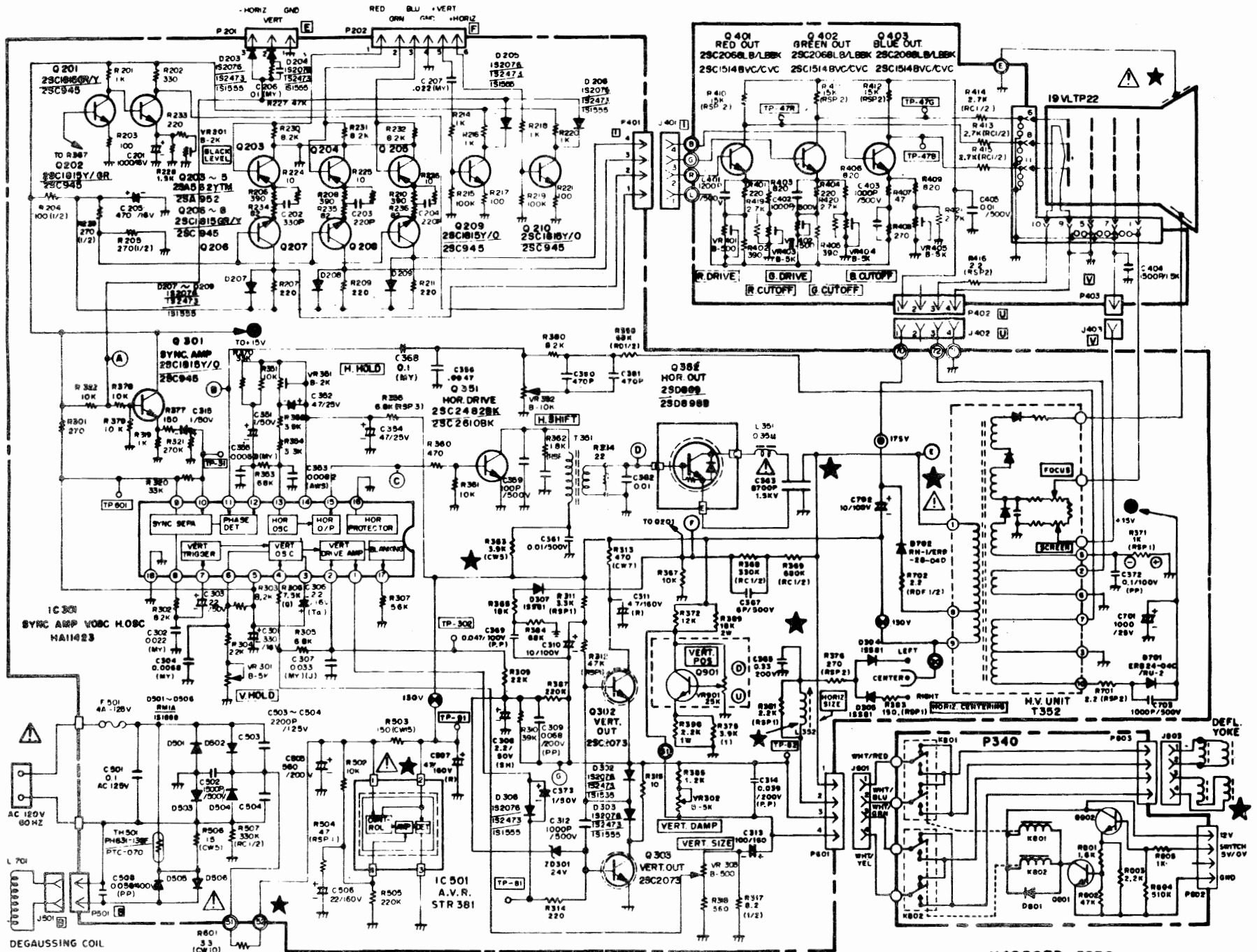
⊙ indicates test point connection
 ⚡ indicates chassis ground unless otherwise specified
 Hz indicates cycles per second

