

**HP 9835A/B
DESKTOP COMPUTER
SERVICE MANUAL**

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**HP 9835A/B
DESKTOP COMPUTER**



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P.O. Box 301, Loveland, Colorado 80537

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Table of Contents

Chapter 1: General Information

Introduction	1-1
9835 Specifications	1-2
Environmental Range	1-2
Size / Weight	1-2
Power Requirements	1-2
Data Storage	1-2
Thermal Printer	1-3
CRT Display (9835A)	1-3
LED Display (9835B)	1-3
Equipment Supplied	1-4
Repair Philosophy	1-5
Safety	1-6
Procedure for all Personnel	1-6
General Safety Guidelines for High Voltage Testing	1-6
Power Cords	1-8
Grounding Requirements	1-9
Installation	1-9
9835A CRT Installation	1-9
Power Requirements	1-10
Fuses	1-10
Setting the Voltage Selector Switches	1-10
Printer Paper	1-12
Cartridge Installation	1-13
Initial Turn-On	1-13
Computer Cleaning	1-14
Case	1-14
Fan Filter	1-14
Magnetic Tape Head	1-14
Tape Cartridge Considerations	1-15
Options	1-17
Thermal Printer (Option 500)	1-17
Character Set Options	1-19
ROM Options	1-20
Memory Options	1-22
Table Mounting	1-25

Chapter 2: How To Fix It

Introduction	2-1
Pre-Service Call Problem Isolation	2-1
On-Site Service Procedure	2-3
9835 Test ROM	2-3
Turn-On Mode	2-4
Test Mode	2-4
Program Mode	2-6
Processor Section	2-7
Processor Test	2-7
Processor Clock Frequency Adjustment	2-7
Processor Operation	2-10
Memory Section	2-13
KO Read/Write Memory Test	2-13
K6 Read/Write Memory Exerciser	2-14
K2 ROM Test	2-15
9835 Power-On Memory Test	2-15
Memory Troubleshooting	2-16
Read/Write Memory Operation	2-18
Read Only Memory Operation	2-19
CRT Section	2-23
K3 CRT Test	2-23
CRT Self Test Switches	2-26
CRT Raster Size	2-27
CRT Display Focus	2-28
CRT Intensity	2-29
CRT Display Circuits	2-29
CRT Display Operation	2-30
Internal I/O Section	2-33
Keyboard Test	2-33
K4 Display Test (9835B Only)	2-34
K5 Printer Test	2-35
Printer Adjustments	2-36
K1 Cartridge Drive Test	2-39
K7 Cartridge Drive Exerciser	2-41
K9 Cartridge Troubleshooting	2-41
K8 I/O Test	2-41
Internal I/O Operation	2-42
Power Supply Section	2-48
Power Supply Operation	2-48
Power Supply Adjustment	2-50

Chapter 3: Assembly Access

Introduction	3-1
CRT Assembly Removal (9835A Only)	3-1
CRT Subassemblies	3-2
CRT Safety	3-4
Computer Mainframe	3-8
Shell Removal	3-9
Bezel	3-9
Bezel Removal	3-9
Cartridge Drive Assembly	3-12
Internal I/O Assembly Removal (A36 or A37)	3-13
Display Assembly (9835B Only)	3-14
Key Switch Assembly	3-15
Printer	3-15
Bezel Insert	3-16
Base Assemblies	3-17
Read/Write Memory Assemblies (A24 and A25)	3-17
Power Supply (A51)	3-18
9835A CRT Interface (A71)	3-18
Processor Assembly (A11)	3-19
Fan	3-19
ROM Interface Assembly (A12)	3-20
Power Module	3-20
I/O Backplane (A81)	3-20

Chapter 4: Replaceable Parts

Introduction	4-1
--------------------	-----

Appendix:

Subject Index	A-1
---------------------	-----

Figures

1-1	Power Cords	1-8
1-2	CRT Installation	1-9
1-3	Fuse Access	1-11
1-4	Voltage Selector Switches	1-12
1-5	Loading Printer Paper	1-12
1-6	Cleaning the Tape Head	1-15
1-7	Tape Cartridge	1-16
1-8	Filler Plate Removal	1-18
1-9	Printer Installation	1-19
1-10	Character ROM Sockets	1-20
1-11	Installing a ROM	1-21
1-12	SW1 and SW2 Settings for A24 and A25	1-23
1-13	SW3 Settings for A24	1-24
1-14	Table Mounting Specifications	1-25
2-0	Test ROM Trouble Chart	2-0
2-1	Clock Frequency Adjustment	2-7
2-2	Oscilloscope Display	2-9
2-3	Address Extension	2-11
2-4	Address Extension Block Diagram	2-11
2-5	Block Select Flowchart	2-12
2-6	Memory Blocks	2-19
2-7	Read/Write Block Diagram	2-20
2-8	ROM Block Diagram	2-21
2-9	CRT Test Displays	2-25
2-10	CRT Self Test Switches	2-26
2-12	Centering Magnet Tabs	2-27
2-13	Improper Tab Positioning	2-28
2-14	CRT Block Diagram	2-31
2-15	Keyboard Test Sequence	2-34
2-16	Display Test Sequence	2-35
2-17	Printer Test Results	2-35
2-18	Printer Intensity Adjustment	2-36
2-19	Print Head Alignment Set Up	2-37
2-20	Print Head Alignment	2-38
2-21	Alignment Fixture Adjustments	2-38
2-22	Tape Cartridge Drive Block Diagram	2-45
2-23	Internal I/O Block Diagram	2-47
2-24	Power Supply Test Points	2-51
2-25	9835 Block Diagram	2-51

3-1	Removing the CRT Assembly	3-2
3-2	CRT Subassemblies	3-2
3-3	CRT Bottle Designation	3-4
3-4	Bottle Removal Position	3-6
3-5	Anode Connector Removal	3-7
3-6	Computer Assemblies	3-8
3-7	Shell Removal Screws	3-9
3-8	Bezel Removal	3-10
3-9	Bezel Assembly Access	3-11
3-10	Bezel Assemblies	3-12
3-11	Cartridge Drive Removal	3-13
3-12	A36 or A37 Assembly Removal	3-14
3-13	Assembly Removal Screws	3-15
3-14	Bezel Insert Removal	3-16
3-15	Base Assemblies	3-17
3-16	Read/Write Memory Access	3-18
3-17	Processor Removal	3-19
3-18	I/O Backplane Removal	3-21
4-1	Printer Parts 09835-67940	4-7
4-2	Power Supply Schematic Diagram	4-9
4-3	Alignment Fixture Schematic Diagram	4-10
Tables		
1-1	Equipment Supplied	1-4
1-3	Repair Philosophy	1-5
1-4	Voltage Operating Ranges	1-11
1-5	Memory Options	1-22
2-1	Test ROM Summary	2-0
2-2	Power Supply Specifications	2-50
4-1	Replaceable Parts	4-2

Chapter 1

General Information

Introduction

This manual provides installation and maintenance information for the 9835 Desktop Computer. The various chapters in this manual include:

- General Information
- How To Fix It
- Assembly Access
- Replaceable Parts

This chapter contains general servicing information. Here are the topics discussed in this chapter:

- Specifications
- Equipment supplied with the computer
- Repair Philosophy
- Safety Guidelines
- 9835 Installation
- Options available, including field installation of options

9835 Specifications

Environmental Range

Operating Temperature: +5°C to +40°C ambient
Storage Temperature: -40°C to +65°C
Ambient Humidity: <80%

Size / Weight

	<u>9835A</u>	<u>9835B</u>
Height:	375.9mm(14.8 in)	129.5 mm(5.1 in)
Width:	383.5mm(15.1 in)	383.5mm(15.1 in)
Depth:	495.3mm(19.5 in)	495.3mm(19.5 in)
Net Weight:	11.8kg(26 lbs) 9835A Mainframe 11.8kg(26 lbs) 9835B Mainframe 10.4 kg (23 lbs) 9835A CRT	

Power Requirements

AC Line Voltage: 110 volts ac +15%, -20%
220 volts ac +15%, -10%

Line Frequency: 48 to 66 Hz(inclusive)

Power Consumption: 9835A: 165 watts
9835B: 110 watts

Data Storage

Read / Write Memory

	<u>9835A</u>	<u>9835B</u>
Standard:	(32K bytes) 20,458 bytes	24,150 bytes
Option 201:	(64K bytes) 49,962 bytes	56,854 bytes
Option 202:	(128K bytes) 115,402 bytes	122,294 bytes
Option 203:	(192K bytes) 180,842 bytes	187,834 bytes
Option 204:	(256K bytes) 246,282 bytes	253,274 bytes
98321F:	32K byte memory-field installed	
98322F:	64K byte memory-field installed	

Tape Cartridge

Capacity:	217,000 bytes
Search Speed:	2286mm/sec.(90 inches/sec.)
Read/Write Speed:	559mm/sec. (22 inches/sec.)
Tape Length:	42.67m (140 ft)
Typical Rewind Time:	19 seconds (end to end)
Transfer Rate:	1480 bytes/sec.

Thermal Printer

Line Length:	16 characters – 5x7 dot matrix
Printing Speed:	190 lines/minute
Paper Width:	57.15mm(2.25in)
Character Set:	128 standard ASCII characters plus optional character sets which provide from 6 to 94 additional characters

CRT Display (9835A)

Screen Size:	261mm x 193mm (10.3 x 7.6 in)
Refresh Rate:	60Hz
CRT Phosphor:	P31
Raster Size:	215mm x 134mm(8.48 x 5.30 in)
Character Size:	2.3mm x 2.95mm (.09 x .116 in)
Screen Capacity:	24 lines of 80 characters

LED Display (9835B)

Display Size:	32 characters – 5x7 dot matrix
---------------	--------------------------------

Equipment Supplied

Table 1-1 lists the equipment supplied with each standard 9835A or 9835B.

Table 1-1. Equipment Supplied

Item	Quantity	Part Number
Operating and Programming Manual	1	09835-90000
Beginner's Guide	1	09835-90001
Programmer's Introduction	1	09835-90002
Owner's Manual	1	09835-90005
Reference Guide	1	09835-90010
System Test Manual	1	09835-90040
System Test Cartridge	1	09835-90041
Utility Library	1	09835-10000
Special Function Key Overlays	5	7120-6452
Blank Tape Cartridges	2	9162-0061
Dust Cover	1	9222-0594 (9835A only) 9222-0495 (9835B only)
Magnetic Head Cleaner	1	8500-1251
Spare Fuses		
3 Amp (NB)	1	2110-0003
1.5 Amp (NB)	1	2110-0043
Fuse Holder Cap	1	2110-0544
I/O Door	1	5041-1403

The following items are also available –

Item	Part Number
Soft Carrying Case – Computer	98025A
Soft Carrying Case – CRT	09845-64404
Printer Paper (6 Roll Pack)	9270-0479
Printer Paper (single roll)	9270-0480

Repair Philosophy

The 9835 electronic assemblies are divided into those that can be exchanged and those that can be repaired in the field. Table 1-3 lists the 9835 electronic and electro-mechanical assemblies and whether they are to be exchanged on the Green Stripe Exchange Program or repaired in the field. Component repair items not repairable in the field should be ordered at list price but not returned.

Table 1-3. Repair Philosophy

Assembly Part No.	Description	Exchange	Repair
0960-0480	Tripler		X
1818-2800 thru 1818-2813	System ROMs		X
3160-0209	Fan		X
5061-3002	Cartridge Drive Assembly	X	
09835-61601	I / O Cable Assembly		X
09835-61602	Memory Bus Cable Assembly		X
09835-61603	9835A Power Harness		X
09835-61613	9835B Power Harness		X
09835-61672	CRT Socket Cable Assembly		X
(A11) 09835-66511	Processor Assembly	X	
(A12) 09835-66512	ROM Interface Assembly	X	
(A24) 09835-66524	32K-byte R / W Memory Assembly	X	
(A25) 09835-66525	64K-byte R / W Memory Assembly	X	
(A36) 09835-66536	Internal I / O Assembly	X	
(A51) 09835-66551	Power Supply Assembly	X	
(A70) 09835-66570	CRT Motherboard Assembly		X
(A71) 09835-66571	CRT Interface Assembly		X
(A72) 09835-66572	Alpha Control Assembly	X	
(A73) 09835-66573	Display Logic Assembly	X	
(A74) 09835-66574	CRT Analog Assembly		X
(A75) 09835-66575	CRT High Voltage Assembly		X
(A81) 09835-66581	I/O Interface Assembly		X
09835-67904	Transformer Assembly		X
09835-67925	Language ROM Drawer Assembly		X
09835-67972	CRT Assembly		X
09835-68001	9835A Keyboard Assembly		X
09835-68002	9835B Keyboard Assembly		X

Safety

WARNING

LETHAL VOLTAGES ARE PRESENT INSIDE THE 9835. THERE ARE NO CUSTOMER SERVICEABLE PARTS INSIDE THE 9835.

Procedure For All Personnel Trained In Electrical or Electronic Installation, Maintenance and/or Repair

- Do all possible operations with the power source inactivated.
- If the installation, maintenance or repair has to be done while energized, the following precautions should be taken:
 - a. Never work alone in high voltage areas. In case of accidental shock, a life may depend on rapid removal from the energized source and appropriate first-aid action.
 - b. Employees working in high voltage areas should know where to obtain respiratory resuscitation and/or cardiac pulmonary resuscitation (CPR), in case a fellow worker needs assistance.
 - c. In case of burns, treat only after the person is breathing and has a normal heartbeat.

These simple precautions can save a life.

General Safety Guidelines For High Voltage Testing

Here is a list of safety guidelines to be followed when working with voltages in excess of 50vdc or 50vac RMS.

1. Know each step of the test procedure. Check the test set up to be sure the instruments are connected properly and that all control settings are correct.
2. Never defeat interlocks.
3. Never have one hand on chassis or other ground while measuring high voltages with a probe held in the other hand. Use the one hand method, i.e., probe in one hand, the other hand behind the back or in a pocket.
4. Make sure the probe being used has voltage insulation higher than the voltage being measured. Check wires and probes for cracked insulation and defects. If any defects are noted do not use until repairs are made.

5. Make certain that the instrument being worked on is turned off and capacitors and high voltage circuits are discharged before any component or hardware is removed or touched. Remember that a circuit can be lethally charged if a component is open, missing, or a wire is disconnected or open even with the ac power switch off. Isolated heat sinks will also be statically charged.
6. Make certain that instruments used for testing are used within their rated specification. Never use instruments floated above their specified rating.
7. Never reach around energized high voltage circuits. Always turn equipment off and discharge the high voltage before reaching.
8. NEVER WORK ALONE. Be familiar with location of power switches in your area and what they control. Know how to free a fellow worker from high voltage without energizing yourself.
9. Keep work area neat, free of any interfacing conductive material, and free of any sharp objects. Remember a reaction to a shock can cause one to strike nearby objects which can result in a serious injury.
10. Always leave safety shields in place unless work must be done on circuits behind the shields. Replace the shields after work is completed.
11. Never leave work area with high voltage equipment energized and high voltage circuits exposed.
12. Have available and use approved warning signs and tags in areas where high voltage testing is in process.
13. Do not make measurements in a circuit where corona is present. Corona can be identified by a pale-blue color, or from a buzzing sound emanating from sharp metal points in the circuit, or from the odor of ozone.
14. Hands, shoes, floor, and workbench must be dry. Avoid making measurements under humid, damp or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or instruments.
15. All test procedures and safety procedures should be strictly followed at all times.

Power Cords

Power cords supplied by HP will have polarities matched to the power-input socket on the equipment, as shown below:

- L = Line or Active Conductor (also "live" or "hot")
- N = Neutral or Identified Conductor
- E = Earth or Safety Ground

WARNING

IF IT IS NECESSARY TO REPLACE THE POWER CORD, THE REPLACEMENT CORD MUST HAVE THE SAME POLARITY AS THE ORIGINAL. OTHERWISE A SAFETY HAZARD FROM ELECTRICAL SHOCK TO PERSONNEL, WHICH COULD RESULT IN INJURY OR DEATH, MIGHT EXIST. IN ADDITION, THE EQUIPMENT COULD BE SEVERELY DAMAGED IF EVEN A RELATIVELY MINOR INTERNAL FAILURE OCCURRED.

Power cords with different plugs are available for the equipment; the part number of each cord is shown below. Each plug has a ground connector. The cord packaged with the equipment depends upon where the equipment is to be delivered.

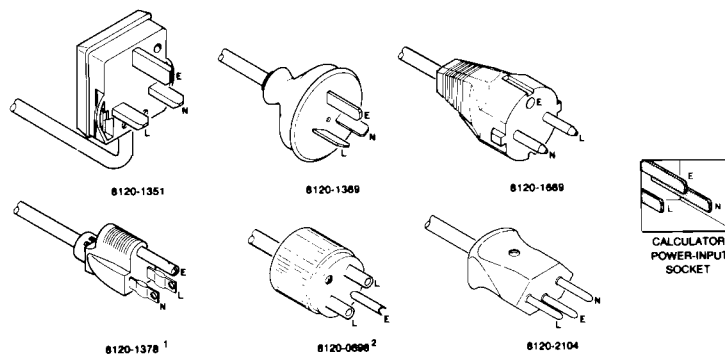


Figure 1-1. Power Cords

¹ UL and CSA approved for use in the United States of America and Canada with equipment set for either 100 or 120 Vac operation.

² UL and CSA approved for use in the United States of America and Canada with equipment set for either 200 or 240 Vac operation.

Grounding Requirements

To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that the computer chassis be grounded. The computer is equipped with a three conductor power cable which, when connected to an appropriate power receptacle, grounds the computer chassis.

Installation

9835A CRT Installation

After unpacking the computer, the CRT assembly must be mounted onto the mainframe assembly. The CRT assembly plugs into the top of the mainframe. Set the front of the CRT on the mainframe shell as shown in Figure 1-2. Connect the CRT interface cable to the connector on the top of the mainframe. Fold the cable so it will fit in the recessed area on the bottom of the CRT.



Figure 1-2. CRT Installation

Power Requirements

The computer will operate on a line voltage of either 100V, 120V, 220V or 240V ac (+5%, -10%). The line frequency must be within the range of 48 to 66 Hz (inclusive). The computer requires a maximum of 220 voltamps.

NOTE

9835A Access: To access the fuse, voltage selector switches and printer paper, slide the CRT assembly to the left until the paper cover door can be opened.

Fuses

WARNING

DISCONNECT THE AC POWER CORD BEFORE REMOVING OR INSTALLING A FUSE.

The computer's fuse is located under the paper cover (see Figure 1-3).

The computer requires a 3 amp fuse for 100 volt and 120 volt ac operation and a 1.5 amp fuse for 220 volt and 240 volt ac operation (see Table 1-4).

To change the fuse, first disconnect the power cord from the computer. Then remove the fuse cap by pressing inward while twisting it counterclockwise. Remove the fuse from the cap and insert the correct replacement fuse (either end) into the cap. Finally, put the fuse and cap back into the fuse holder. Press on the cap and twist it clockwise until it locks in place.

Setting The Voltage Selector Switches

Ensure that the two voltage selector switches, under the paper cover, are set to the correct powerline voltage. Figure 1-4 shows the correct settings for each nominal line voltage. If it is necessary to alter the setting of either switch, insert the tip of a small screwdriver into the slot on the switch. Slide the switch so that the position of the slot corresponds to the desired voltage, as shown.

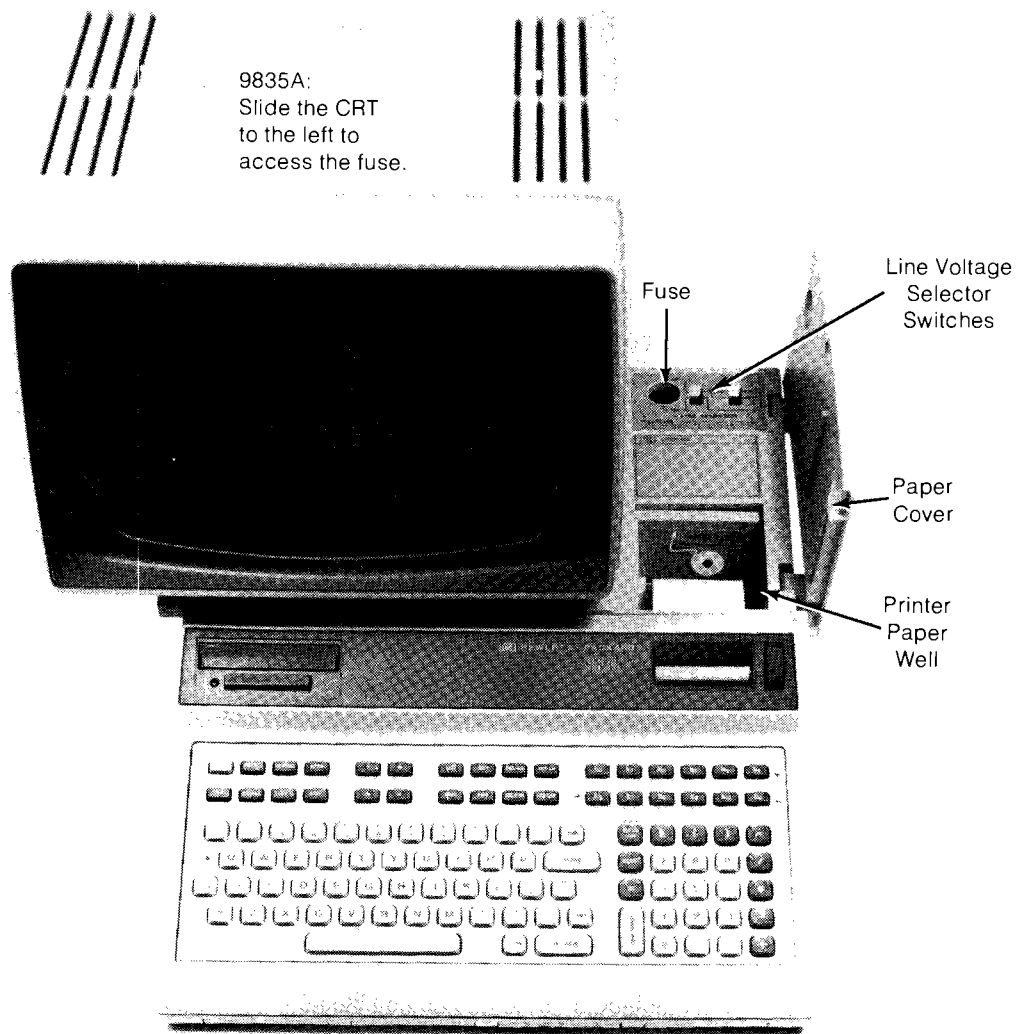


Figure 1-3. Fuse Access

Table 1-4. Voltage Operating Ranges

Nominal Voltage	Operating Range* -10%, +5% of Nominal	Computer Fuse	HP Part Number
100	90 to 105 volts	3A NB	2110-0003
120	108 to 126 volts	3A NB	2110-0003
220	198 to 231 volts	1.5A NB	2110-0043
240	216 to 252 volts	1.5A NB	2110-0043

* Line voltages higher than the maximum in each range should not be applied. If higher voltage variations exist, line preconditioning is necessary.

1-12 General Information

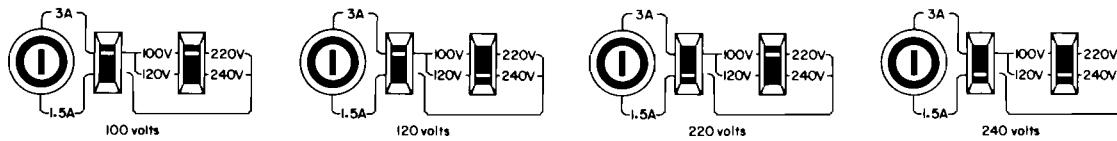


Figure 1-4. Voltage Selector Switches

Printer Paper

To install the printer paper, use the following procedure.

- Lift the paper cover.
- Insert the spindle through the center of the roll of paper.
- Position the spindle in the guides so that the paper will unwind from the bottom of the roll (see Figure 1-5).
- Insert the end of the paper into the slot in the front of the paper well and turn the printer's thumb wheel to advance the paper through the printer.

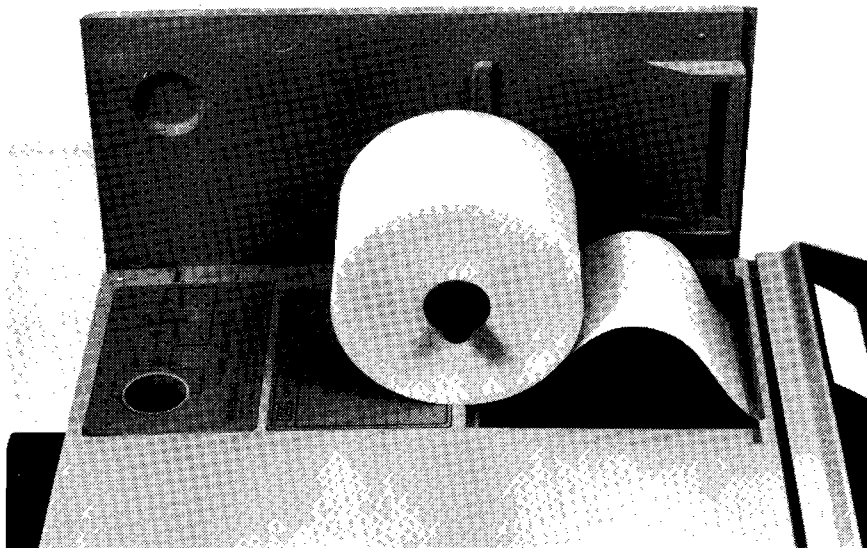


Figure 1-5. Loading Printer Paper

Cartridge Installation

To install a tape cartridge, slide the cartridge into the cartridge drive with the label of the cartridge facing the back of the computer.

To remove the cartridge, press the cartridge eject bar.

Initial Turn-On

Before applying power to the computer, check the following items.

- Disconnect power cord.
- Install CRT assembly (9835A).
- Set line voltage selector switch.
- Install proper fuse.
- Power switch (right side of mainframe) set to off or "0" (point of the switch rocker is toward the "0" on the switch bezel).
- Connect power cord.

Switch the power switch on (point of the switch rocker is toward the "1" on the switch bezel). Almost immediately after the power is switched on, the computer will beep once and begin to do a self-test of the memory. As memory is being tested, `MEMORY TEST IN PROGRESS` is displayed. The length of the test depends on the size of user read/write memory which is installed.

Should the memory test fail, the machine beeps continuously and the following display appears –

```
PART OF MEMORY FAILED SELF-TEST!
```

In this case, you still have part of the memory available for use, however. Executing `LIST` will display the amount of available memory in bytes.

If the computer has the internal printer, errors detected during the memory test are printed on the printer.

Should no message appear, but the computer beeps repeatedly, the memory failure occurred at a memory address too low to activate the operating system. Refer to the memory section in Chapter 2 for assistance.

When the computer is ready to use, `9835A READY FOR USE` or `9835B READY FOR USE` is displayed.

1-14 General Information

Should the CRT or display remain blank longer than 30 seconds (approximately), hold down **CONT'L** then press **STOP** to reset the computer.

On the 9835A, the blinking cursor appears on the CRT display. Adjust the intensity control located beneath the lower right corner of the CRT bezel, for the desired display intensity. On the 9835B, the "+" appears on the LED display.

Auto Start

If a tape cartridge is present in the tape drive at power on, the computer automatically performs the following operation: LOAD "AUTOST";1 at power on. See the 9835A/B Operating and Programming Manual for more explanation of auto start.

Computer Cleaning

Case

The computer case can be cleaned by using a soft, moist cloth. Do not use harsh or abrasive detergents, and do not allow moisture to penetrate the computer.

Fan Filter

The fan filter is on the back of the computer. Just pull it out to remove it. Clean the filter in warm soapy water and rinse it in clean water. Then dry it thoroughly and replace it.

Magnetic Tape Head

To ensure the reliability of tape operation, it is recommended that the tape head be cleaned after every eight hours of tape operations. It's a good idea to clean the tape head before making important recordings.

The tape head is cleaned as follows:

1. Remove the tape cartridge if installed.
2. Clean the tape head with a cotton swab that has been dampened with head cleaning solution (see Figure 1-6). Wipe the top of the tape head a few times with the cotton swab. Remove any other dust that has accumulated in the vicinity of the tape head.

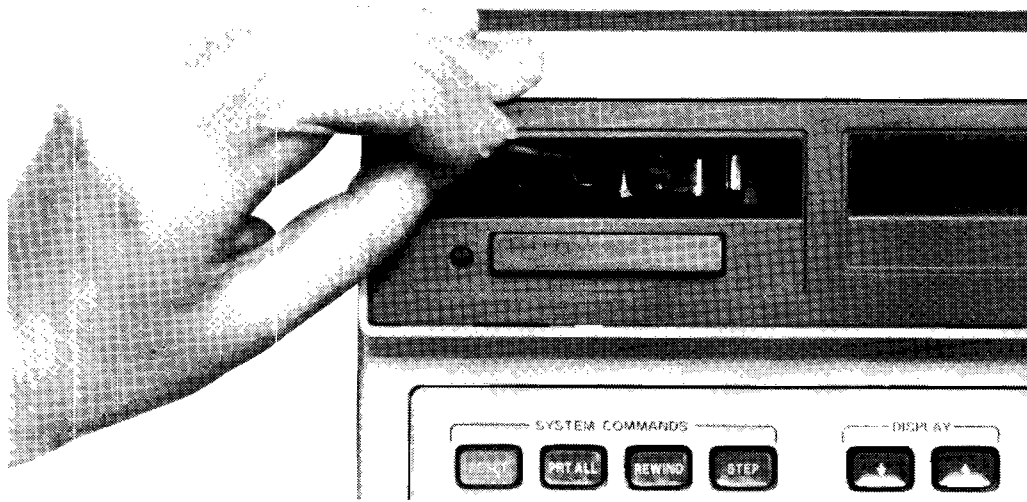


Figure 1-6. Cleaning the Tape Head

Tape Cartridge Considerations

The following describes tape cartridge anomalies and their cures.

- It is a good idea to remove a tape cartridge from the computer when you are not using the computer. If a cartridge is left in the computer, a flat spot may develop on the friction drive wheel in the cartridge drive unit. This condition will cause errors when using the tape. The flat spot is only temporary and may be corrected by running the tape forward to the end of tape, and then rewinding the tape.
- The tape drive belt may lose its tension with age. A loose drive belt is evident when the tape is not wound smoothly on the tape reels. This condition can be seen through the front of the cartridge. A cartridge with this condition should be replaced.
- If the tape unwinds completely from one of the reels, refer to the following drawing and use the procedure below to re-thread the tape.
 1. Remove the 4 screws holding the cartridge cover and remove the cover.
 2. Thread the tape around the guides as shown in drawing.
 3. Moisten the end of the tape so that it will stick on the tape reel.
 4. Using a sharp pencil or other pointed object, guide the end of the tape between the drive belt and the reel.
 5. As you wind the tape onto the reel, ensure that there is no slack in the tape. If the tape is not tight, start over again.

1-16 General Information

6. Wind at least 10 turns of tape onto the reel.
7. Reassemble the cartridge.

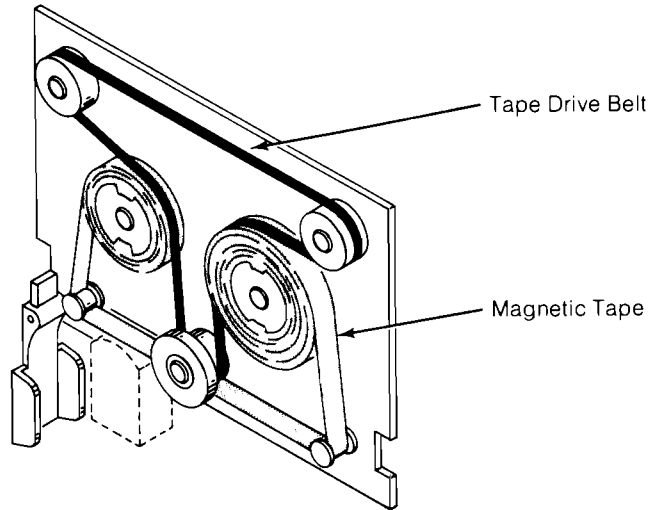


Figure 1-7. Tape Cartridge

Options

The following presentation is a description of the various 9835A/B options and procedures to install each option.

WARNING

REMOVE ANY AC POWER FROM THE 9835 BEFORE INSTALLING ANY OPTION.

Thermal Printer (Option 500)

A 16-character thermal printer is available for permanent output of program listings, program results, catalogs, etc. The printer is an option on both the 9835A and 9835B. The printer can be installed at the factory or in the field. The printer field installation kit for the 9835A is 98350F. The 9835B printer field installation kit is 98351F. The difference between the kits is the bezel insert included for the different models. Here is a list of the assemblies included in the kits.

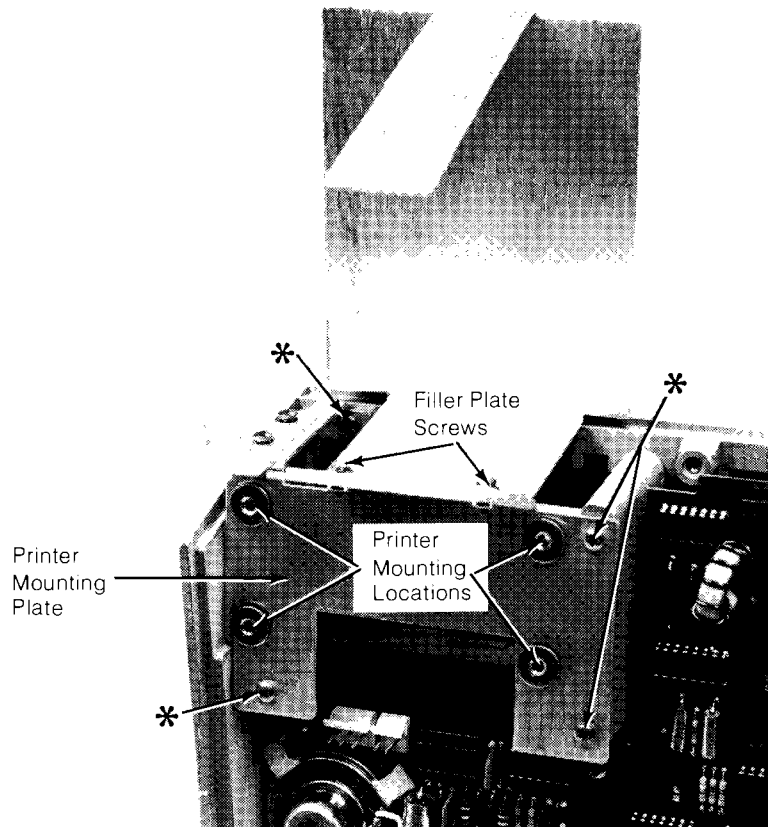
Part Number	Description
5040-8192	Printer Bucket
09815-20602	Paper Spindle
09835-64415	9835A Bezel Insert
09835-64435	9835B Bezel Insert
09835-67940	Printer Assembly



Printer Installation Procedure

The computer must be disassembled to install the printer. Refer to the assembly access procedures in Chapter 3 for assistance.

1. Remove the bezel assembly from the computer.
2. Remove the two screws that hold the filler plate bracket to the bezel and remove the bracket (see Figure 1-8).
3. Remove the printer mounting bracket and mount the printer on the bracket using the four screws, washers and rubber grommets supplied (see Figure 1-8).
4. Remove the bezel insert and install the new insert supplied in the kit. See Chapter 3 for bezel insert removal procedures.



* Printer Mounting Plate Removal Screws

Figure 1-8. Filler Plate Removal

5. Install the printer assembly onto the bezel using four screws (see Figure 1-8).
6. Connect the four printer connectors to the A36 assembly as shown in Figure 1-9.
7. Install the printer bucket with the two screws provided.
8. Reinstall the bezel and perform the printer tests found in the printer section of Chapter 2 (adjust as necessary).
9. Reassemble the computer.

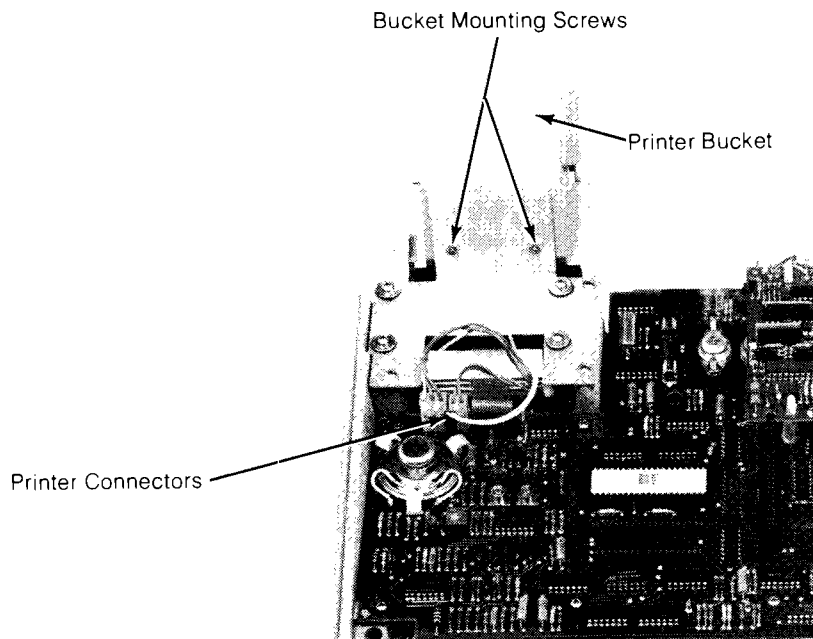


Figure 1-9. Printer Installation

Character Set Options

NOTE

The final character set configurations and part numbers are not available at this time. The information given here may change. Manual changes or service notes will be made available when final character set information becomes available.

Each character set option contains a plug-in ROM which replaces ROM number 9 in the system ROM drawer and a keyboard overlay.

The following character sets are available for the 9835A/B:

Character Set	Option
Standard ASCII	800
French	810
Spanish	820
German	830
Katakana	840

The character set ROMs can be installed in the field. Figure 1-10 shows the character ROM sockets on the A36 or A37 assembly and the ROMs that can be installed in each socket.

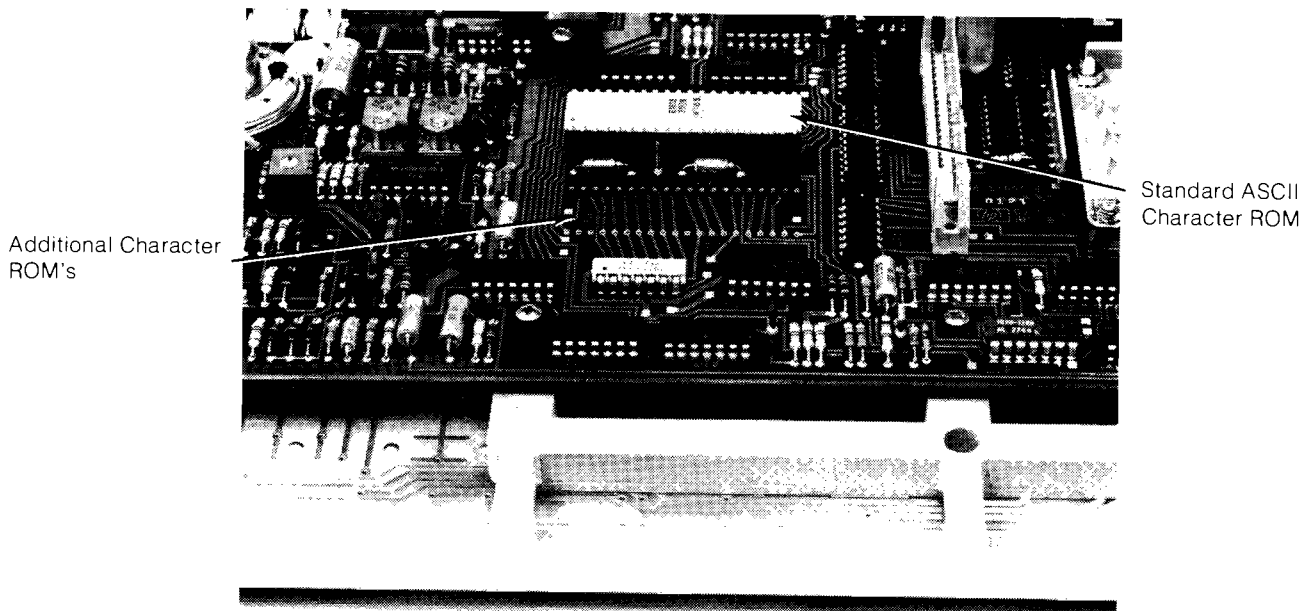


Figure 1-10. Character ROM Sockets

After installing a ROM, perform either the CRT, LED display or printer test to check the new characters.

ROM Options

There are several plug-in option ROMs (Read Only Memories) which provide additional language capabilities to perform specific tasks, such as using mass storage devices. The ROMs available at this time are:

- Assembler Development ROM (HP P/N 98330A).
- Mass Storage ROM (HP P/N 98331A) allows disks to be used with the 9835A/B.
- I/O ROM (HP P/N 98332A) expands input and output capabilities.
- Plotter Graphics ROM (HP P/N 98337A) allows plotters to be used with the 9835A/B.
- Assembler Execution ROM (HP P/N 98338A).
- Assembler Development and Execution ROM (HP P/N 98339A).

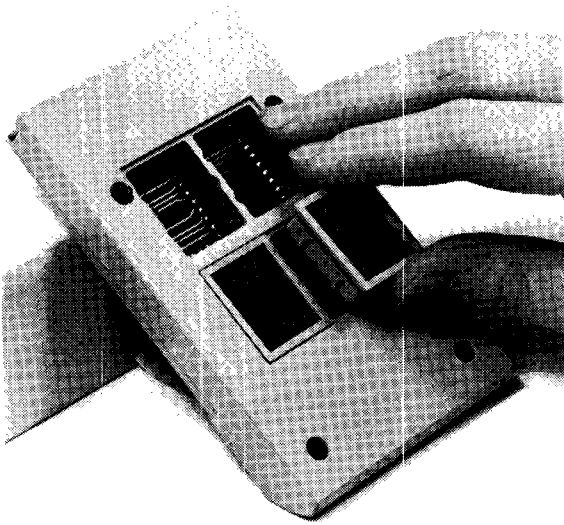
The 9835A/B has four ROM slots located in the bottom front of the computer. A ROM can be inserted into any one of the ROM drawers which is then inserted into one of the slots.

To install a ROM:

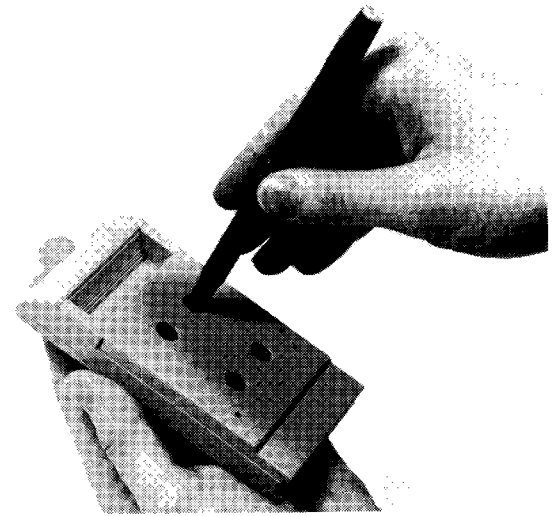
- Pull out a drawer to find an available spot.
- Align the label on the ROM so that the top is toward the back of the drawer (the ROM and the ROM drawers are keyed).
- Push the ROM in until it is even with the top of the drawer.

To remove a ROM:

- Remove the proper drawer.
- Turn the drawer over and remove the desired ROM by using a finger, pen, or screwdriver to push on the round removal button which shows through the small hole, as shown.



Installing A ROM



Removing A ROM

Figure 1-11. Installing a ROM

Memory Options

The standard read/write memory for the 9835A is 20,458 bytes. The standard memory for the 9835B is 24,150 bytes. The following memory options are available.

Table 1-5. Memory Options

Option	Assemblies	Total	Memory in Bytes*
	Present	9835A	9835B
201	one-A25 assembly	49,962	56,854
202	two-A25 assemblies	115,402	122,294
203	three-A25 assemblies	180,842	187,734
204	four-A25 assemblies	246,282	253,174

Memory Installation

Two field installable memory kits are available:

98321F contains one, 32K-byte memory assembly (A24)

98322F contains one, 64K-byte memory assembly (A25)

Verify the available memory before and after installing a memory assembly to ensure that the memory is installed correctly. With no ROMs installed, press **LIST** **CMX/E** before memory installation and note the "memory available display". Write down the number in the display. After memory installation, press **LIST** **CMX/E** and again note the number in the memory available display. The difference between the two numbers indicates the amount of memory added in bytes. Obviously, the number after you install a memory assembly should be more than before you installed it; if not, there is something wrong. The 9835 has room for four memory assemblies. The A24 and A25 memory assemblies can be installed in any one of the four memory locations. The A24 assembly (09835-66524) is a 32K-byte assembly. The A25 assembly (09835-66525) is a 64K-byte assembly. The computer uses 64K-bytes as one block of memory. Thus, an A24 assembly is one-half of a block and the A25 assembly is a full block.

When a full block (A25) is installed, it should be set to a block number not already used by another assembly.

Single half blocks (A24) should be assigned the highest block number in the system.

Two half blocks (A24) should be combined to form a full block by assigning both half blocks to the same block number and setting one half to the upper part and the other half to the lower part of the block. Here is an explanation of the switch settings on the A24 and A25 assembly. Remember that the read/write memory occupies the even memory blocks. Refer to the Memory Section in Chapter 2.

* Total memory is displayed by pressing **LIST** **CMX/E** after switching the computer on.

SW1 on the memory assembly defines the block number. Block 0 is set when the SW1 switches are all set to 0. In the case of block 0, SW2 must be set to "special"; left switch off and right switch on. For all other SW1 settings (all settings other than 0) SW2 must be set to "normal"; left switch on, right switch off. The first sixteen even blocks on SW1 are available for read/write memory. The block selected is equal to the binary value of the SW1 settings.