For safety purposes (and continuing reliability)
 ⚠ replace all components marked with safety symbol with identical type.
 NOTE: FR → fusible resistor

00-4147-04
 G07-CB0

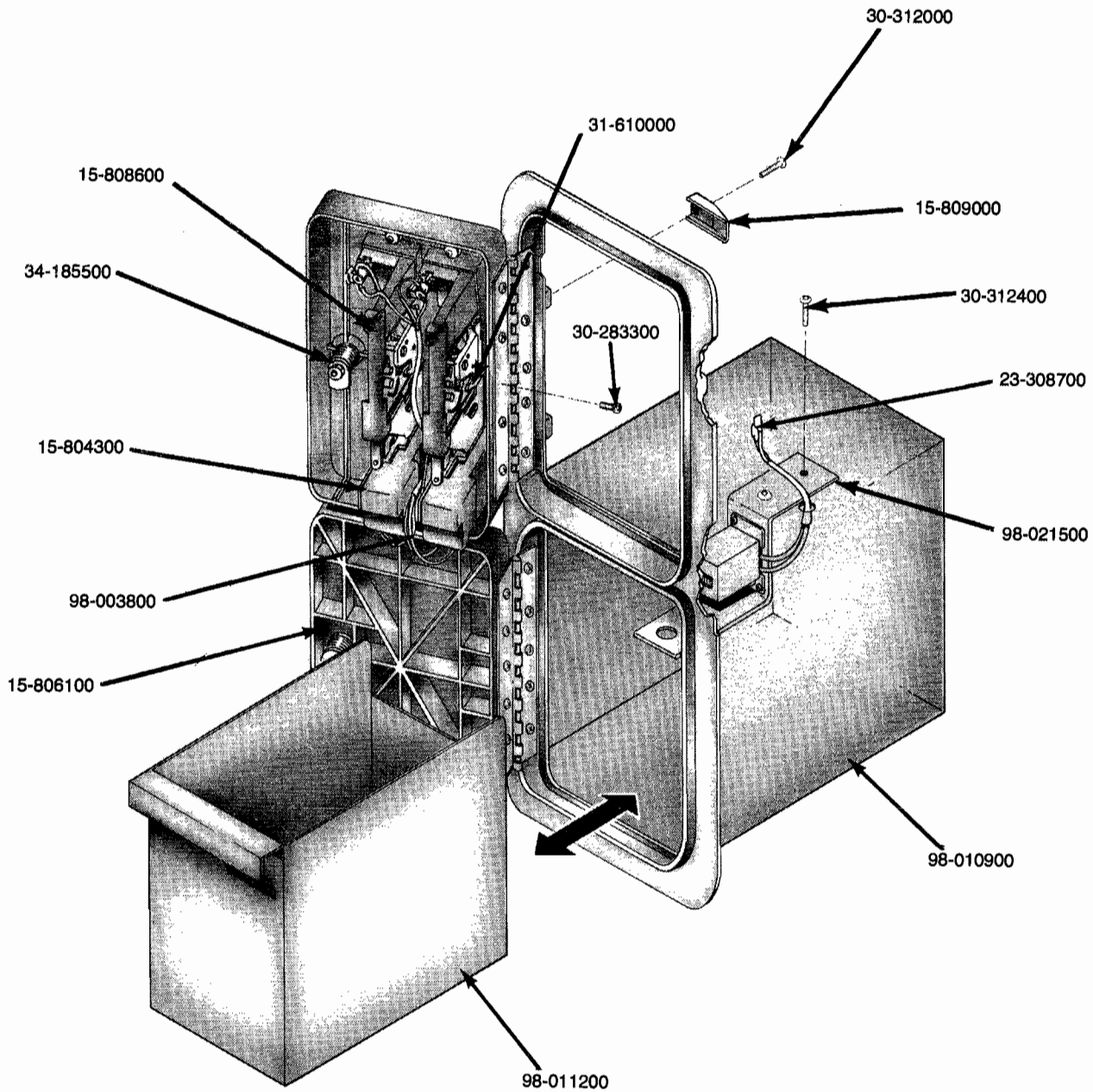
Parts identification on circuit boards:
 e.g. SU1126A (R107 = R1107)
 SU3030A (R113 = R3113)