NOTE

SW1 only sets bits 1 through 4. Bit 0 (not on the switch) is hardwired and is always 0. Thus, only even blocks can be selected. There must be an assembly assigned to block 0. All other assemblies can be assigned to other even blocks.

If SW2 is set to "special" on an assembly other than block 0, some of the memory is mapped into the next highest ROM block.

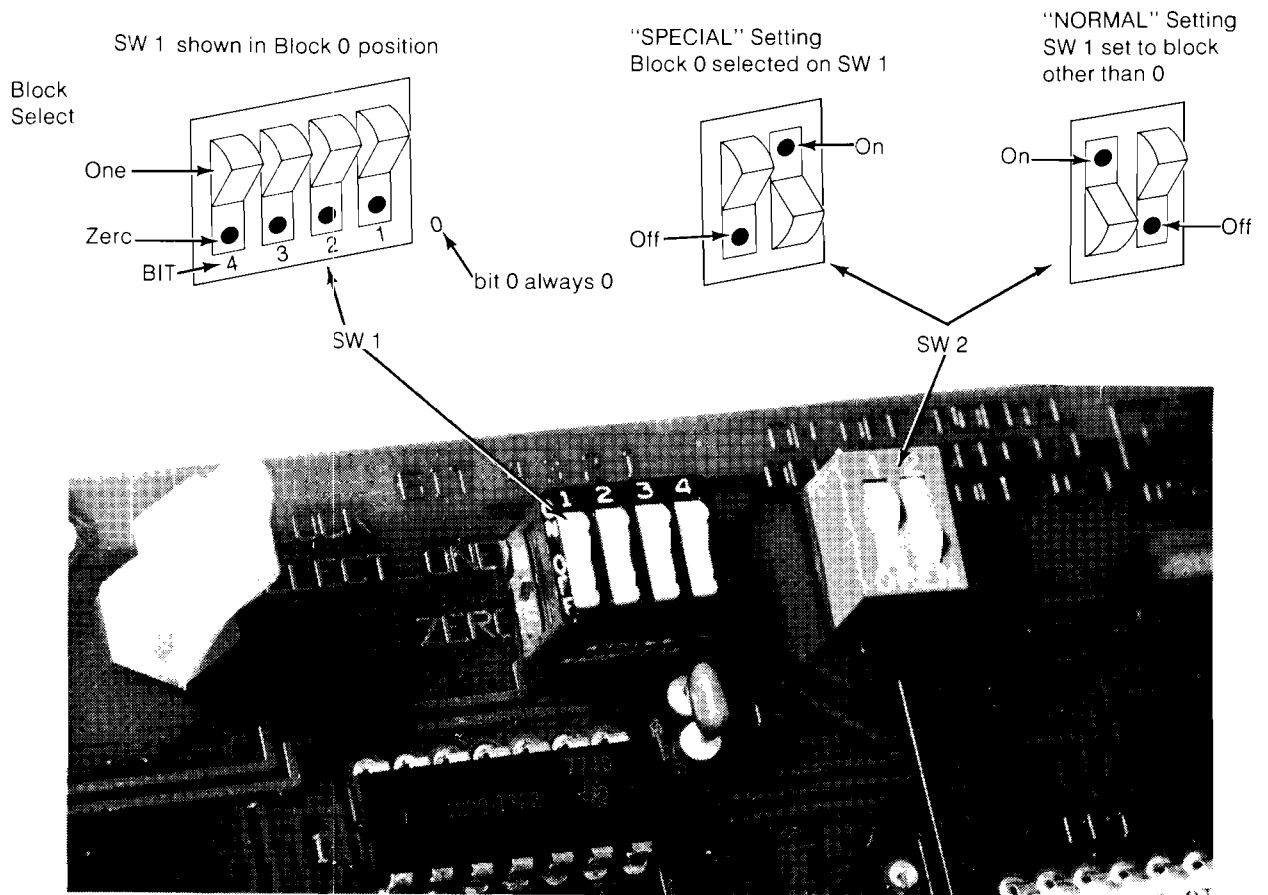


Figure 1-12. SW1 and SW2 Settings for A24 and A25

1-24 General Information

On 32K byte assemblies, which contain only a half-block, SW3 has to be set to designate the top or bottom half of the block. Blocks are filled from the top of the block, down. SW3 is positioned to either the top half (1) or the bottom half (0) (see Figure 1-13):

If a memory failure occurs, you can change the block number for a particular memory assembly to eliminate the error or change the location of the error. This may help isolate a bad memory assembly.

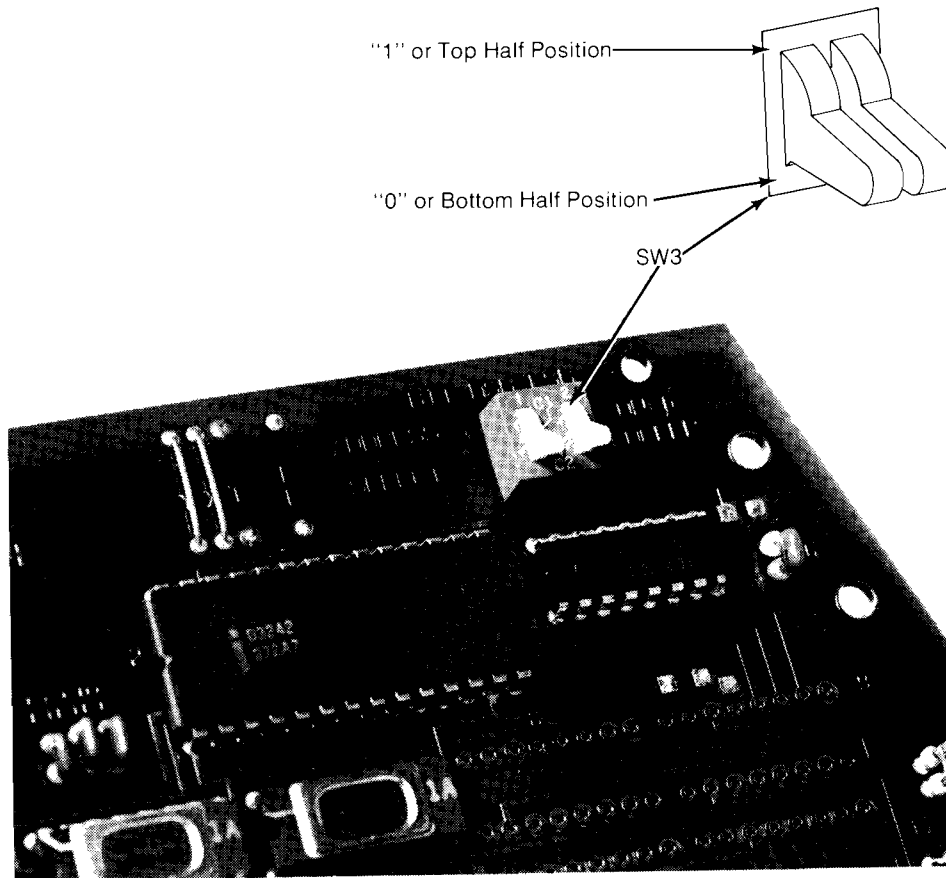


Figure 1-13. SW3 Settings for A24

NOTE

An A24 assembly adds 32,736 bytes.

An A25 assembly adds 65,440 bytes.

Table Mounting

The computer can be mounted to the top of a desk or table by following these steps –

- 1. Drill 5 holes in the top of your desk or table to accommodate #6-32 (National Coarse) screws according to the diagram below.
- 2. Remove the Phillips head #6-32NC screws that hold the rubber feet to the bottom of the computer.
- 3. Use screws that are 1/2 inch longer than the thickness of the table top. This 1/2 inch allows for the thickness of the rubber feet and the hole for the screw in the bottom of the computer.

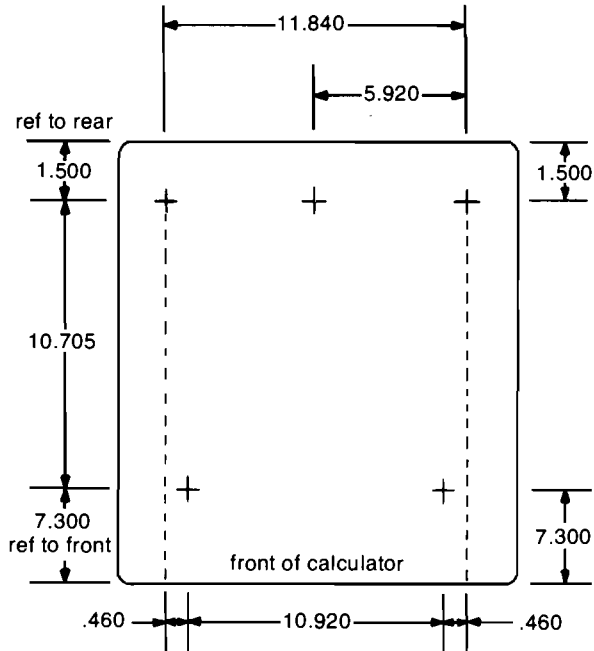
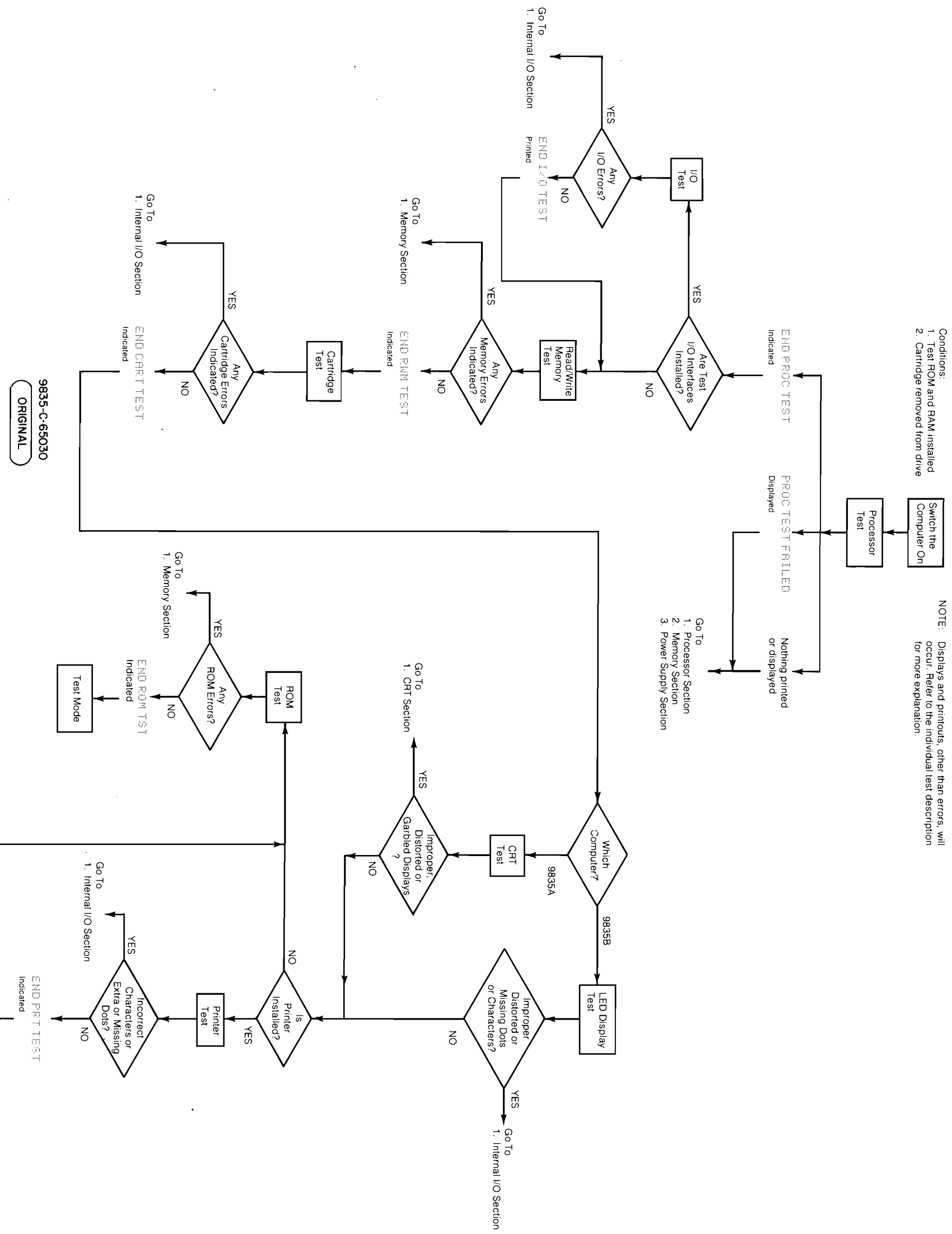


Figure 1-14. Table Mounting Specifications



9835-C-65030
 ORIGINAL

Figure 2-0. Test ROM Trouble Chart

Table 2-1. Test ROM Summary

Test ROM Test	Found In Section	Page Number
K0 Read/Write Memory	Memory	2-13
K1 Cartridge Drive	Internal I/O	2-33
K2 ROM	Memory	2-13
K3 CRT	CRT	2-23
K4 Display	Internal I/O	2-33
K5 Printer	Internal I/O	2-33
K6 Read/Write Exerciser	Memory	2-13
K7 Cartridge Drive Exerciser	Internal I/O	2-33
K8 I/O	Internal I/O	2-33
K9 Cartridge Drive Troubleshoot	Internal I/O	2-33
K10 System Loader (Factory Use Only)	9835 Test ROM	2-3
K11 Computer Control	9835 Test ROM	2-3

Chapter 2

How To Fix It

Introduction

This chapter is intended to help you repair the 9835A/B computer. The method used relies on the 9835 Test ROM and Test RAM to isolate a faulty computer section.

This chapter is divided into the major computer sections. Each section consists of the description of the test ROM test for that section, any adjustments involved in that section and a block diagram and theory of operation of the section.

The various sections of this chapter and the computer are:

- Processor
- Memory (ROM and Read/Write)
- Internal I/O
- CRT
- Power Supply

Before you get to the various sections, use the trouble isolation procedures described in the on site service procedure.

Before you make a service call, take advantage of the automatic turn-on test described below. By asking the customer questions about the turn-on test, you can either eliminate the problem without a call or semi-isolate the problem before you make the service call.

Pre-Service Call Problem Isolation

Things to verify and talk to the customer about before you make a service call.

First, ensure that the computer is switched on; check fan operation by feeling the air drawn in by the fan.

2-2 How To Fix It

If you don't have airflow, check the fuse, the line voltage selector switches and the power cord. A blown fuse or an inoperative fan can be caused by:

1. Defective power supply module (exchange).
2. Defective fan (change).
3. Defective primary power wiring (repair).
4. Improper fuse (change).

The computer's turn-on sequence can be used to isolate a problem. Here is a breakdown of the computer turn-on sequence.

When the computer is switched on, a beep is normally heard. The beep is the final result of an internal processor test which executes about one hundred miscellaneous instructions. If you don't hear the beep, one of the following assemblies may be defective.

- Processor assembly A11
- Internal I/O assembly A36 or A37
- System ROM drawer
- Power supply assembly A51

If the upper-most addresses in block 0 (76000-77777) are not functional, the beep will not be heard. The block 0 memory assembly should also be a suspect assembly in this case.

After the processor test (if the beep is heard), the computer begins a memory self-test. When the memory test is complete, 9835A/B READY FOR USE is displayed. If a memory failure occurs, one of three possible failure results can occur.

1. If PART OF MEMORY FAILED SELF TEST is displayed, a memory failure has occurred. However, there is at least 16K-bytes of useable memory in block 0. Memory failure information is printed (printer must be installed). Refer to "9835 Power-On Memory Test" in the memory section for test details.
2. If the computer beeps at a one beep per second rate (approximately), a memory failure has occurred and there is less than 16K-bytes of useable memory in block 0.
3. If the computer beeps at a five beep per second rate (approximately), the CRT or the LED display is not connected. In addition, a memory failure may have occurred.

If displays do not appear on the CRT, try adjusting the intensity control.

If you don't have a cursor, the problem can be in the CRT. Try pressing the "A" and "D" test switches on the back of the CRT.

On-Site Service Procedure

The 9835 test ROM's turn-on mode sequence provides a logical testing sequence to find and isolate a 9835 problem.

Once at the customer's site, check the obvious things such as the fuse, line selector switches, power cord and fan operation, then;

- Remove any I/O interfaces from the computer.
- Remove any cartridge from the cartridge drive.
- Install the 9835 test ROM and test RAM

Switch the computer on and follow the 9835 test ROM trouble chart as the computer performs the tests and indicates pass and fail conditions. Through the combination of the test ROM and the trouble chart, defective assemblies or sections can be isolated.

For a complete description of the 9835 test ROM, refer to the presentation below.

For a complete description of each test ROM test, refer to the various computer sections.

9835 Test ROM

The 9835 test ROM (09835-67997) and the test RAM (09835-67998) is intended to help the HP Customer Engineer to exercise, test and troubleshoot the 9835 computer. The test ROM and its associated test RAM can be plugged into any of the ROM slots on the front of the computer. Since the ROM redefines the 9835 capabilities, when the test ROM is installed, the basic language is not readily available unless **CONT L** **STOP** or **K11** is pressed. **CONT L** **STOP** or **K11** transfers control back to the computer's operating system. Press **SHIFT** **CONT L** **STOP** to re-enter the test ROM from the computer's operating system. The test ROM has three modes of operation. The three modes are:

- Turn-on mode
- Test mode
- Program mode

Turn-On Mode

NOTE

Remove any cartridge installed in the cartridge drive before switching the computer on.

The turn-on mode automatically begins when the computer is switched on with the test ROM installed (cartridge must be removed). Thus, simply switching the computer on will automatically run a series of test ROM tests. The turn-on mode test sequence consists of the following tests:

- Processor test
- I/O test (external)
- Read/write memory test
- Cartridge drive test
- CRT test (9835A) or display test (9835B)
- Printer test (if installed)
- ROM test

In the turn-on mode, the I/O test is run automatically. The I/O test requires that one to three test interfaces be installed. If you wish to skip the I/O test, it is important that all interfaces be removed from the computer.

A complete description of each turn-on mode test is given in the appropriate sections following in this chapter. Refer to the test ROM summary and the test ROM trouble chart.

To exit the turn-on mode, press **STOP** at anytime. Pressing **STOP** will put the computer in the test mode. When all the turn-on tests are completed, the computer enters the test mode. Use the turn-on mode to test the overall computer and to determine which section might be defective.

Test Mode

To enter the test mode from the turn-on mode, press **STOP**. **TST MODE** will be indicated. In the test mode, the special function keys are defined to perform specific tests when pressed. The special function keys are defined as follows:

- K0 - Read/write memory test
- K1 - Cartridge drive test
- K2 - ROM test
- K3 - CRT test (9835A)
- K4 - Display test (9835B)
- K5 - Printer test
- K6 - Read/write exerciser
- K7 - Cartridge drive exerciser
- K8 - I/O test
- K9 - Cartridge drive troubleshoot
- K10 - System Loader (for factory use only)
- K11 - Computer control

Refer to the individual sections in this chapter for a description of each test listed above, except K10 and K11 which are explained below.

Notice that the turn-on tests are identical to the test mode tests.

To exit any test mode test, press **STOP**.

To exit the test mode and return to the turn-on mode, press **SHIFT** **CONT'L** **STOP** or switch the computer off; then on.

To exit the test mode and enter the program mode, press **SHIFT** **K0**.

Use the test mode to run individual tests as an aid in troubleshooting.

K10 System Loader

This key is normally used at the factory. K10 will load special binary programs from Track A, File 0 of a cartridge installed in the computer's cartridge drive.

K11 Computer Control

This key transfers control from the test ROM to the computer's operating system. Press **SHIFT** **CONT'L** **STOP** to return control to the test ROM.

Program Mode

NOTE

Only the numeric keypad on the right side of the keyboard is functional in program mode.

The program mode allows you to select one or more individual tests and run them sequentially either once or continuously. To enter the program mode, the computer must first be in the test mode. Once in the test mode, press **SHIFT** **k0** to enter the program mode. **PGMMODE** will be indicated. Press the special function keys of the tests you wish to run followed by a comma and the number of times the test is to be run. Erroneous keys will result in a beep. The tests are run in the order in which they are entered. After the tests are entered in the desired sequence:

1. Press **SHIFT** **k1** to run the sequence once.
2. Press **SHIFT** **k7** to run the sequence continuously.

Here is an example sequence.

- SHIFT** **k0** – Enter program mode
- k2**, 3 – ROM test run 3 times
- k5** – Printer test
- k3**, 2 – CRT test run 2 times
- SHIFT** **k7** – The above sequence will be run continuously.

Press **STOP** at any time to exit the test in progress and the program mode. The computer returns to the test mode when **STOP** is pressed.

The remainder of this chapter describes the computer sections.

Processor Section

The processor consists of the A11 processor assembly (09835-66511). The A11 assembly is an exchange item.

Processor Test

The processor test is run automatically when the computer is switched on and no tape cartridge is installed in the cartridge drive. The test checks the processor functions and the ability to communicate with ROM and read/write memory. If the processor test passes, `END PROC TST` is indicated. If the processor test fails, `PROC TST FAILED` is indicated and the test ROM will 'hang up' until the computer is reset (`SHIFT` `CONT` `STOP`).

Processor Clock Frequency Adjustment

The power supply voltages should be checked and adjusted before attempting to adjust the processor clock frequency. The frequency is checked at the CK test point on the A11 assembly (see Figure 2-1). For radio frequency interference considerations, the processor clock is dithered (frequency modulated) about its 12.0 MHz center frequency. Disable the dither by installing a jumper (a pair of tweezers) in the two pads marked "KD" on the A11 assembly (see Figure 2-1). See the processor operation section for a description of the dither operation.

Refer to Figure 2-1 for location of the adjustment.