19" COLOR GAME MONITOR SCHEMATIC DIAGRAM



K4956RD-5838
M051-00C52-A019

V. PARTS



NOTE: FOR YOUR CONVENIENCE
THESE ARE WICO PART NUMBERS.

Figure 4. Coin Door, Over/Under With Cash Box
(700-0164-01)

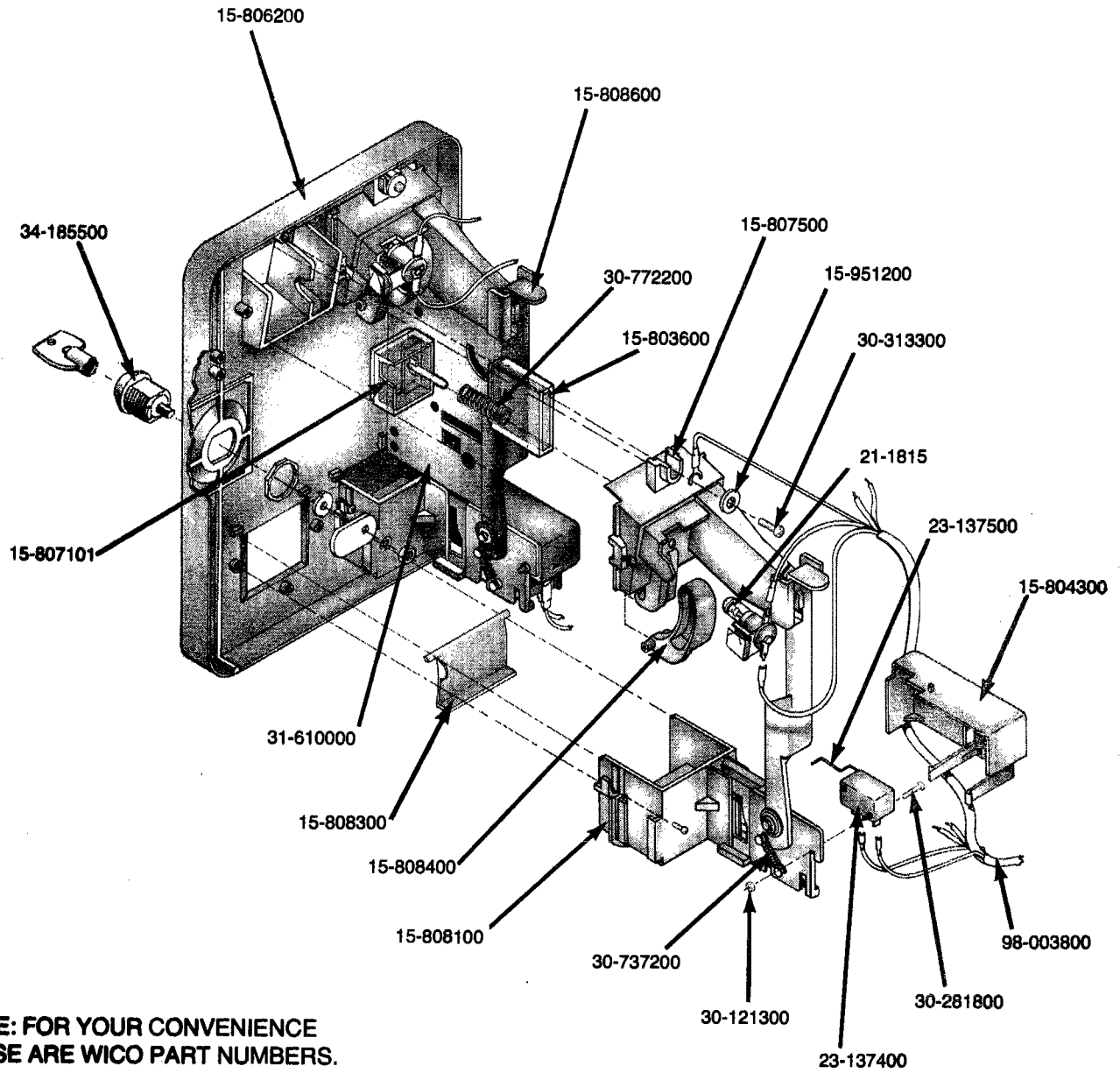


Figure 5. Coin Mechanism Assembly
(700-0164-01)

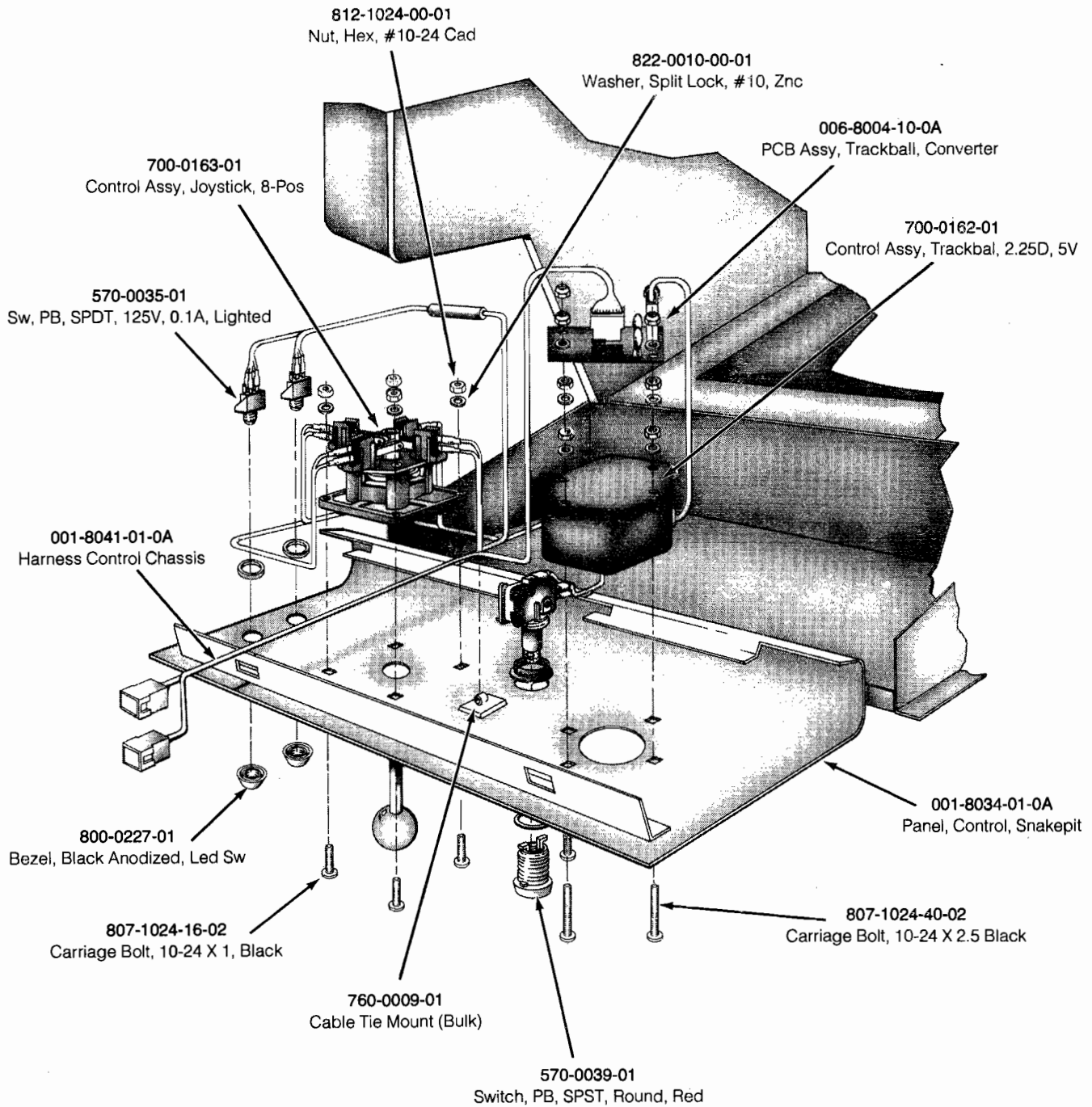


Figure 6. Control Panel Assembly, Snakepit
(000-8002-10-0A)