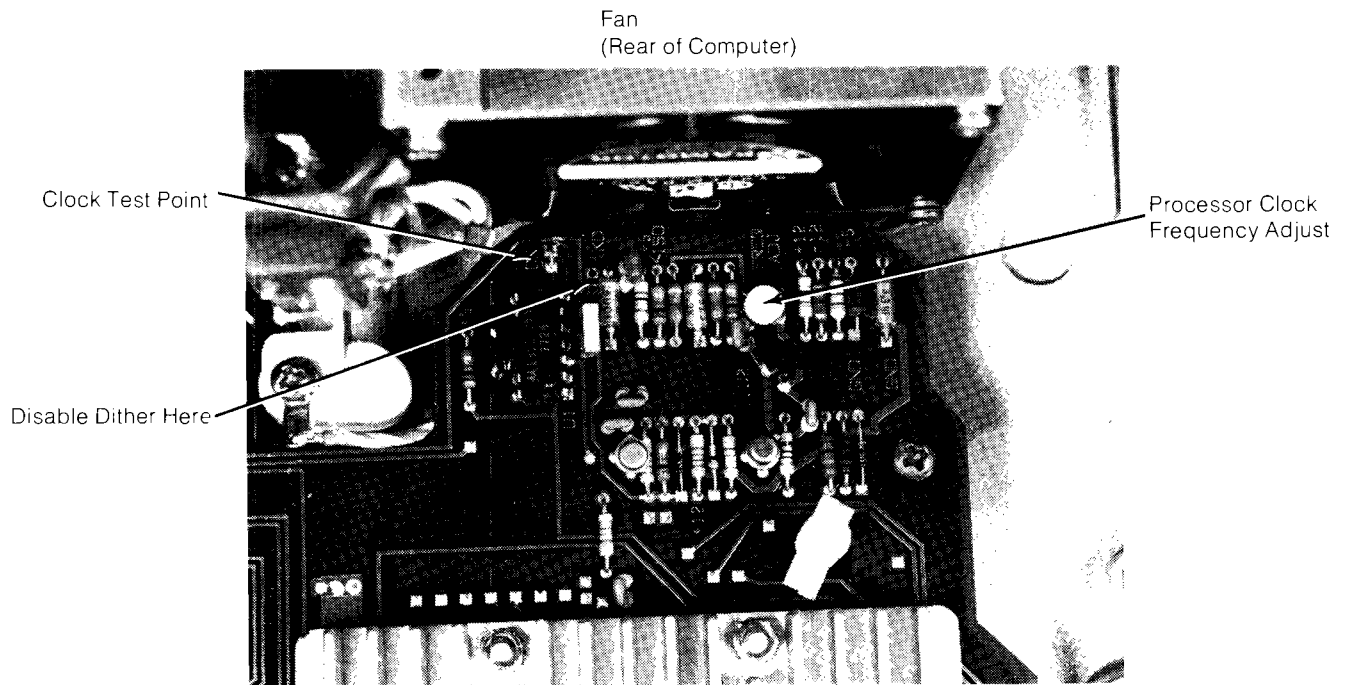


Figure 2-1. Clock Frequency Adjustment

2-8 How To Fix It

An oscilloscope with a calibrated sweep speed of .1 μ s/Div is required to make this measurement. To measure the processor clock frequency, set the controls as necessary to view a 12mHz, 4 volt peak-to-peak signal. The switch-settings listed below are applicable to an HP 180A oscilloscope, using a 10-to-1 probe.

- Volts/Div. – .1v
- Time/Div. – .1 μ sec
- Trigger – Int.
- Slope – +
- Sweep Mode – Auto
- Adjust trigger level for a stable triggered display.

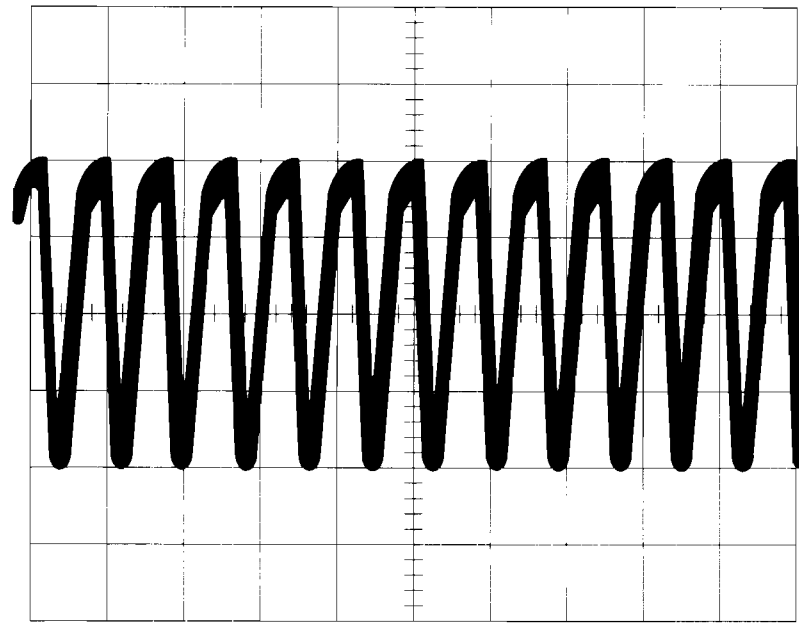
Adjust the processor clock frequency for 12 cycles visible in 10 divisions on the oscilloscope (see Figure 2-2).

$$\frac{12 \text{ cycles}}{10 \times .1\mu\text{sec}} = 12\text{mHz}$$

A frequency counter with a gate time greater than 250ms can also be used to check the processor clock frequency. When using a frequency counter, adjust the clock to 12mHz \pm .1mHz. The dither should be disabled when using the frequency counter.

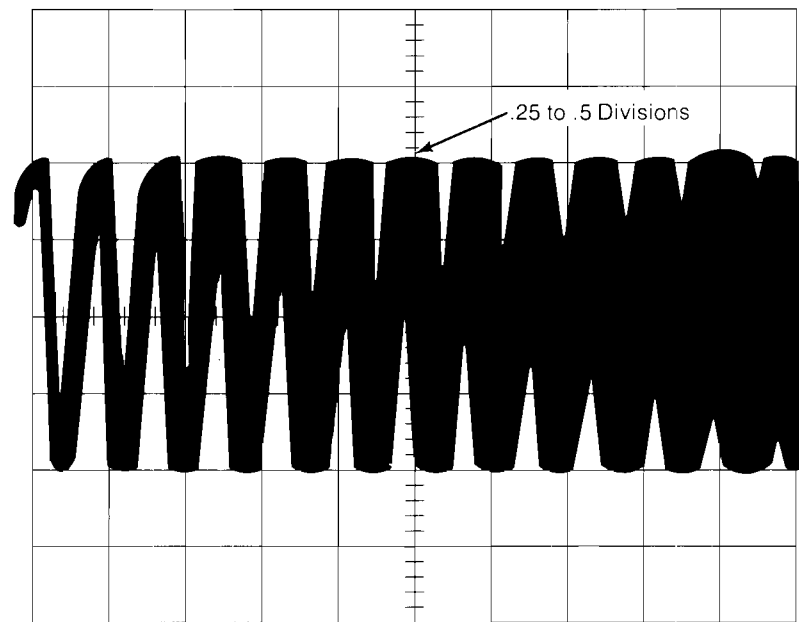
Dither Check

Excessive dither can cause the processor clock to swing outside the allowable operating range. Too little dither can cause excessive radiated RFI. To check the dither, follow the procedures for the processor clock adjustment to view the processor clock as shown in Figure 2-2A. Remove the jumper from the "KD" pads; the waveform should appear as in Figure 2-2B. Check the top of the center cycle, it should be between .25 and .5cm wide. If the dither is out of specifications, especially excessive dither, replace the A11 assembly.



A

Dither Disabled



B

Dither

Figure 2-2. Oscilloscope Display

Processor Operation

The primary function of the A11 assembly is to buffer the processor to the various system busses. Other functions include:

- Clock generation
- Initialization
- Address extension

Here is a brief description of the processor functions. Refer to the 9835 block diagram (Figure 2-25) when reading this presentation.

Clock Generation

The 12mHz clock is produced by a voltage controlled multivibrator. This frequency is adjustable and is temperature compensated. Dither is applied to the clock frequency to reduce the radiated radio frequency interference at the clock frequency. The dither oscillator operates at approximately 13kHz and is not adjustable. The output of the dither oscillator is applied to the reference voltage input to the 12mHz clock oscillator. The clock reference voltage is varied at the 13kHz dither rate. This results in a 12mHz clock swing of $\pm 400\text{kHz}$. Thus the dithered clock varies from 11.6mHz to 12.4mHz at a 13kHz rate. The 12mHz clock is applied to the processor chip. $\Phi 1$ and $\Phi 2$ clock outputs from the processor chip are used to synchronize processor operation to the computer operation.

Initialization

The processor requires a power-up signal (PON) to tell it when to initialize. The computer requires an initialize signal (INIT).

When the computer is switched on, the PVAL signal from the power supply indicates that the +5 volt supply is present and sufficient time (80msec) has elapsed for the 12mHz clock to start. A processor state machine provides a synchronous power-up signal (PON) and the initialize signal (INIT) from the PVAL signal. This sequence assures that no power-up "glitches" will appear on the INIT signal and that any true PON or INIT signal will be at least 2 microseconds long. These glitches could activate peripherals and result in erratic operation. The start memory signal is inhibited to prevent unwanted memory cycles.

When the computer is reset (control-stop keys), a RESET signal is provided to the processor. The RESET signal is inhibited during a memory cycle so resident information will not be destroyed.

Address Extension

The processor's address extension provides memory block switching so that a much larger memory can be addressed. Block switching extends the address space of the 16-bit processor to an effective address of 22 bits (see Figure 2-3). To accomplish this, memory is divided into 64K-byte blocks. The 64K-bytes within a block are addressed by the lower 15 bits via the 16-bit IDA bus. The most significant bit of the 16-bit address is used to indicate the upper or lower block. The block that is actually addressed is selected by the 17-bit block select code given by the address extension.

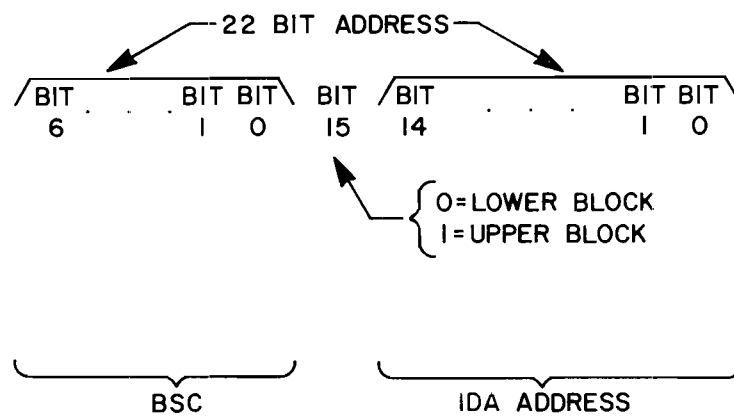


Figure 2-3. Address Extension

Here is a block diagram showing how the address extension interfaces to the processor.

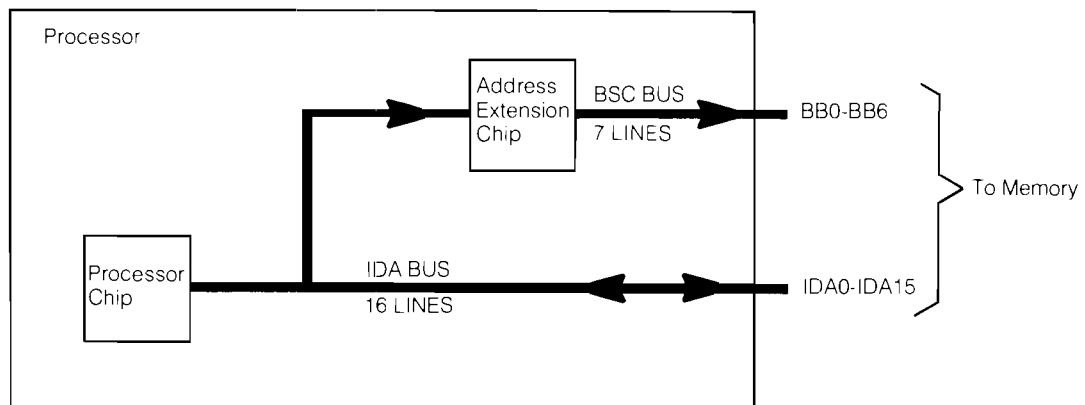


Figure 2-4. Address Extension Block Diagram

2-12 How To Fix It

Six registers in the address extension chip are manipulated by software and contain block select code information (BSC).

- R32 – contains BSC of current upper Data block
- R33 – contains BSC of current lower Inst. block
- R34 – contains BSC of current upper Inst. block
- R35 – contains BSC of current lower Data block
- R36 – contains BSC of current upper base page block
- R37 – current DMA block

The following flowchart briefly describes the conditions under which each register is used.

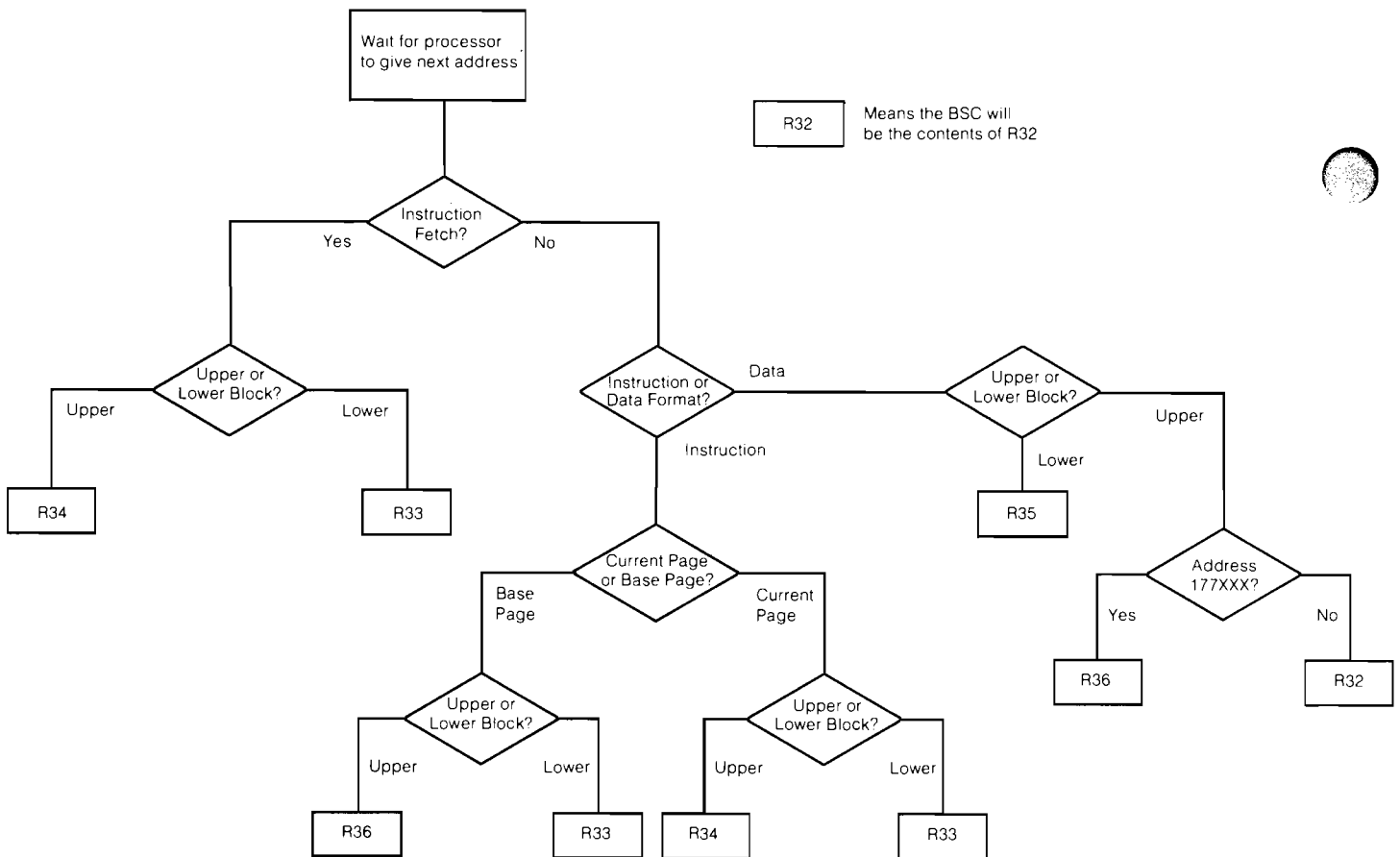


Figure 2-5. Block Select Flowchart

Memory Section

The memory section is made up of both ROM and read/write memory. Here is a list of the computer assemblies involved:

09835-66524(A24)	32K-byte read/write memory
09835-66525(A25)	64K-byte read/write memory
09835-66512(A12)	ROM Interface
09835-66513(A13)	System ROM drawer
5021-1403	Optional Plug-in ROM drawer

The A24 and A25 assemblies are exchange items; however, procedures are given to help isolate a faulty memory chip. The ROM interface and the various system and optional plug-in ROMs are to be replaced but not returned to the factory.

K0 Read/Write Memory Test

This test is run automatically in the turn-on mode. It can also be run separately in the test mode. This test is the short memory test.

The K0 read/write memory test tests all even blocks (read/write memory) in the computer starting at block 0. The test first checks for the presence of memory. If memory is found, the following is indicated.

```
RWM TST BL #XX ADR YYYYY - ZZZZ
```

- XX = The block select code in which memory was found.
- YYYYY = Lowest octal address in that block.
- ZZZZ = Highest octal address in that block.

After this message is indicated, the memory block is tested. It takes about 50 seconds for each 64K-byte block.

When all the even blocks are tested, END RWM TST is indicated.

2-14 How To Fix It

If an error occurs, the test indicates:

```
XXX RWM ERR ADR YY - ZZZZZ HAD QQQQQQ NOT RRRRRR
```

XXX identifies the particular memory test that failed. Here is a list of the codes and the corresponding test.

TRV - Trivial Data
RBT - Rotating Bit
MRC - Marching 1s and 0s
BYT - Byte
REF - Refresh
MAP - Mapping (blocks 0 and 1 only)
WKB - Walking Bit

YY = The block select code of the memory block in which the error occurred.
ZZZZZ = The octal address within that block.
QQQQQQ = The actual octal data at that address.
RRRRRR = The expected octal data.

If eight errors are detected in a single block, the testing of that block is terminated and the test proceeds with the next block.

Refer to the memory troubleshooting portion of this section to isolate a faulty memory chip.

K6 Read/Write Memory Exerciser

This test is the long read/write memory test (walking bit). It performs a more rigorous test than the K0 test previously described. This test requires considerable time; it takes 5 hours to test one 64K-byte block of memory. It is not necessary to press **[K0]**; simply press **[K6]**. The K6 exerciser can be used to perform extended memory testing to catch intermittent failures.

K2 ROM Test

This test computes checksums in every odd block of memory. A checksum is computed for every 4K-bytes of ROM. If the checksum is 0, the test concludes that there is no ROM in that particular address space and proceeds to the next. If the checksum is equal to -1 , the test computes the checksum for that address nine more times and then indicates:

XX - Y

XX = The block in which the ROM tested good

Y = The most significant octal digit of the starting address being tested (e.g., if Y = 2, address = 20000₈).

If an error occurs (checksum is other than 0 or -1), the test indicates:

ROM ERR XX - Y

XX = The block in which the ROM tested bad

Y = The most significant octal digit of the starting address being tested (e.g., if Y = 2, address = 20000).

The test then proceeds to the next address space.

9835 Power-On Memory Test

The 9835 has a built in memory test which is run automatically when the computer is switched on. This test determines how much read/write memory is available and tests the memory before the operating system is enabled. Here is a description of the test.

To determine the amount of memory in the current block, the number 177777₈ is stored in locations 70K, 60K, 50K, 40K, 30K, 20K, 10K and 0K of that block. If all zeros are returned from one of these locations, there is no memory there. If a pattern other than 177777₈ (all ones) is returned, a memory failure is reported. The amount of memory seen by the computer is the number of consecutive 8K-byte blocks that return 177777₈ (beginning from the top (70K) down).

When the size of the current block is known, that block is tested by writing the pattern 125252₈ into all locations followed by a 10 millisecond refresh test. Likewise, the pattern 052525₈ is tested. If a bad memory location is found, the lower 8K-bytes of the block are deleted and the test is repeated on the remaining memory until it passes or until there is no memory left in the block. The lowest 8K-byte portion of the block is deleted each time an error occurs. Thus the error or errors can be isolated.

2-16 How To Fix It

Memory failures are printed, or displayed if the printer is not operational. The printer must be installed to obtain the printed failure information. Memory failures are printed in the following format:

BB AAAAAA CCCCCC
BB = The block containing the failure
AAAAAA = The failing octal address
CCCCCC = The octal data in that address

Notice that there is nothing to compare the data against. If the data looks like the 177777_8 pattern with one or more bits wrong (e.g., 177577) and the octal address is an even 8K number (e.g., 60000) then the failure occurred when the memory size was being determined. If the data looks like the 125252_8 or the 052525_8 patterns with one or more bits wrong, then the memory failure occurred during the memory test.

Memory Troubleshooting

It is possible to isolate a defective RAM chip from the test ROM memory test printout or the power on memory test printout.

Generally multiple failures in these tests will indicate that the memory control logic is defective. Use these procedures to isolate a defective RAM.

Test ROM Memory Test Printouts

Sample error printout:

Block → Address Actual Octal Data Expected Octal Data
RWM ERR ADR 02 - 02052 HAD 000400 NOT 000000

1. The upper digit of the address indicates either the top or lower half of a block.
If the upper digit is 0 through 3, the lower half is indicated.
If the upper digit is 4 through 7, the top half is indicated.

2. Decode the data into binary values and compare the bits.

Actual Data — 000 000 000 100 000 000
Expected Data — 000 000 000 000 000 000

Bit 8 does not compare

3. The bits that do not compare indicate a defective RAM location. The following figure shows the RAM chips that correspond to each bit position.

Power On Memory Test Printouts

Sample error printout:

Block	Address	Octal Data
↘	⏟	⏟
00	60002	052725

1. The upper address digit indicates either the top or lower half of a block.
 If this digit is 0 through 3, the lower half is indicated.
 If the digit is 4 through 7, the top half is indicated.
2. Decode the data into its binary value.

Data — 000 101 010 111 010 101

3. Compare the data with the nearest pattern used by the test. The patterns used are:

177777₈

125252₈

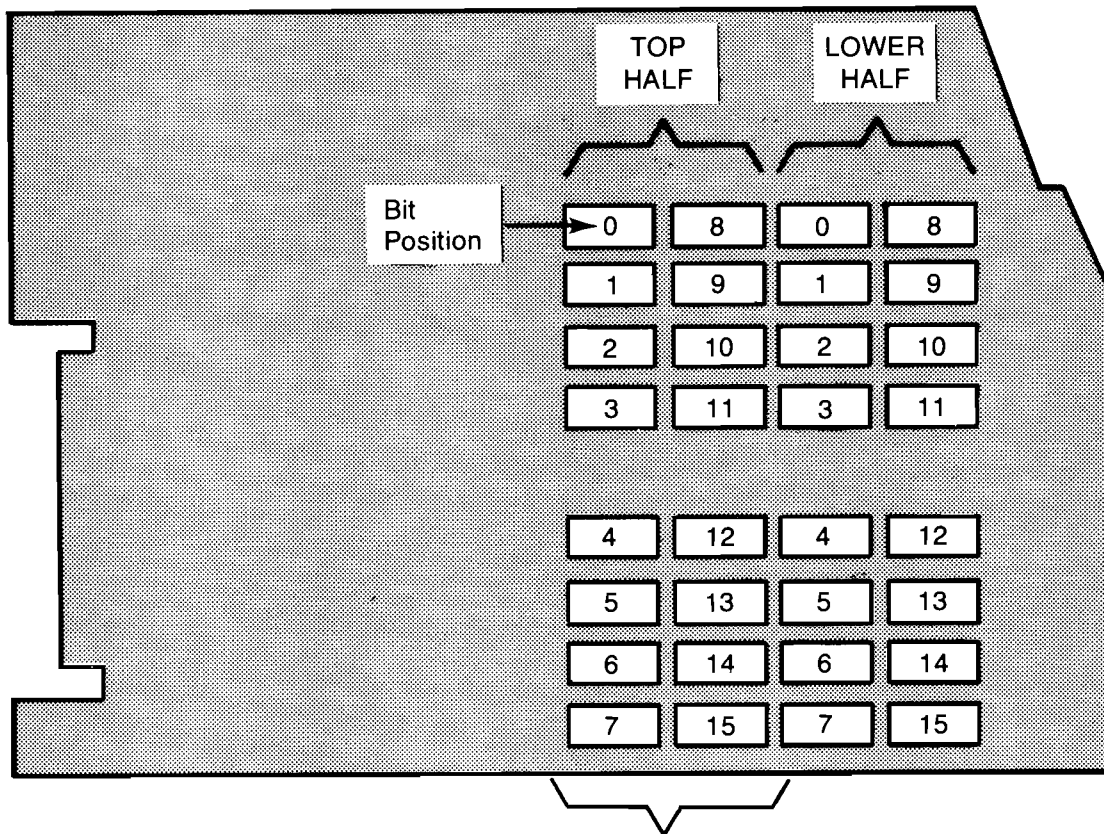
052525₈

Data — 000 101 010 111 010 101

Pattern — 000 101 010 101 010 101

↖ Bit 7 does not compare

4. The bits that do not compare indicate a defective RAM location. The following figure shows the RAM chips that correspond to each bit position.