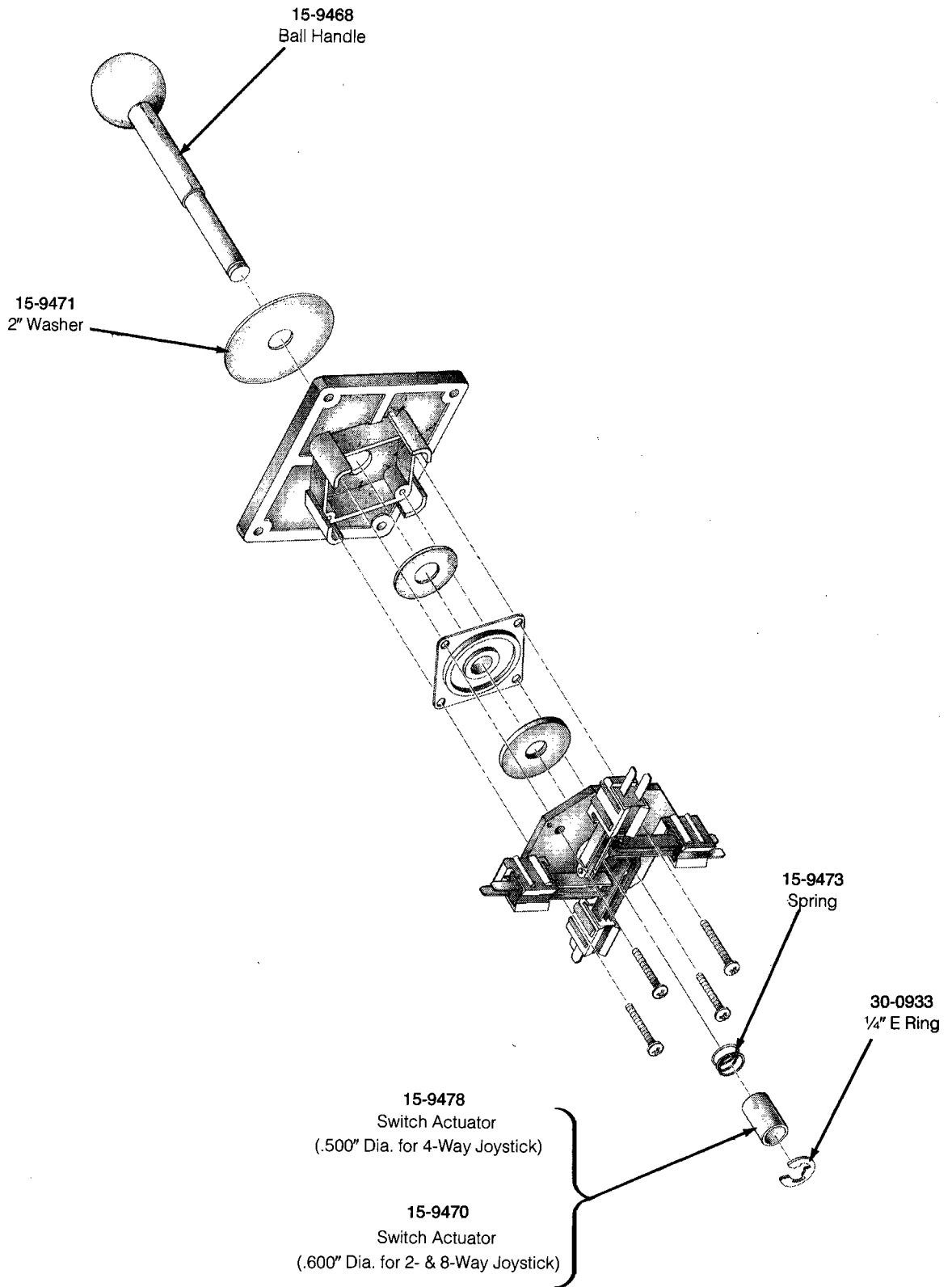


Figure 9. Wico Joystick Assembly
(700-0163-01)

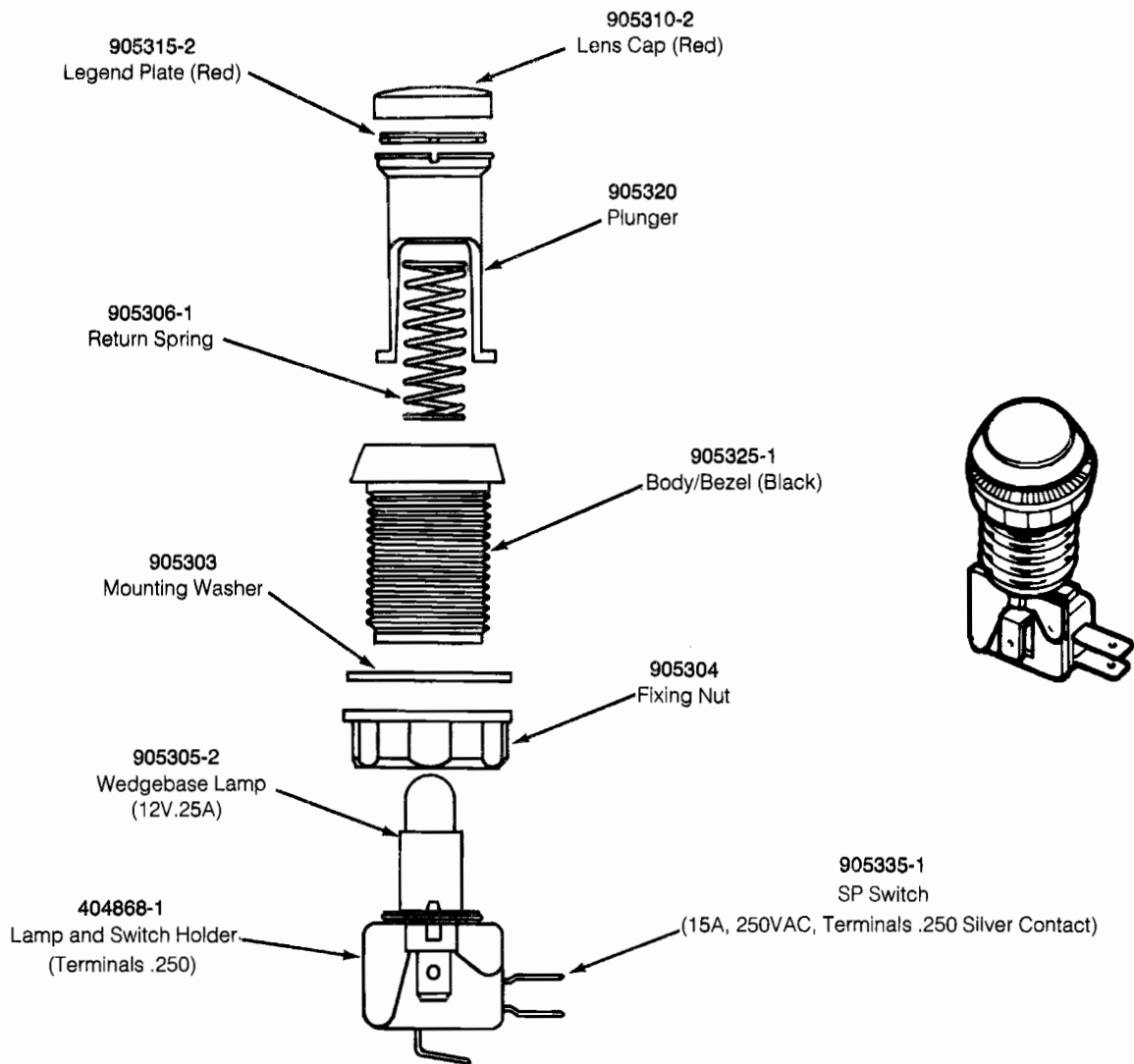


Figure 8. Coinco Switch Assembly (570-0039-01)

**COINCO SWITCH ASSEMBLY
(570-0039-01)
PARTS LIST**

PART NO. (COINCO)	DESCRIPTION	QUANTITY
905310-2	LENS CAP (RED)	1
905315-2	LEGEND PLATE (RED)	1
905320	PLUNGER	1
905306-1	RETURN SPRING	1
905325-1	BODY/BEZEL (BLACK)	1
905303	MOUNTING WASHER	1
905304	FIXING NUT	1
905305-2	WEDGEBASE LAMP (12V.25A)	1
404868-1	LAMP AND SWITCH HOLDER (TERMINALS .250)	1
905335-1	SP SWITCH (15A, 250VAC, TERMINALS .250 SILVER CONTACT)	1

NOTE: FOR YOUR CONVENIENCE
THESE ARE WICO PART NUMBERS.