NOTE

Only the top half chips are loaded on a 32K-byte assembly.

Read/Write Memory Operation

The A24 and A25 read/write memory assemblies contain address recognition, refresh timing, multiplexing and some of the system timing and interfacing needed to access the IDA bus. The A24 assembly has sixteen, 16K-word RAMS and the A25 assembly has thirty-two, 16K-word RAMS. Read/write memory occupies "even" memory blocks (see Figure 2-6). The memory assemblies are responsible for:

- Address recognition and decoding of block, row and column information.
- Return of the memory present portion of the memory handshake with the processor.
- Timing management during and after a memory access including memory refresh cycles.

There is room for four memory assemblies in the 9835. These spaces may be filled with any combination of 32K-byte or 64K-byte memory assemblies, or they may be empty. The computer functions in 64K-byte blocks. When a memory assembly is installed, its addressing should go into an unused portion of a presently used block or the next available block. Partial blocks should be at the end of the highest block. SW1 on the memory assembly designates the block selection. Refer to memory options in Chapter 1 for memory switch information. Refer to Figure 2-7 for the read/write memory block diagram.

Read Only Memory Operation

All the 9835 ROMs function on the same IDA bus (refer to Figure 2-8). A ROM will work anywhere it is plugged into the computer without distinction as to system language ROM or option ROM. The 9835 ROMs return a signal to the processor indicating that the address has been recognized and the ROM is activated.

The ROM interface assembly (A12) provides the ROM support logic. Three sets of buffers are used to isolate the ROMs from the IDA bus. One buffer serves option ROM slots 1 and 2, another serves option ROM slots 3 and 4, and the third buffer serves the system language ROM drawer. If a ROM doesn't work, move it to a different position and then move the drawer to a different slot to determine whether the ROM, the slot or the ROM interface assembly is bad. All ROMs occupy odd memory blocks (refer to Figure 2-6). Eight, 8K-byte ROMs make up a block.

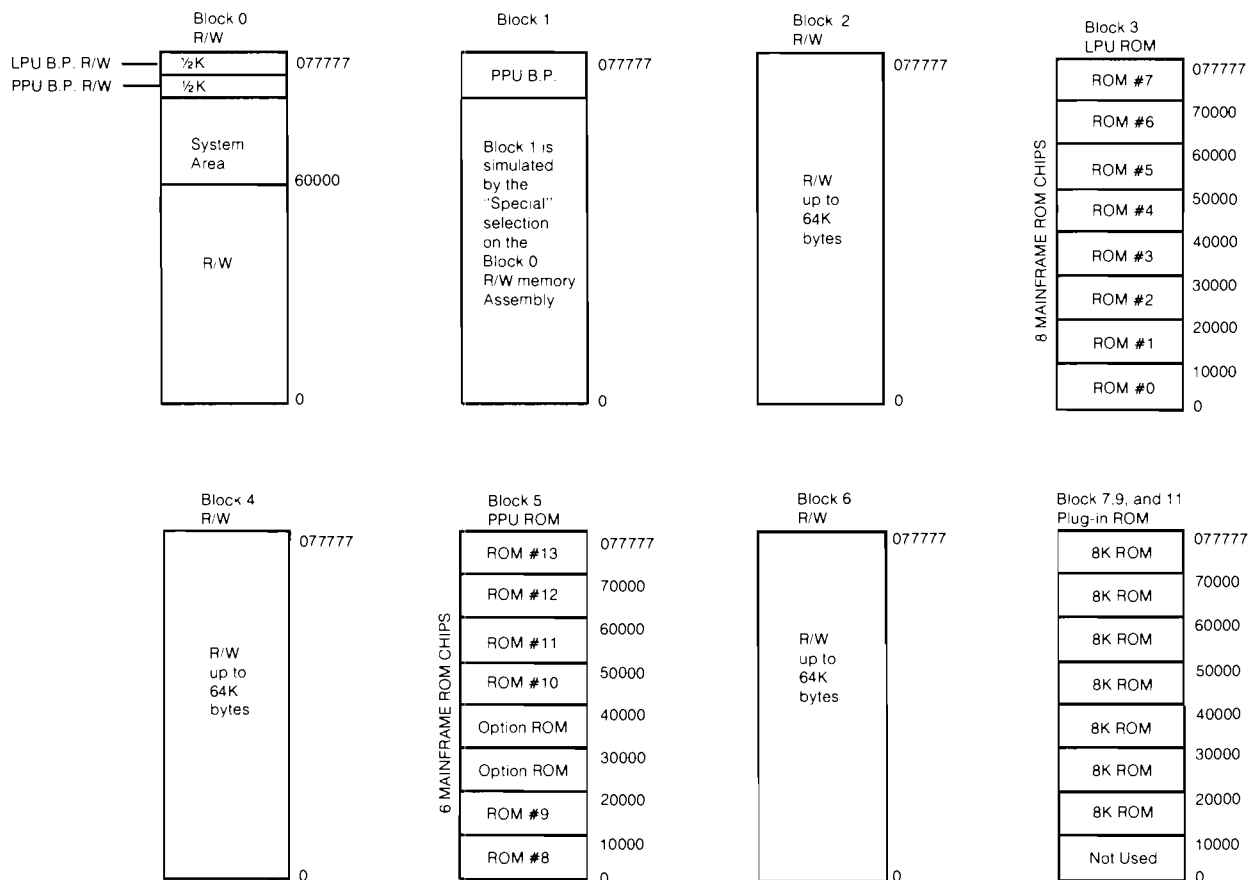


Figure 2-6. Memory Blocks

NOTE

System ROM number 8 (1818-2808) is present in the 9835A only. System ROM number 20 (1818-2820) is present in the 9835B only.

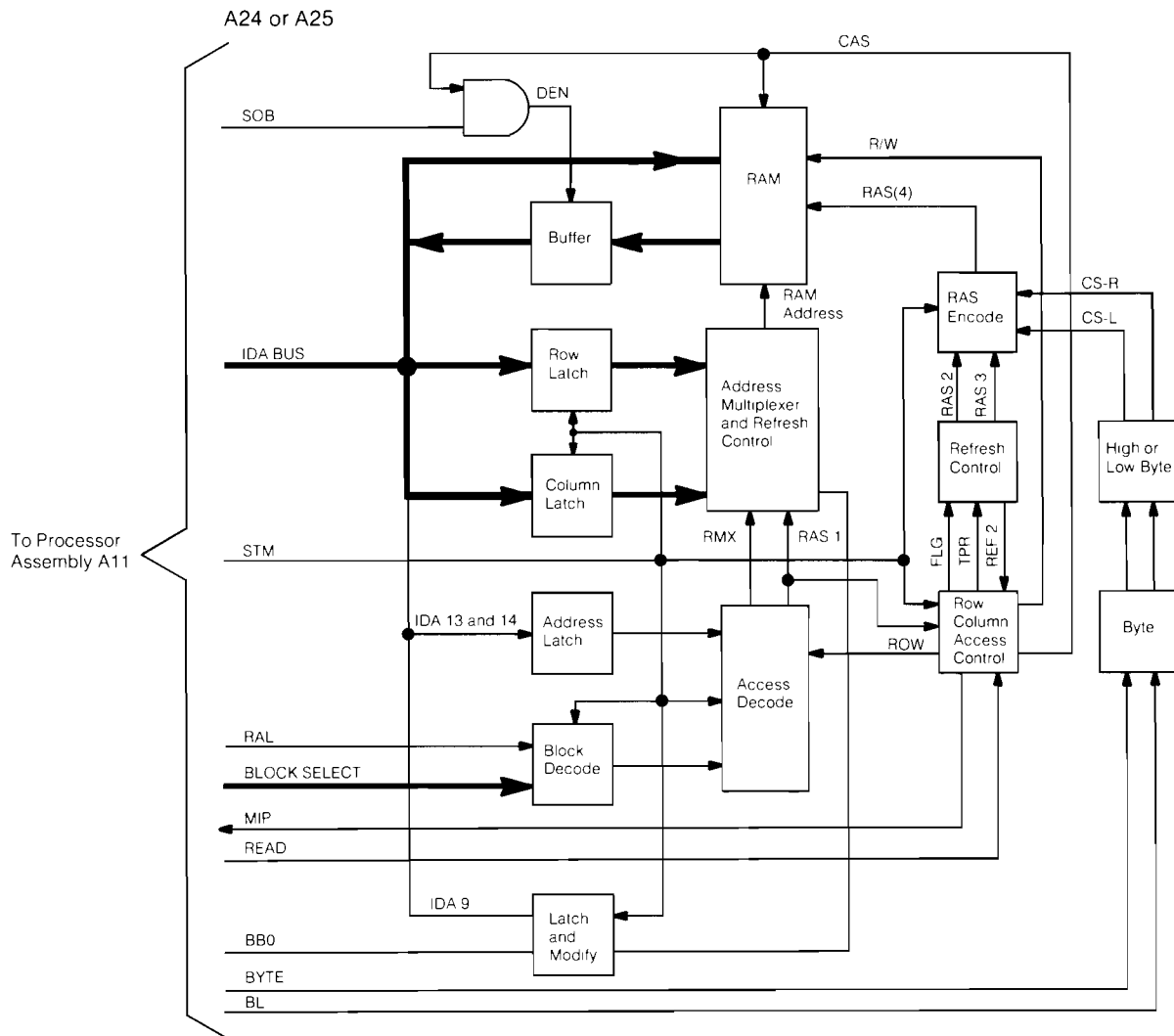


Figure 2-7. Read/Write Block Diagram

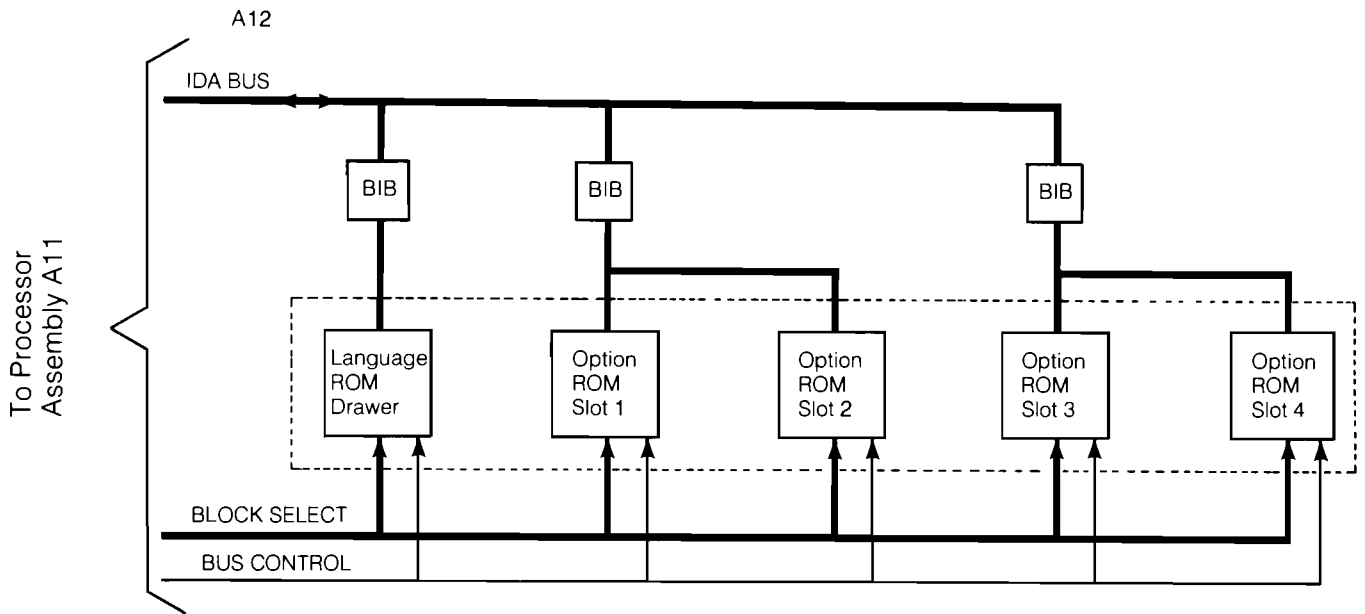


Figure 2-8. ROM Block Diagram



CRT Section

NOTE

The CRT assembly is part of the 9835A only. The 9835B does not have a CRT.

The CRT assemblies are listed below:

09835-66570(A70)	CRT Motherboard
09835-66571(A71)	CRT interface assembly
09835-66572(A72)	Control logic assembly
09835-66573(A73)	Display logic assembly
09835-66574(A74)	CRT analog assembly
09835-66575(A75)	High voltage assembly
09835-67971	CRT/yoke assembly

The A72 and A73 assemblies are exchange items. The other CRT assemblies are to be replaced but not returned to the factory.

When replacing the CRT/yoke assembly, the defective CRT should be disposed of in the shipping container in a safe manner.

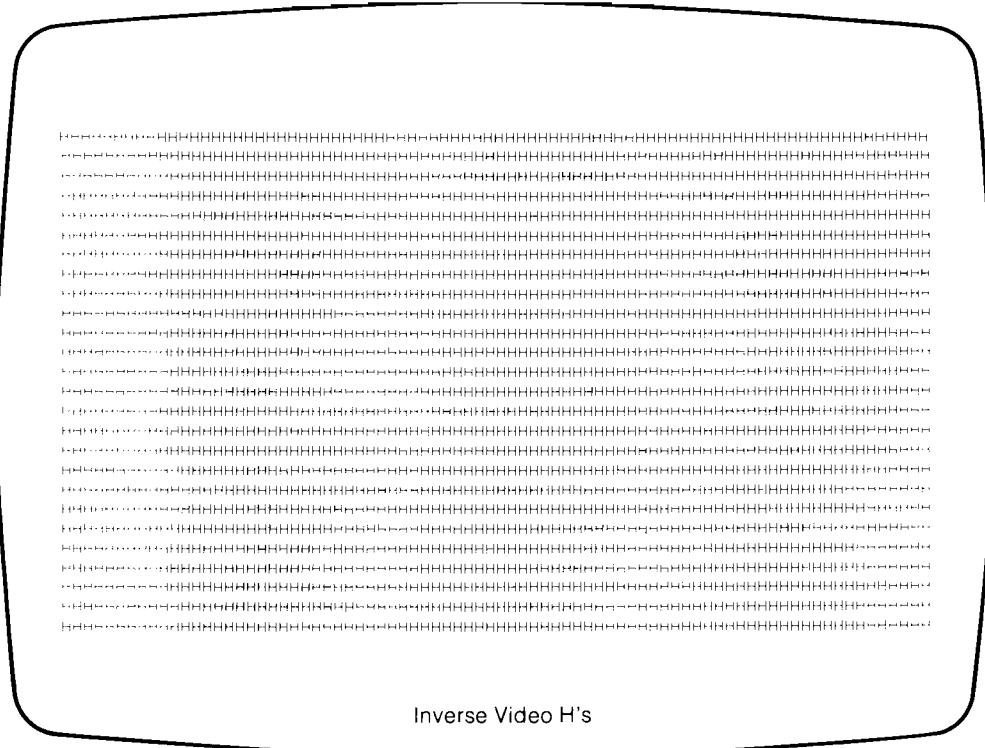
K3 CRT Test

CRT TST is indicated when this test is in progress. The test consists of four separate displays, each of which is displayed for about ten seconds. Each display can be held indefinitely by pressing **CONT**. Pressing **CONT** a second time advances the test to the next display. The four CRT test displays are shown in sequence below with a description of each display.

1. Full screen of inverse video Hs. Check that the characters are readable in all areas. Refer to the focus adjustment if adjustment is required.
2. Full screen inverse video. Check the pincushion and size. Check for missing dots or lines in the inverse video.
3. Six groups of characters, four rows in each group. The first group is the entire character set with no special features. The second group is the optional character set shown twice. If the plotter graphics ROM is not installed, this group is solid inverse video.

The last four groups contain the CRT character set shown twice with a different special feature for each group. Group three shows the cursor, group four shows inverse video, group five shows blinking and group six shows underlining.

4. Raster alignment pattern; check linearity size and position with this pattern. Use the alignment mask and refer to the raster size adjustment.



NOTE

Allow a 15 minute warmup before aligning the CRT raster.

NOTE

Apparent CRT problems can be caused by the processor clock frequency being out of specifications.

CRT Self Test Switches

The CRT self test switches can help you quickly isolate a problem to either the CRT assembly or the mainframe assembly. The switches are accessed from the CRT rear panel (see Figure 2-10).

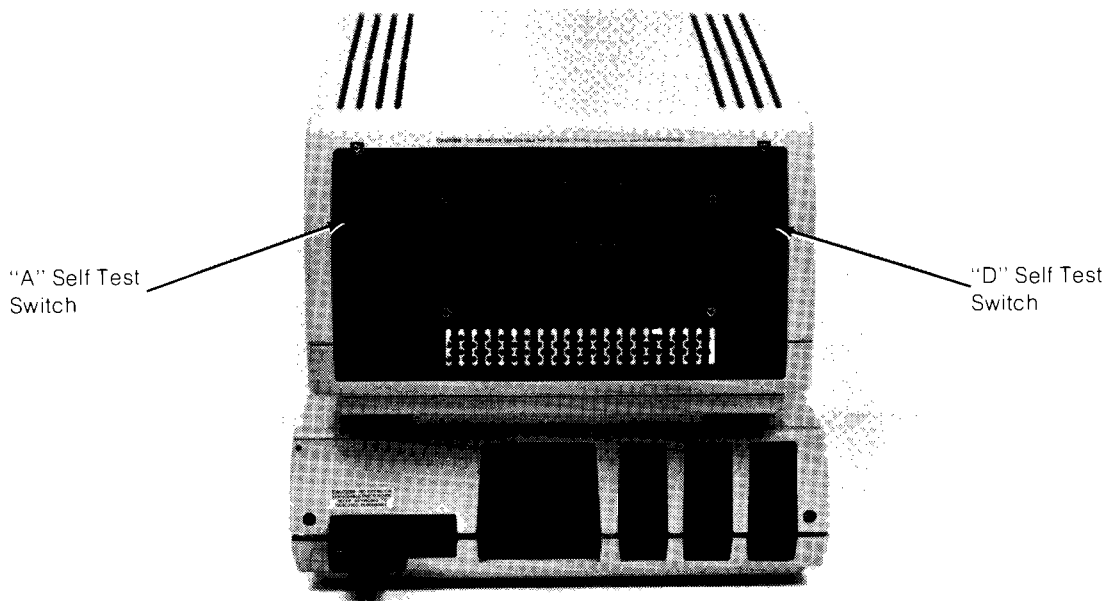


Figure 2-10. CRT Self Test Switches

Normally, pressing the A self test switch results in an inverse video raster. This checks about 80% of the CRT assembly operation and the operation of the +5V, -12V and -20V RAW power supplies.

- If the inverse video appears, the problem is likely to be found in the mainframe.
- If the inverse video does not appear, the problem is likely to be found in the A73, A74, A75 or CRT/yoke assemblies in the CRT assembly or the power supplies (listed above) that feed the CRT assembly.

Normally, pressing the D self test switch results in the CRT character set being displayed.

This test checks the operation of the A72 assembly as well as the assemblies and power supply voltages confirmed by the A self test switch. Thus, using the two switches you can check about 90% of the CRT electronics.

CRT Raster Size

The raster size should be checked whenever one of the CRT section assemblies has been changed. To adjust the raster, use this procedure.

- Install the CRT alignment mask on the face of the CRT.
- Remove the CRT top cover.
- Press the A self test switch on the A73 assembly, shown in Figure 2-10, to display the raster in inverse video.
- Use the width and height controls on the A74 assembly (see Figure 3-2) to align the edges of the inverse video to the raster outline on the CRT alignment mask.

WARNING

HIGH VOLTAGE IS PRESENT IN THE HIGH VOLTAGE CAGE. USE AN INSULATED TOOL SUCH AS A SOLDERING AID OR PLASTIC ALIGNMENT TOOL TO MOVE THE TABS.

If the entire raster is not centered in the raster outline or if the raster is skewed in the raster outline, it may be necessary to reposition the centering magnet tabs located at the rear of the CRT yoke (see Figure 2-12). Figure 2-13 gives an example of improper centering magnet tab positioning.

- Remove the high voltage cage cover to access the tabs and move as necessary.

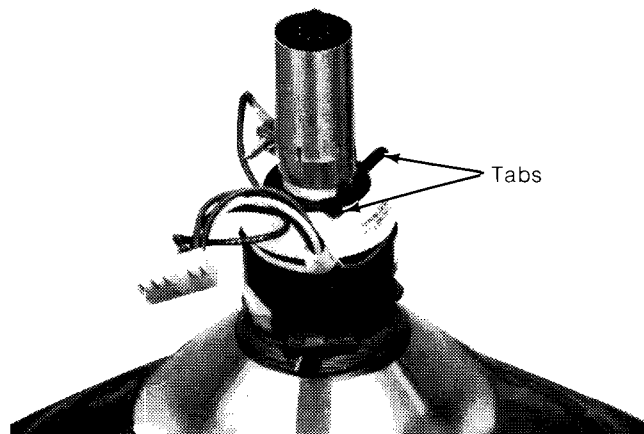


Figure 2-12. Centering Magnet Tabs

If the edges of the raster are not straight (i.e., the edges bow in or out in reference to the raster outline on the mask) the yoke's "pincushion" alignment is improper. Major pincushion problems cannot be aligned in the field. Figure 2-13 gives an example of bad pincushion alignment. The centering magnet tabs effect the pincushion alignment somewhat. Its a good idea to try to correct for minor improper pincushion alignment with the centering tabs first before replacing the CRT/yoke assembly. If this problem occurs, the CRT/yoke assembly should be changed.