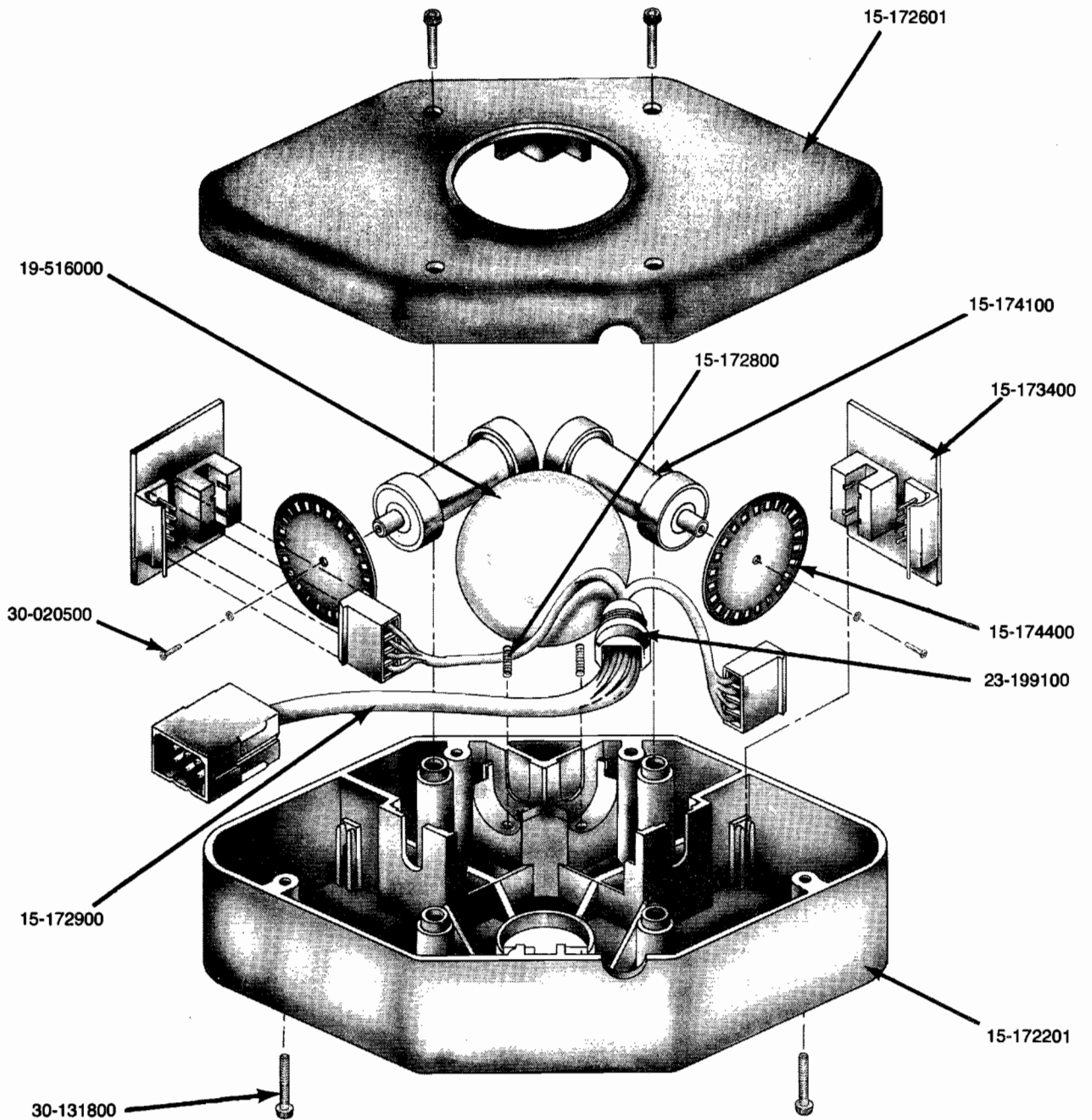


Figure 7. Track Ball Assembly
(700-0162-01)

NOTES

VI. SERVICE BULLETINS

Bally

SENTE SERVICE

April 29, 1985

S E R V I C E B U L L E T I N

GAME: SENTE 'TRIVIAL PURSUIT'

SUBJECT: PROGRAM CARTRIDGE INTERCHANGEABILITY BETWEEN UPRIGHT AND
 COCKTAIL GAMES

1. Program cartridge E-PROM Date Code 12-84 can only be used in upright games only.
2. Program cartridge E-PROM Date Code 2-12-85 can be used in upright and cocktail games.
3. When picture fails to flip properly in cocktail games, check dip switch setting and program cartridge E-PROM Date Code.

Andy Ducay
Technical Service Manager

AD/dd

Bally

SENTE™

December 19, 1984

S E R V I C E B U L L E T I N

GAME: BALLY SENTE SAC I (Serial Nos. 101 to 218)

CONDITION

A possible 117VAC short condition under Electronic Chassis Assembly (000-6011-10-0A) when panel is moved in and out.

MODIFICATION

When the 117VAC Safety Switch was eliminated, wire nuts were used to secure the wires. They can be pulled off, and to prevent a short condition, tape and dress these two wires.

Andy Ducay
Technical Service Manager

AD/dd

S E L F T E S T

Enter the self test in game over by moving self test switch on electronic panel to the right.

T E S T S E Q U E N C E

1. RAM ROM TEST
 - A. Only first error encountered is displayed
 - B. Error address is displayed on screen

2. SOUND BOARD TEST
 - A. Sound board ok
 - B. Sound board error

3. SWITCH TEST

4. OPTION SWITCHES
 - A. Factory settings
 - B. Option switch H1 & G1

5. BOOKKEEPING
 - A. Reset bookkeeping during self test as per instruction on screen

6. RETURN TO PLAY MODE