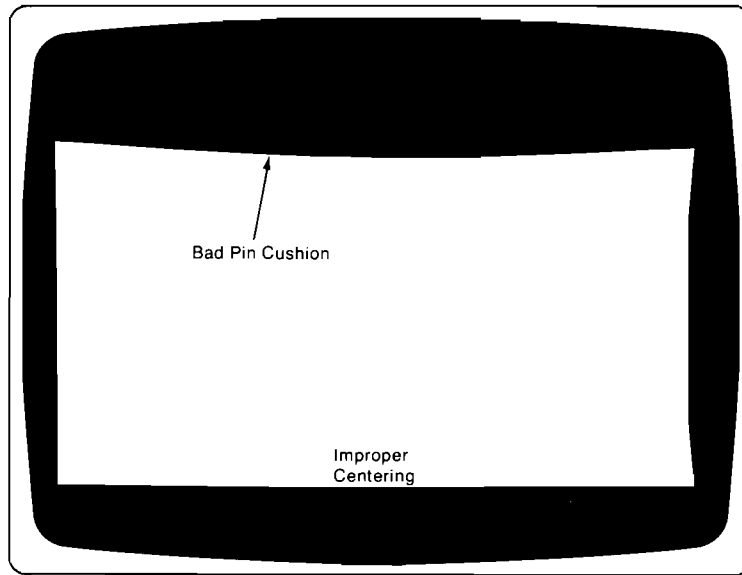


Figure 2-13. Improper Tab Positioning

- Reassemble the computer after the raster is aligned.

CRT Display Focus

The focus should be checked whenever the A75 or the CRT/yoke assembly has been changed.

The focus control is located on the A75 assembly inside the high voltage cage. Remove the CRT top cover and the high voltage cage cover to access the A75 assembly (see Figure 3-2).

Display a full raster pattern of characters; either the test ROM CRT test or the D self-test switch provides these patterns. Adjust the focus control to sharpen the appearance of the displayed characters. It may not be possible to focus all areas of the display at a particular control setting; in this case, the focus control should be set at the point that gives the best overall display appearance.

CRT Intensity

The intensity should be checked whenever the A75 or the CRT/yoke assembly has been changed.

The intensity control is located on the A75 assembly inside the high voltage cage. Remove the CRT top cover and the high voltage cage cover to access the A75 assembly (see Figure 3-2).

To adjust the CRT intensity, use the following procedure.

1. Advance the A75 intensity control and the operator's intensity control on the lower right corner of the CRT bezel to maximum intensity.
2. With both controls at maximum settings, horizontal retraces should appear on the CRT. Adjust the A75 intensity control until the retraces are no longer visible.
3. Press the A self test switch and notice the intensity of the full raster display.
4. Use the A75 intensity control to reduce this intensity by approximately $\frac{1}{2}$. This control setting is between $\frac{1}{8}$ and $\frac{1}{4}$ of a turn less on the A75 intensity control.
5. Adjust the operator's intensity control for the desired intensity.
6. Reassemble the computer.

CRT Display Circuits

The display circuits are contained on a CRT control logic assembly, a CRT display logic assembly and the CRT monitor itself. The display is a 12 inch magnetic deflection CRT using a raster scan. Up to 24 lines of 80 characters can be displayed at one time from a standard 128 character ASCII character set. Other character sets can be added. Information can be highlighted by inverse video, underlining and blinking.

CRT Interface

The CRT circuits interface directly to the IDA memory bus via the CRT interface assembly (A71). The interface connections to the mainframe are located in the mainframe in front of the I/O backplane assembly. Power for the CRT is also brought from the power supply through the CRT interface.

The CRT accesses addresses 60000_8 to 77777_8 of Block 0 read/write memory for data to be displayed. This space is more than enough to store one full display with a different feature for each character. Blanks to the right of displayed information are not stored in memory.

CRT Display Operation

The following presentation describes the theory of operation of the various CRT assemblies. Refer to the CRT block diagram (Figure 2-14) when reading this presentation.

Control Logic Assembly (A72)

The control logic assembly reads memory, processes the data and decodes it to a form that the CRT can use. Each byte from memory represents a combination of features, an ASCII character or a control code. As each memory byte is processed, the data is placed into a 12-bit word. The first 8 bits contain the character code for the displayed character and the last 4 bits indicate if any highlighting features should be applied to the character.

Display Logic Assembly (A73)

The display logic assembly generates all the necessary timing signals required to display the data received from the control logic assembly. The display logic provides three signals to the CRT, they are:

HS1	Horizontal sync 1 is the signal that starts horizontal retrace.
VR	Vertical reset is the signal that resets the vertical ramp generator
V1	Video information is transferred on this line to the video amplifier.

The display logic receives the full line buffer (FLB) control signal from the control logic.

The display logic sends three signals to the control logic; new page (NP), new line (NL) and new word (NW).

CRT Display (A74,A75)

The CRT display circuits contain the horizontal, vertical and video driver circuits.

The video driver is basically an inverting level shifter which provides the large voltage swings (23 volts peak to peak) required at the cathode of the CRT to turn the electron beam on and off.

Video data comes from the display logic (V1 signal). The intensity adjustment controls the output of the intensity supply. The output of the intensity supply and the video data are applied to the video driver and then to the CRT.

The horizontal driver provides a modified ramp waveform to the horizontal deflection yoke to sweep the CRT electron beam in horizontal scan lines. Input to the horizontal driver is the HS1 line. The horizontal size control circuit controls the yoke current and thus the horizontal width.

Retrace generates a high voltage pulse (approximately 300 volts) which is used as the input voltage for the high voltage flyback transformer. The high voltages used to operate the CRT are derived from this transformer.

They are:

+12Kv	anode voltage
+400v	first accelerator grid
0 to 400v	variable for focus grid
-15 to -85v	variable for control grid

The vertical drive provides current to the vertical yoke to scan the display from top to bottom. The VR signal is used to synchronize the vertical retrace. The vertical ramp generator supplies a linear ramp voltage. The slope of this ramp is determined by the vertical size control.

The vertical drive amplifier uses the ramp voltage as a reference and uses feedback to control the current through the vertical yoke. The vertical yoke current is sensed in the vertical linearity correction circuit. The corrected output signal is compared to the ramp voltage at the input of the drive amplifier to modify the ramp voltage.

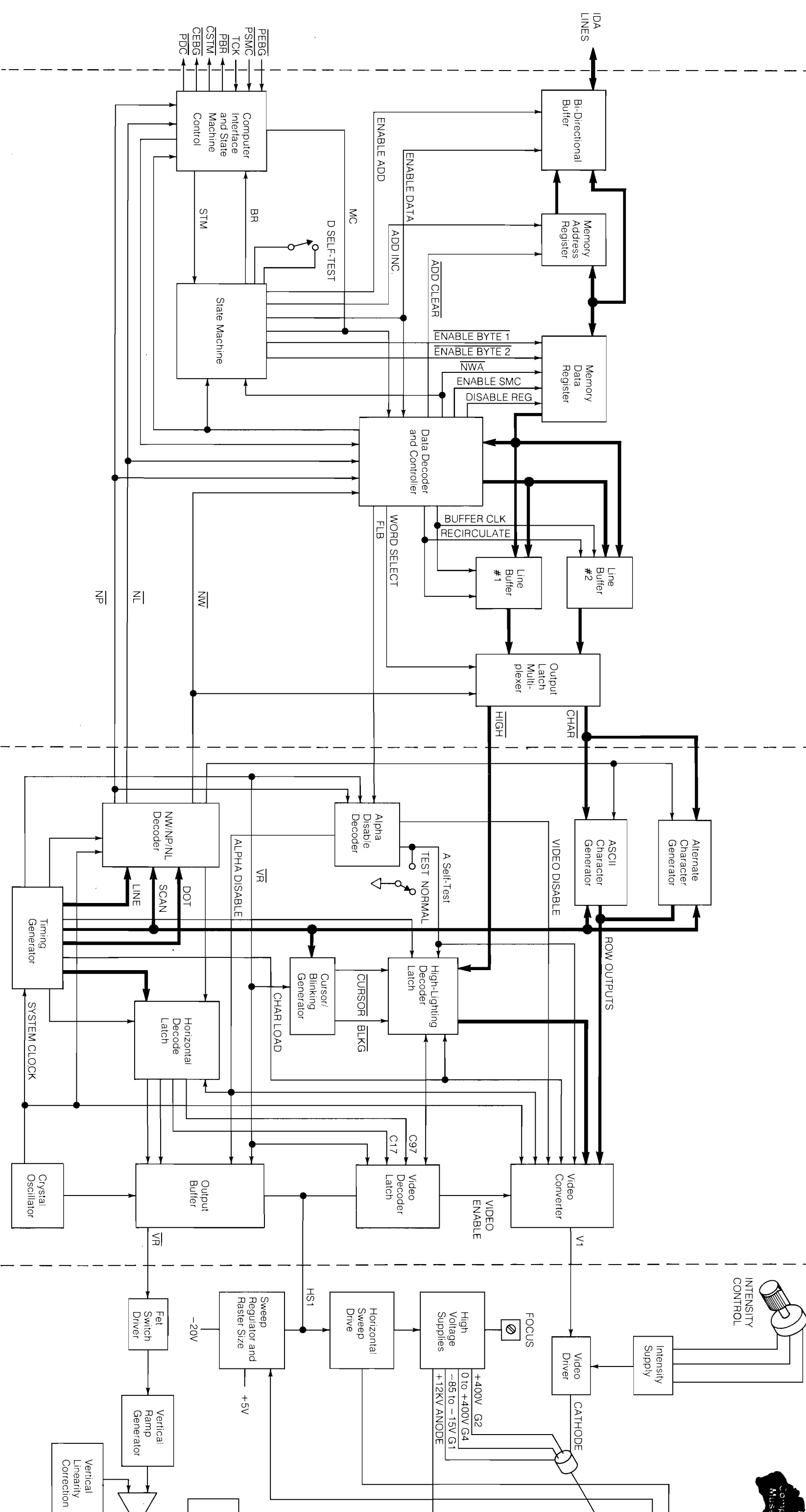


Figure 2-14. CRT Block Diagram

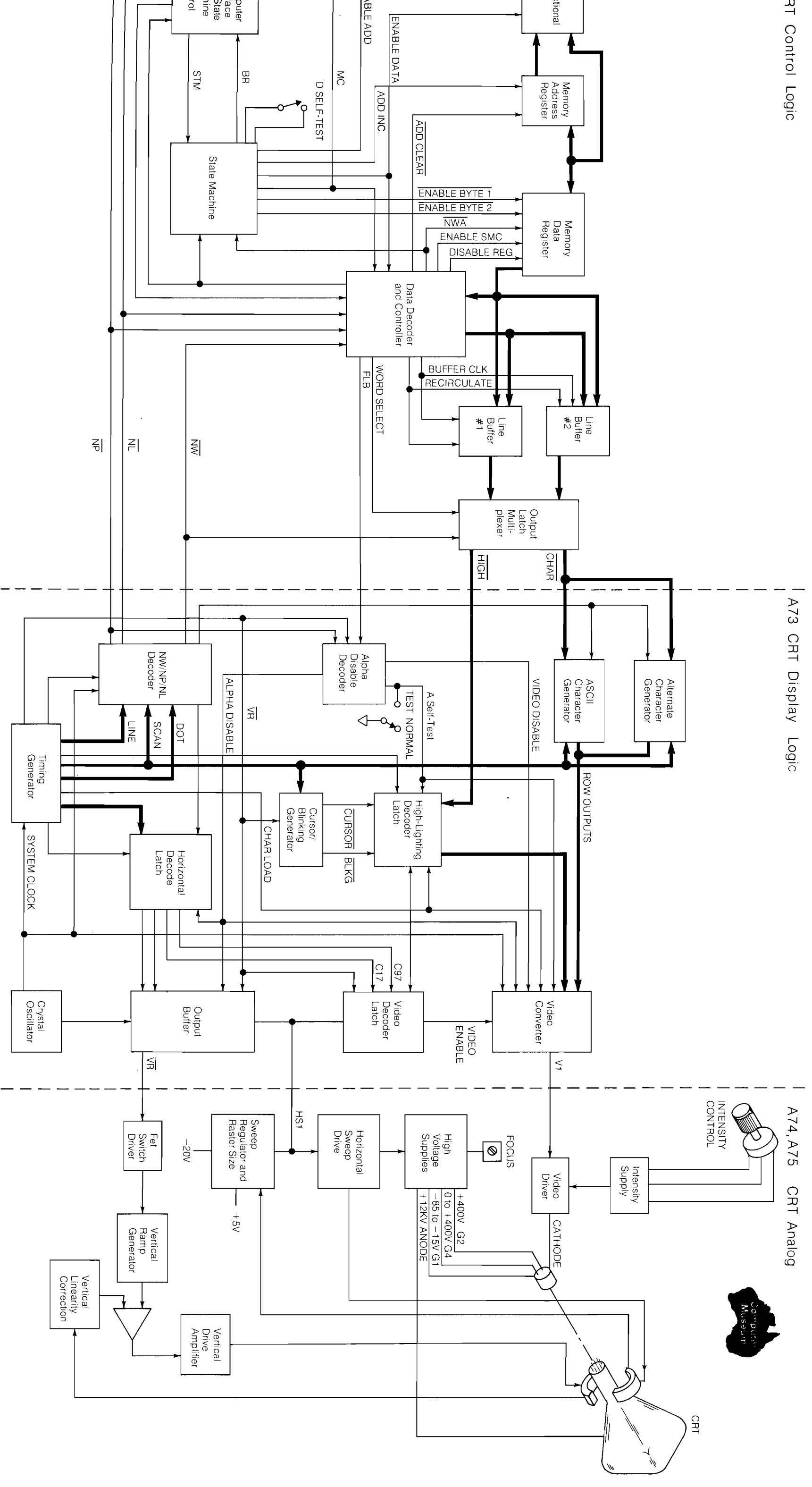


Figure 2-14. CRT Block Diagram

Internal I/O Section

The internal I/O section is made up of the following assemblies:

09835-66536(A36 or A37)	Internal I/O control assembly
09835-68001	Keyboard (9835A)
09835-68002	Keyboard (9835B)
09825-66541	LED display (9835B only)
09835-67940	Thermal printer
5061-3002	Cartridge drive

All these assemblies make up the keyboard bezel assembly.

The cartridge drive and the 9835B LED display assembly are exchange items. The thermal printer is component repairable. The keyboard switch assembly is to be exchanged but not returned to the factory.

The internal I/O assembly tests and adjustments are described in the following order.

- Keyboard
- LED display
- Thermal printer
- Cartridge drive

Keyboard Test

To test the keyboard, use the keyboard test on the System Test Cartridge.

Use this test to check that all the keyswitches are functioning. After the program is loaded, the computer indicates which key to press and in what order. Figure 2-15 shows the test sequence. Press each key in sequence. If the wrong key is pressed or if a key is defective, the computer beeps.

To skip a bad key, press **CONT'L** (+). When the keyboard test sequence has been completed, the computer indicates **PRESS CNTRL** and the test can be started again.

NOTE

The shift lock key should be on while the fifth row of keys is being tested.

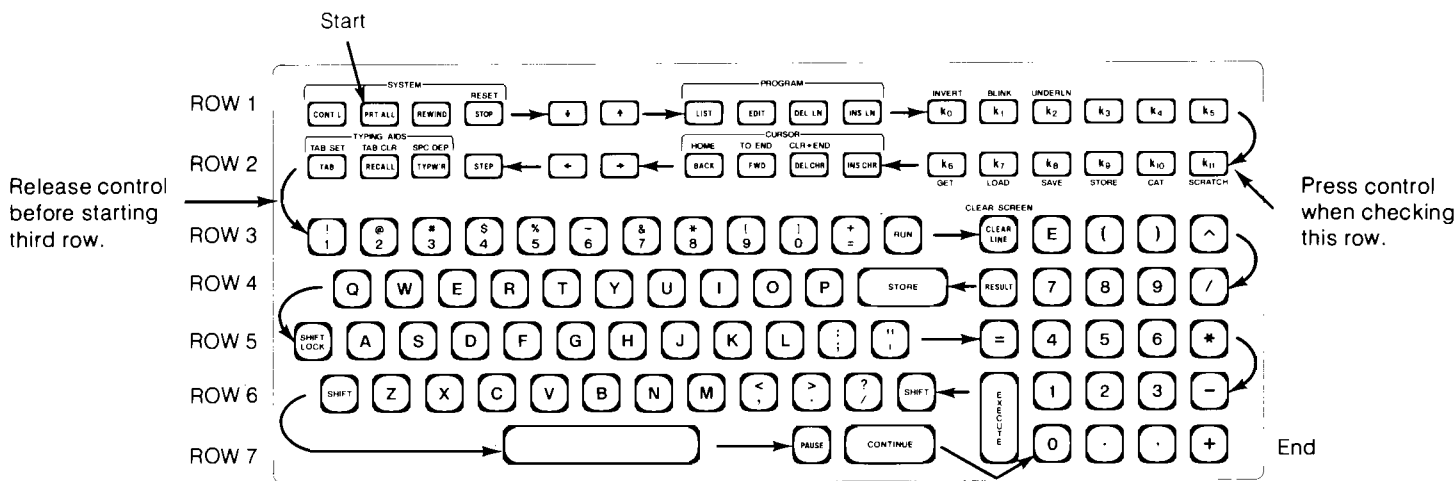


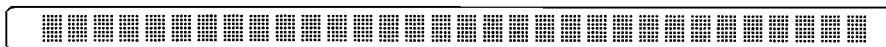
Figure 2-15. Keyboard Test Sequence

K4 Display Test (9835B Only)

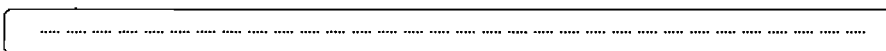
This test checks the computer's character set and the LED display. DSP TST is indicated when this test is in progress. The test displays six groups of 32 characters. The six groups are shown in the proper sequence below.

Any group can be displayed indefinitely by pressing **CONT**. Press **CONT** again to advance the display to the next group. Here are some things to check during the display test.

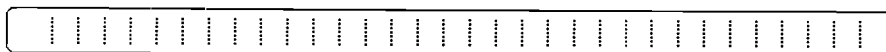
Group 1 lights up all the display dots. Check that all the dots are lit. This display can cause thermal overload if displayed continuously for more than 5 minutes.



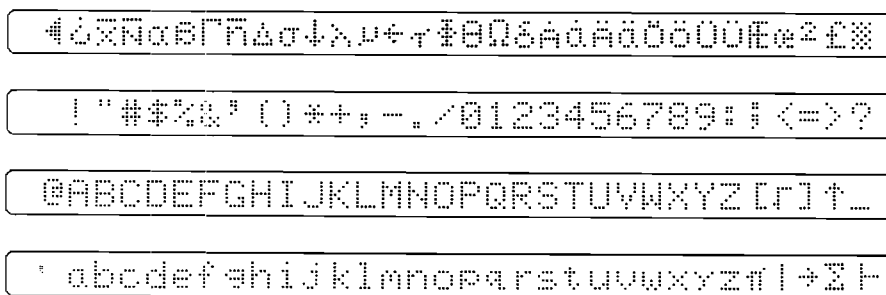
Group 2 displays dashes. The change in height between characters should be less than one-half the height of one row of dots. Check that only one dot in each column is lit.



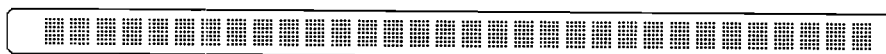
Group 3 displays vertical lines. Only one dot should be lit in each row.



Group 4 displays the character set (32 characters at a time). Verify that the characters are correct.

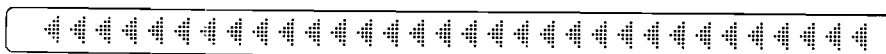


Group 5 displays the blinking full cursor.



Blinking

Group 6 displays the blinking half cursor.



Blinking

Figure 2-16. Display Test Sequence

K5 Printer Test

The computer indicates PRT TST when this test is in progress. Press **[K5]**; the printout results with the standard (Option 800) character set is shown below.

```

#&~NαβΓñΔσ↓λμ+τ‡θΩ&ÁáĀāĈĉŒœ²£¤
θΩ&ÁáĀāĈĉŒœ²£¤
!"#$%&'()*+,-./0123456789:;[<=>?
@ABCDEFGHIJKLMNO
PQRSTUVWXYZ [r] ↑_
' abcdefghijklmno
pqrstuvwxyz [r] →Σƒ
    
```

Figure 2-17. Printer Test Results

When the computer indicates REMOVE PRT PAPER, remove the paper from the printer and the print head. If the paper out switch is functioning, the computer indicates INSERT PRT PAPER. Replace the printer paper and press **[CONT]**.

Printer Adjustments

Printer Intensity

The printer intensity should be adjusted to produce clear and crisp printed characters. The intensity adjust is located on the A36 assembly as shown in Figure 2-18.

The following program will print characters that can be used as a test pattern while making this adjustment.

```
10: PRINT "ZZZZZZZZZZZZZZZZZZ"  
20: GO TO 10  
30: END
```

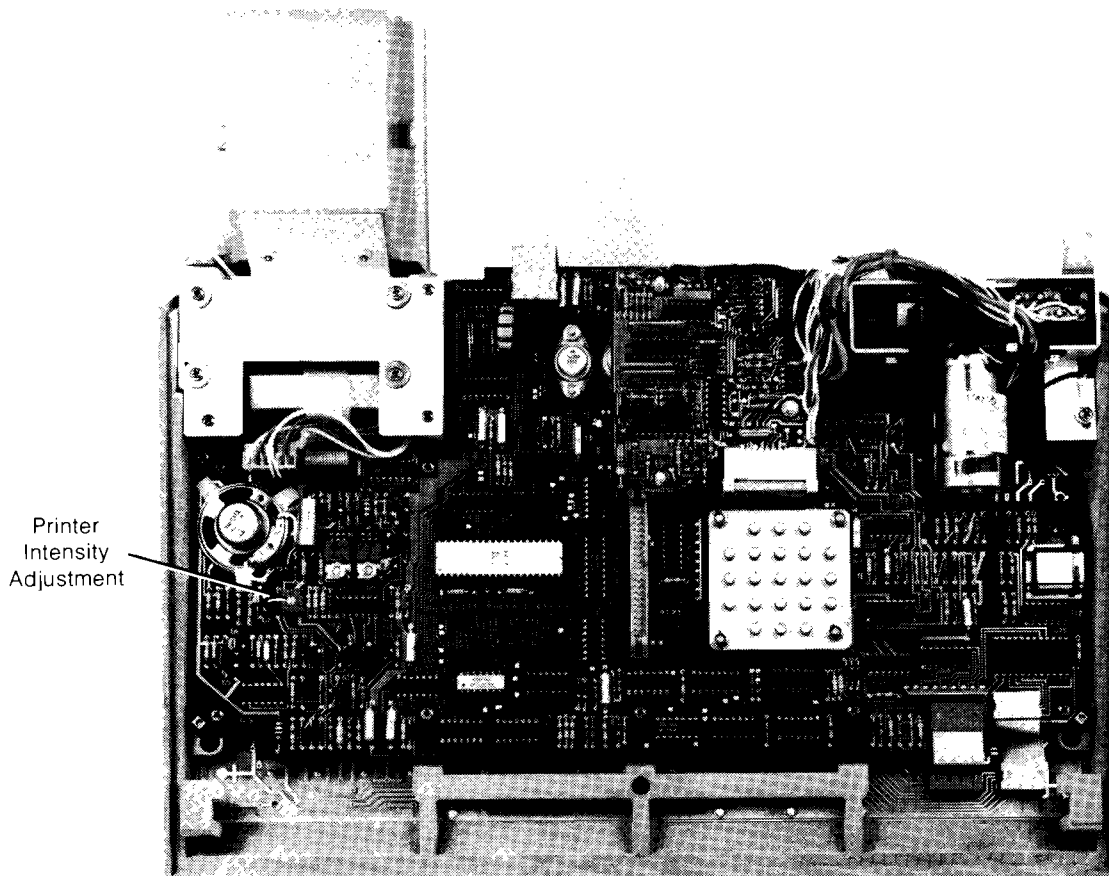


Figure 2-18. Printer Intensity Adjustment

Print Head Alignment

The uniformity of the character intensity is a function of the print head alignment.

To make this adjustment, the printer must be removed from the bezel; refer to Chapter 3. Using the Print Head Alignment Fixture (98240-67901) supplied in the product support package, set up the printer as shown in Figure 2-19.

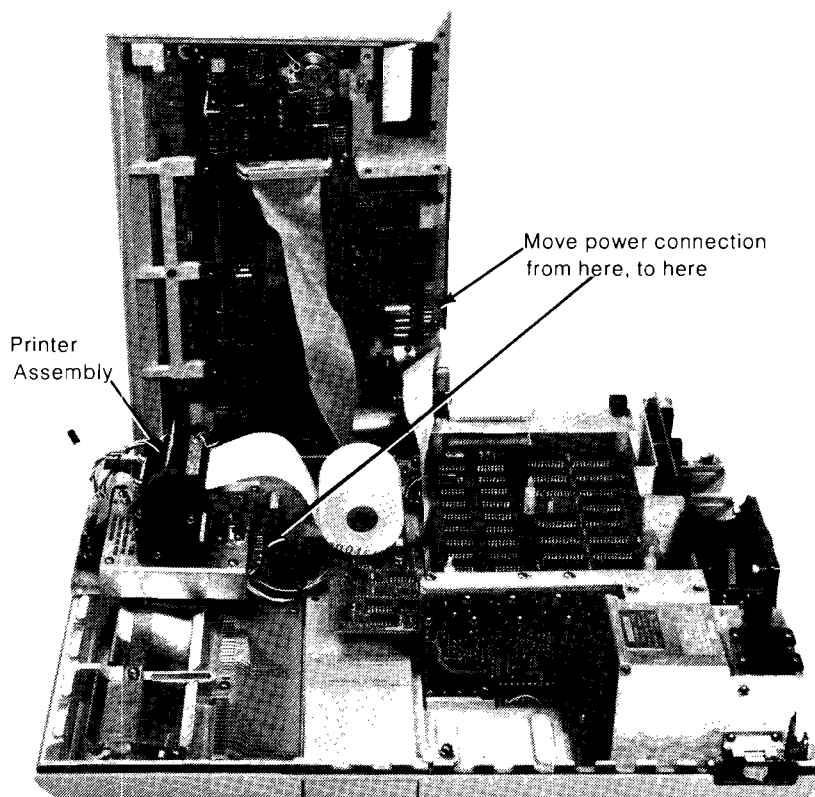


Figure 2-19. Print Head Alignment Set Up

NOTE

Print head alignment should be done with the print intensity adjustment on the alignment fixture set to minimum intensity (see Figure 2-21).

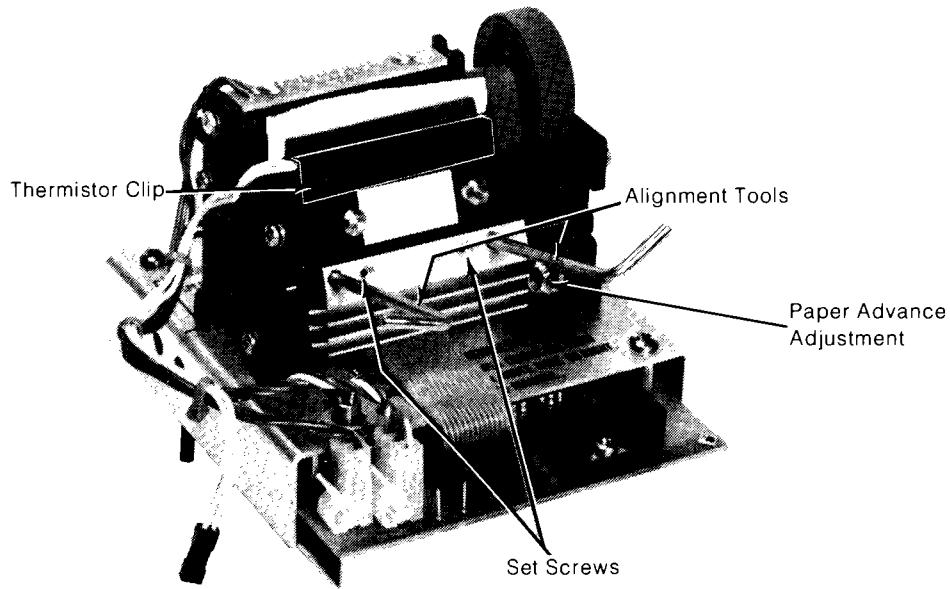


Figure 2-20. Print Head Alignment

Loosen the two allen setscrews (Refer to Figure 2-20) enough to move the print head slightly. Place the alignment fixture print switch to the ON position. Rotate the adjustment tools (8710-0693) to move the print head to obtain the best print quality. Make sure that the thermistor clip is not binding; this could make adjustment impossible.

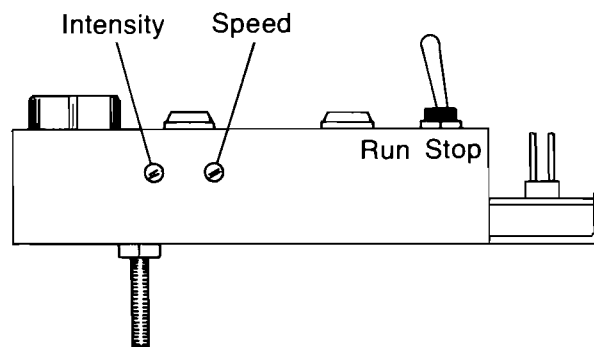


Figure 2-21. Alignment Fixture Adjustments

When the print head is properly aligned, tighten the two allen setscrews snugly, but do not overtighten.

CAUTION

DO NOT OVERTIGHTEN THE PRINT HEAD SETSCREWS. EXCESSIVE TIGHTENING MAY WARP THE ALUMINUM HEAT SINK CAUSING IT TO BIND ON ITS PIVOT.

Paper Advance Adjustment

The paper advance adjustment is set at the factory and normally does not require adjusting. Adjustment is made only if the character height is greater than normal. If necessary, here is the procedure:

- Loosen the lock nut on the advance adjustment screw (see Figure 2-20).
- While the print test is running, turn the adjustment screw clockwise until the printer stops advancing paper.
- Slowly turn the adjustment screw counter-clockwise until the printer just begins to advance without missing line spaces (normal character height).
- Continue to turn the screw another 3/4 turn counter-clockwise and tighten the lock nut without altering the setting.
- Seal the adjustment screw with a drop of glue or paint.

K1 Cartridge Drive Test

This test checks the cartridge drive electronics and hardware. Use a known good, initialized cartridge with no valuable information on it. Press **[K1]**; the test first checks that the flag line is clear; then it checks that data can be written to and read from registers 4 and 6 in the cartridge drive controller.

The computer indicates `INSERT CART (WPR ON)`. Insert a write protected cartridge into the drive and press **[CONT]**.

The computer indicates `REMOVE CART`. Remove the cartridge from the drive and press **[CONT]**.

The computer indicates `INSERT CART (WPR OFF)`. Insert an initialized, unprotected cartridge and press **[CONT]**.

The computer indicates `CART TEST` and the cartridge read/write test begins. The cartridge test takes about 90 seconds and checks:

2-40 How To Fix It

- That data can be written and then read at high (verify) and low signal thresholds.
- That gaps can be counted at high and low speeds.
- That the hole detect circuit is working.

If an error occurs during the test, the computer will indicate:

XXX CART ERR REC YYY

YYY = The record in which the error occurred.

XXX = The failure mode.

Here is a list of the failure modes (XXX above).

BCS	Record body checksum error
HCS	Head checksum error
RNF	Record not found
VFY	Verify
COT	Cartridge out
WPR	Write protect
HOL	Hole
SVF	Servo fail
BLT	Blank tape
REG	Data error
CSM	Checksum register error
NRF	Incorrect tape format
HNC	Hardware not connected (flag high)

All errors except the first four listed above will terminate the test if they occur.

Eight errors involving either BCS, HCS, RNF or VFY will be allowed before the test is terminated.

END CART TST is indicated when the test is completed.

K7 Cartridge Drive Exerciser

Pressing K7 performs the cartridge test segment of the K1 cartridge drive test (described above) continuously. Press **STOP** to exit this test.

K9 Cartridge Troubleshooting

This test provides continuous signals to aid in troubleshooting the cartridge drive. This test is normally used only at the factory. Press **K9**; the following keys are used in this test.

- REWIND** Rewinds the tape.
- W Writes data on the selected track.
- R Reads data on the selected track at the selected threshold level
- A Selects track A (this is the default track)
- B Selects track B.
- H Sets the high read threshold
- L Sets the low read threshold

K8 I/O Test

This test checks that data can be read from and written to I/O test interface modules, and that the majority of the DMA circuit is functioning. One to three 98032A interfaces with test connectors are required to run this test. The interface select codes must be set to 5, 7 and 10. The test first checks for the presence of each interface and indicates **I/O TST SC X**, where X is the select code of the interface being tested. When the test is completed, **END I/O TST** is indicated. If an error occurs, **YYY I/O ERR SC X** is indicated.

YYY = The failure mode.

X = The select code.

Here is a list of the failure modes (YYY).

- R4 Data error in reading or writing register 4
- R5 Data error in reading or writing register 5
- R6 Data error in reading or writing register 6
- STS Status line stuck high
- DMA DMA transfer error
- INT Interrupt never occurred to signify end of DMA transfer

When an error occurs, the test waits until **CONT** is pressed. Press **STOP** to enter the test mode.

Internal I/O Operation

The A36 or A37 assembly controls all internal I/O operations. It interfaces the power supplies and the IOD bus to the various internal peripherals on the keyboard bezel (see Figure 2-23). The keyboard, display and printer controller (KDP) controls all the functions of the keyboard, display and printer. An optional KDP controller can be added to the A36 or A37 assembly to provide added characters for the LED display and printer. Internal I/O operations are performed via the KDP control registers, R4, R5, R6 and R7. Here is a summary of the registers and the functions each register performs.

- | | |
|----------|---|
| Read R4 | <p>Reads the keyboard keycode</p> <p>Bit 7 = Shift</p> <p>Bits 6 thru 0 = Keyboard scan counter</p> |
| Write R4 | <p>Writes in LED display</p> <p>Bit 7 = Cursor</p> <p>Bits 6 thru 0 = Character code</p> |
| Read R5 | <p>Reads KDP status</p> <p>Bit 4 = Keyboard key is down</p> <p>Bit 3 = Control key is up</p> <p>Bit 2 = Printer is busy</p> <p>Bit 1 = Printer is out of paper</p> <p>Bit 0 = LED display is not installed</p> |
| Write R5 | <p>Write operation control</p> <p>Bits 6 and 5 = Full or half cursor for display</p> <p>Bits 4 and 3 = Busy LED off or on</p> <p>Bit 2 = Beeper pulse</p> <p>Bit 1 = Start display</p> <p>Bit 0 = Start printer</p> |

Read R6 Not used

Write R6 Prints characters

Bits 6 thru 0 = character code

Read R7 Not used

Write R7 Selects main or optional KDP controller

Keyboard Operation

Inside the KDP controller is a 7-bit counter which is used to generate the keyboard scan code. If the scan code generated by the counter matches the code of a key that is pressed the following occurs:

- The key down status from R5 is read by the KDP controller. If “key down” is true, the scan counter is not incremented.
- After a 20 millisecond debounce delay, if the key is still down, the KDP requests an interrupt.
- The processor does an interrupt poll and on an R4 read, the scan counter value, which has been locked, is placed on the IOD bus.
- If the key is still down after .7 seconds, the KDP controller interrupts at a rate of 11 per second as long as the key is held down (the repeat feature).

When the key is released, the scan counter begins to increment again. The counter increments every 85 microseconds.

The shift, shift-lock and control keys are not part of the scanned keyboard section. These keys are detected by the KDP controller through the R4 and R6 registers.

The control key together with the stop key (part of the scanned keyboard) generate the reset signal. This is done independently of any scan count.

Display Operation

The 9835B LED display contains eight, 4 character LED chips. The KDP controller can display up to thirty-two characters at a time. The KDP controller contains a circular read/write memory of thirty-two locations (seven bits wide) to store display information. Each character is a 5x7 dot matrix. The dot patterns for each character are contained in a 128x35 ROM which is part of the KDP controller. This ROM is shared by the display and the printer. When the start display command is given, the KDP controller looks up the 7 bit-column dot pattern from the character ROM according to the character code in the first read/write location. This dot pattern is then shifted to the display shift register.

The next column dot pattern is then found and shifted to the display shift register, and so on until the dot patterns for every character in the display memory have been shifted into the display shift register. Then the first column of every character is displayed for 1.36 milliseconds. This occurs for the other four columns, sequentially, to display all the character columns. The display refresh rate is 128 displays per second.

Printer Operation

The thermal printer can print up to sixteen, 5x7 dot-matrix characters per line. The KDP controller contains a serial read/write memory of sixteen locations (seven bits wide) that holds the characters to be printed. The dot pattern information for each character is contained in the 128x35 ROM built into the KDP controller.

The print cycle starts when R5 bit 0 is a logic 1. The printer control advances the paper one dot row. Then the dot patterns for the top row of the first, fifth, ninth and thirteenth characters are shifted into the printhead (every fourth character). A burn is enabled and the patterns are burned onto the paper for 5.46 milliseconds. Then every fourth character beginning with the second character is shifted in and burned, and so on until the top dot row of all the characters are burned. The dots are allowed to cool for 2 milliseconds and then the paper is advanced to the next dot row. Then the next dot row is burned, and so on until all seven character rows are burned. After the characters are completed, the printer advances two more dot rows, leaving a three dot row space between character rows. One full print cycle requires 333 milliseconds.

Beeper Operation

The KDP controller provides a .67 microsecond pulse to trigger a burst of pulses from the beeper circuit. These pulses are amplified and applied to the speaker.

Tape Cartridge Drive Operation

The tape cartridge drive controller on the A36 or A37 assembly performs numerous operations. Here is a list of the major functions:

- Controls the drive motor (fast, slow, forward, reverse, stop).
- Controls tape acceleration and deceleration.
- Reads data from and writes data on tape.

- Double buffering of data words.
- Precompensates bits when writing.
- Synchronizes the bit pattern read from tape.
- Calculates a checksum during a read or a write.
- Writes gaps and counts gaps on tape.

Refer to the tape cartridge drive block diagram Figure 2-22.

A large scale integrated circuit acts as a cartridge drive controller and interfaces the rest of the cartridge drive circuits to the computer processor. Cartridge drive instructions and data from the processor are input to the cartridge drive controller via the IOD bus. Data read from tape and status information are sent to the processor from the cartridge drive controller.

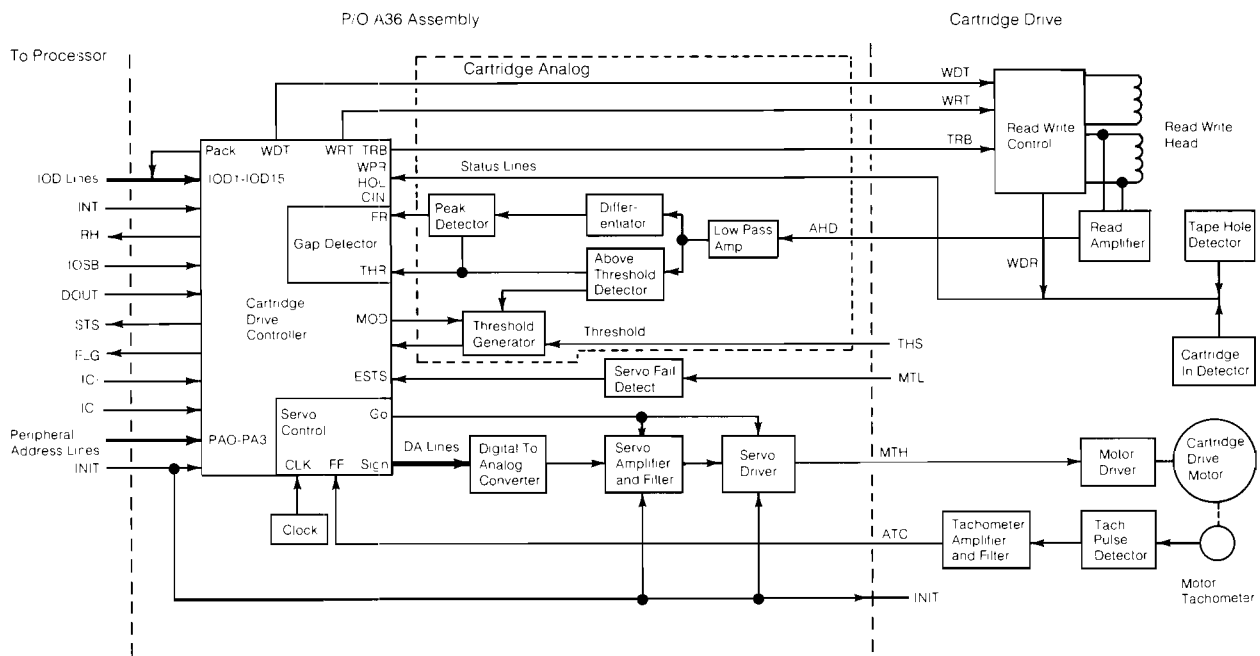


Figure 2-22. Tape Cartridge Drive Block Diagram

Magnetic Recording

Information is stored on the tape by causing the magnetic alignment of the tape surface to change direction at specified points along the tape.

Changes in magnetic alignment are called "flux reversals". The cartridge drive uses a differential distance coding scheme to distinguish one bits from zero bits. A one bit is nominally 1.75 times the length of a zero bit, where the length of a bit is the distance between flux reversals. A threshold value to distinguish one bits from zero bits is set at 1.33 times the nominal length of a zero.

Because of the high bit density written on the tape (up to 1600 flux reversals per inch), the bit lengths approach the size of the magnetic head gap. Thus when reading, the flux lines of the bits on either side of the current bit influence the apparent length of that bit.

This bit interaction is compensated for during the write operation by lengthening or shortening (precompensation) bits from their nominal length according to the current bit and the bits on either side of it. Precompensation therefore compensates for bit interaction encountered by the magnetic head during a read.

Read reliability is also increased by constantly updating the threshold value based on the bit length of the bits currently being read. This also allows tracking of tape speed variations.

Servo Control

Controlled tape acceleration and deceleration occurs from 2 inches/second to 90 inches/second at a rate of 1200 inches/second per second. The frequency feedback signal (FF) controls the servo. There are 968 pulses from the tachometer for every 1 inch of tape. At slow tape speed FF equals 21276Hz (21.98 inches/second) and at fast speed FF equals 87196Hz (90.08 inches/second). The GO signal is used to clamp the servo drivers when the tape is stopped. When the tape has decelerated to 2 inches/second, GO will stop the tape completely. The tape remains stopped until another tape movement instruction is given.

The SIGN and DA0 through DA4 signals provide sign and speed error magnitude signals to the motor drivers.

When either the INIT or GO signals are low, the drive circuits are turned off. This eliminates tape creeping during power-on, power-off or when the tape is supposed to stop.

When writing data, the read/write control circuits isolate the read circuit from the magnetic head, and the WDT signal changes the direction of the current to write the data.

Data read from tape is amplified and applied to a low pass amplifier which provides signal gain and reduces high frequency noise. The threshold detector detects signals from the head that are greater than the threshold set by the cartridge drive controller. The differentiator differentiates the magnetic head signal to detect the peak of the signal. The threshold detector enables a zero-crossing detector to determine the exact point of flux reversal.

Phototransistor detectors are used to sense tape holes (HOL), write protect (WPR) and tachometer pulses. A switch is used to determine if a cartridge is installed (CIN).

Power Supply Section

The power supply consists of the following assemblies:

09835-67904	Power Module Assembly
09835-66551(A51)	Power Supply Assembly

The A51 assembly is an exchange item. The power module is component repairable. There are no test ROM tests for the power supply.

Power Supply Operation

Refer to the power supply schematic diagram in the Replaceable Parts chapter when reading this description.

Power Module (09835-67904)

The power module, located in the right rear corner of the base, contains the ac power input filter, fuse, power on switch, line voltage selector switches and the power transformer. The ac output of the power module is applied to the A51 assembly.

Power Supply Assembly (A51)

The A51 assembly located next to the power module generates the seven power supply voltages and the power valid signal (PVAL).

The +20 volt and -20 volt supplies are unregulated and filtered only by C1, C2 and C3. These voltages are used by the cartridge drive, CRT, printer and are also the source of power for the regulated supplies.

The +12V supply functions as a non-inverting amplifier which amplifies a zener reference voltage. The U5 internal reference zener diode provides a +7.15V reference for the operational amplifier (U5). The output of the amplifier is determined by the voltage at the wiper arm of the output voltage adjust, R22 and the actual 12 volt value. The range of this adjustment on the output voltage is typically $\pm .5$ volts from nominal. R28 (in conjunction with U5) provides current limiting for Q2. CR9 provides overvoltage protection for the +12 volt supply if the U5 operational amplifier fails or if the wiper on R22 opens. The +12V supply provides the reference voltage for the +5 volt supply. Any changes or adjustments of the +12 volt supply effects the +5 volt supply.

The source for the -12 volt supply is the -20 volt unregulated supply. U2 is self-contained 12 volt regulator.

The source for the +7 volt supply is the +12 volt regulated supply. U3 is a self-contained regulator for the +7 volt supply. C17 prevents oscillation of the regulator.

The +5V power supply utilizes a switching regulator to provide maximum output current with minimum heat dissipation by the series pass transistor. Since Q1 draws current only when saturated, power dissipation in Q1 is minimized. A +5V reference is established on the amplifier non-inverting input (pin 3) by voltage divider R10 and R12. When the supply output is less than the reference voltage, U4 switches Q1 on. The +20V Q1 collector voltage, divided by R14 and R11, establishes a higher reference voltage. When the supply output increases to the higher reference voltage, U4 switches Q1 off and the previous reference decreases to the level originally established by R10 and R12. Q1 is switched on when the voltage output is again equal to the reference voltage. The Q1 output is a 20V square wave, which is filtered by L3 and C10. The output of the filter (+5V) is the average value of the Q1 collector signal. CR7 provides a continuous path for inductor (L2) current when Q1 is off. L2 isolates the capacitance of C10 from external filter capacitance. Q6 and CR8 form a “dead short” protection circuit which will shut down the +5 volt supply (when the +12 volt supply is OK) if its value is +3.8 volts or less.

CAUTION

THE +5V POWER SUPPLY IS NOT CURRENT LIMITED. A FAILURE WHICH RESULTS IN EXCESSIVE +5V CURRENT MAY CAUSE DAMAGE TO THE INSTRUMENT.

The source for the -5 volt supply is the -12 volt supply. CR10 and R31 establishes the -5 volt supply.

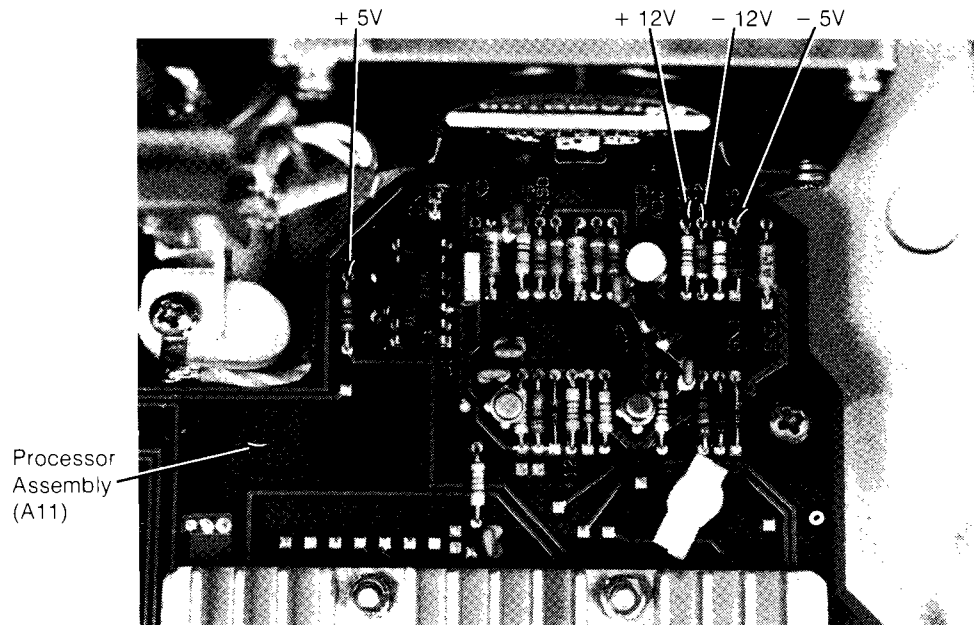
The power valid circuit is made up of U1 and its associated components. This circuit ensures that the -12 volt supply becomes valid before the +12 volt supply. The outputs of U1 pin 1 and U1 pin 2 are high if the +5 volt supply is within its specification (+4.75 to +5.25 volts). This high output begins to charge C4. At this time, the PVAL signal is low. 80 milliseconds after the +5 volt supply is within its specifications, C4 will have enough charge to enable the PVAL signal to go high. The PVAL signal is delayed to allow the processor clock to stabilize before starting any processor operations.

Table 2-2. Power Supply Specifications

Voltage	Voltage Tolerance		Maximum Current	Ripple and Noise	Used By
	Lower	Upper			
+20V RAW	+17V	+24.5V	3A	6V	Cartridge Drive, Printer
+12V	+11.95V	+12.05V	2.6A	.2V	ROM, R/W Memory, I/O, Cartridge Drive, CRT
+7V	+6.8V	+7.2V	.5A	.2V	ROM
+5V	+4.85V	+5.15V	6A	.2A	ROM, R/W Memory, I/O, Print Head, LED Display, Keyboard, Cartridge Drive, CRT
-5V	-5.25V	-4.75V	.02A	.1V	ROM, Internal I/O
-12V	-12.4V	-11.6V	.45A	.2V	R/W Memory, I/O, Cartridge Drive
-20V RAW	-25.5V	-17V	3A	6V	Printer, Cartridge Drive, CRT

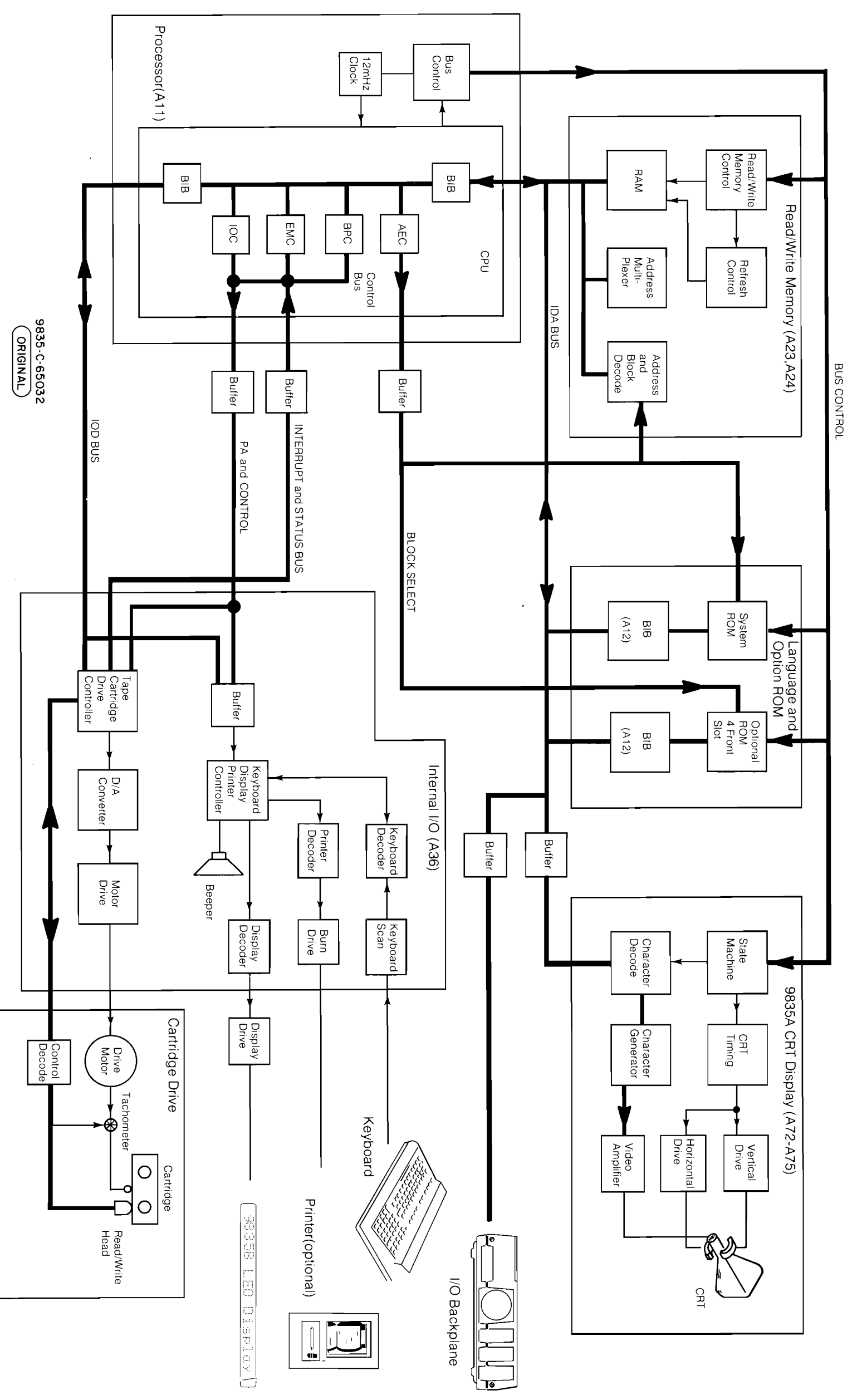
Power Supply Adjustment

The +12V power supply can be adjusted if necessary by R22 on the A51 assembly (see the A51 component locator). The hinged stack has to be swung out to access the adjustment. Since the +5V supply receives its power from the +12V supply, both supplies will be affected when adjusting R22. Check both the +12V and +5V outputs after adjusting R22.



Power Supply Test Points
on the A11 Assembly

Figure 2-24. Power Supply Test Points



9835-C-65032
ORIGINAL

Figure 2-25. 9835 Block Diagram

Chapter 3

Assembly Access

Introduction

This chapter describes how to access the various 9835A/B assemblies.

The following procedures are intended to help you disassemble the computer to access its assemblies. The following tools are required to disassemble the computer.

- #1 Pozi-drive screwdriver
- #2 Pozi-drive screwdriver
- Flat-blade screwdriver
- Needle nose pliers
- Set of Allen wrenches

WARNING

REMOVE ANY AC POWER FROM THE COMPUTER BEFORE REMOVING ANY ASSEMBLY.

CRT Assembly Removal (9835A Only)

NOTE

If you have a 9835B, please skip the CRT Removal section.

The CRT assembly must be removed before the mainframe top cover (shell) or keyboard (bezel) can be removed. To remove the CRT assembly, lean the CRT assembly forward as shown in Figure 3-1 and disconnect the cable connecting CRT assembly to the mainframe. Then lift the CRT assembly up and off the mainframe.

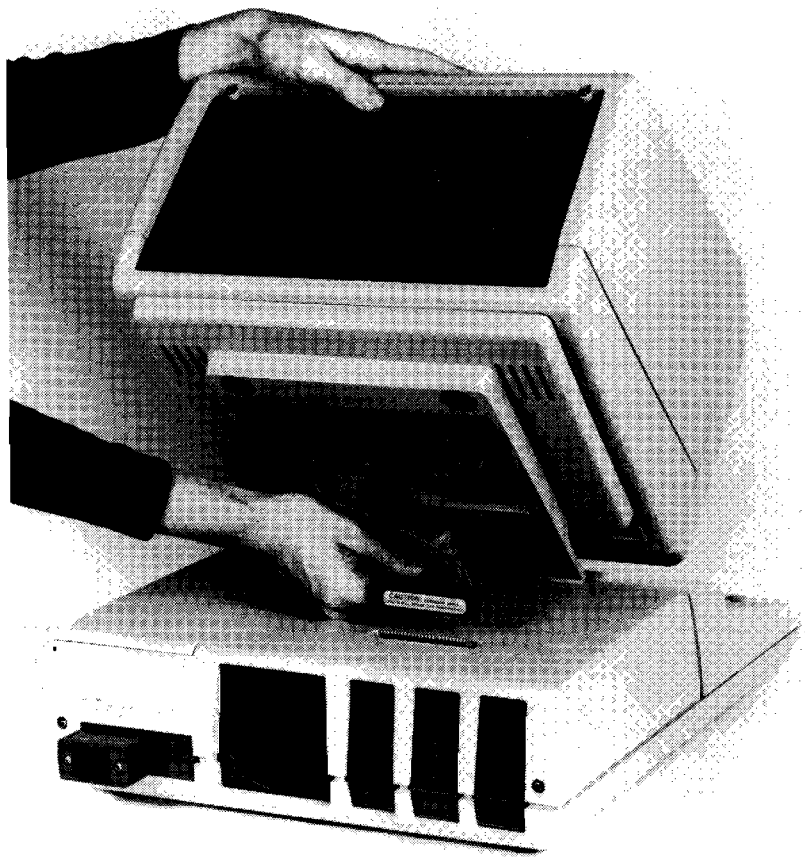


Figure 3-1. Removing the CRT Assembly

CRT Subassemblies

WARNING

WHEN THE CRT TOP COVER IS REMOVED, ALWAYS WEAR SAFETY GLASSES AND ENSURE THAT OTHER PEOPLE IN THE AREA WILL NOT BE EXPOSED TO AN ACCIDENTAL CRT IMPLOSION.

To access the CRT subassemblies, first remove the CRT top cover by removing the screws on the upper left and right corners of the CRT rear panel. Remove the PC assembly holders and the high voltage cover. Figure 3-2 shows the CRT subassemblies.

NOTE

Remove any optional plug-in character ROM before exchanging the A73 assembly. Replacement A73 assemblies are shipped from the factory without the ROM installed.

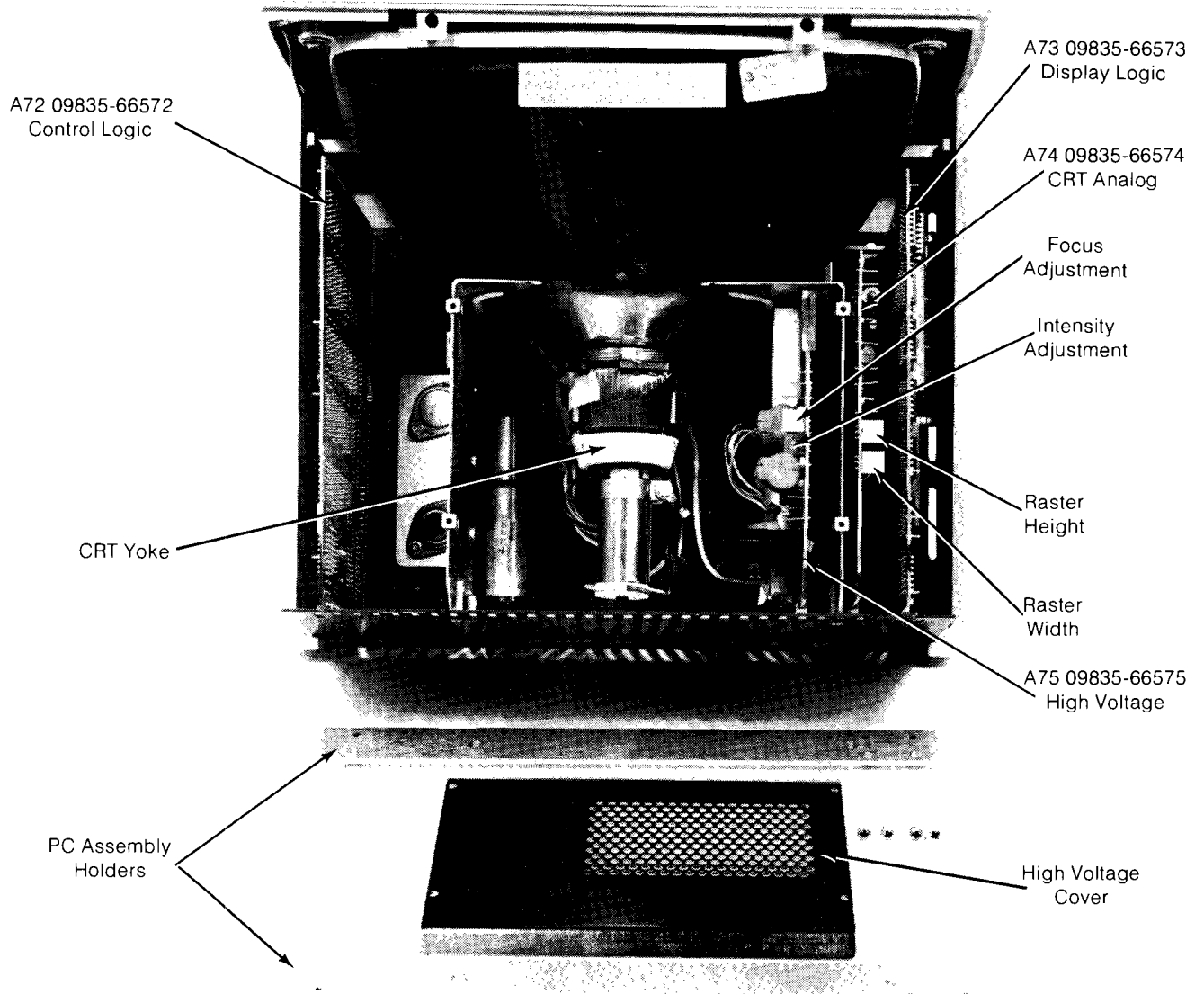


Figure 3-2. CRT Subassemblies

CRT Safety

The CRT bottle should be handled with care to avoid breakage and possible implosion of the bottle.

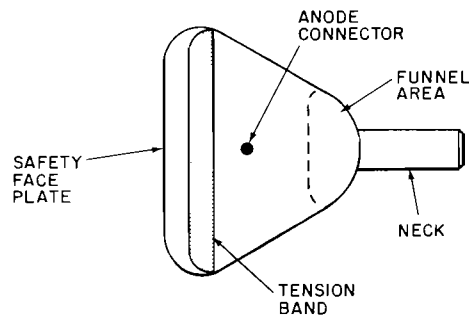


Figure 3-3. CRT Bottle Designation

Implosion

The CRT bottle can implode if it is dropped, hit by a tool or other object, or subjected to stress exceeding the glass strength. The most critical area on the bottle is the funnel area. A break in this area almost always results in an implosion.

Safety Precautions

Here is a list of precautions that should be followed when handling the CRT bottle.

1. The CRT bottle acts as a big capacitor when the computer is turned off. Always allow 10 minutes for the bottle to discharge before you touch the anode connector.
2. Always wear safety glasses.
3. Use a protective shop jacket or coat.
4. Use a rubber mat or carpet on the floor in the working area to reduce the possibility of breakage if the bottle is dropped.
5. When the bottle is removed from the display chassis, place it face down on a thick soft pad.
6. When storing the bottle, put it someplace where it can't fall or be bumped.

CRT Packaging

The CRT packing box is used to store the CRT when it is not installed in the computer and when disposing of a defective CRT.

To remove the CRT from the box, first place the box on the floor with the top of the box up. Open the top of the box and hold the base of the box with your feet. Pull up on the cardboard insert surrounding the CRT and remove the insert with the CRT from the box. Do not handle the CRT by its neck.

WARNING

WEAR SAFETY GLASSES AND REMOVE ITEMS THAT COULD FALL OUT OF YOUR SHIRT POCKET AND STRIKE THE CRT BEFORE REMOVING THE CRT FROM THE BOX.

Always store the CRT (new or defective) in the box. Dispose of defective CRTs in a proper manner.

CRT Bottle Removal

WARNING

ALLOW THE CRT BOTTLE TO DISCHARGE AT LEAST 10 MINUTES BEFORE TOUCHING THE CRT BOTTLE ANODE CONNECTOR.

- Remove the CRT assembly
- Remove the CRT assembly top cover
- Remove the CRT rear panel
- Remove the A72 and A73 PC assemblies
- Place the CRT on the front bezel (see Figure 3-4)
- Remove CRT yoke connector (Figure 3-4) from the A70 assembly, and remove the CRT connector from the back of the CRT bottle.
- Remove the 2 screws shown in Figure 3-4 that hold the CRT bottom chassis to the front bezel.
- Set the bottom chassis down (see Figure 3-5).
- Use a grounded and insulated needlenose pliers to remove the anode connector (see Figure 3-5). Lift the plastic insulation disk of the anode connector. Pinch the connector wires together and remove the anode connector.
- Remove the remaining two screws holding the CRT bottle to the bezel.
- Use the box from the new CRT bottle to store the old bottle.

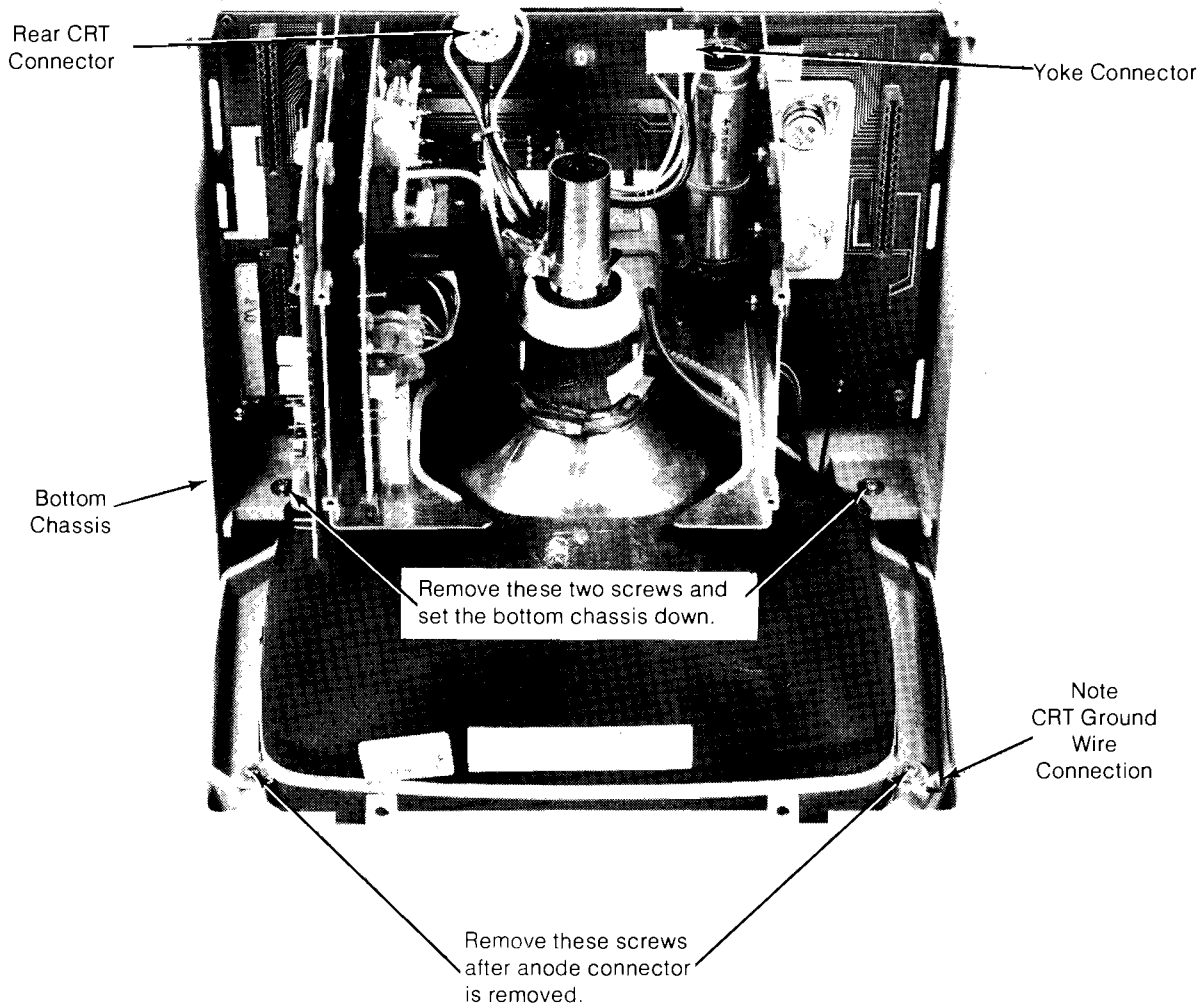


Figure 3-4. Bottle Removal Position

WARNING

WHEN REINSTALLING THE CRT BOTTLE ENSURE THAT THE GROUND WIRE IS CONNECTED TO ONE OF THE CRT MOUNTING SCREWS (SEE FIGURE 3-5). THE WIRE MUST TOUCH THE METAL BAND ON THE CRT. THIS WIRE GROUNDS THE CRT BOTTLE STATIC SHIELD COATING. IF THE WIRE IS NOT CONNECTED, A SHOCK HAZARD EXISTS.

After the assembly is reinstalled, perform the test ROM CRT display test and the CRT alignment procedures found in the CRT section of Chapter 2.

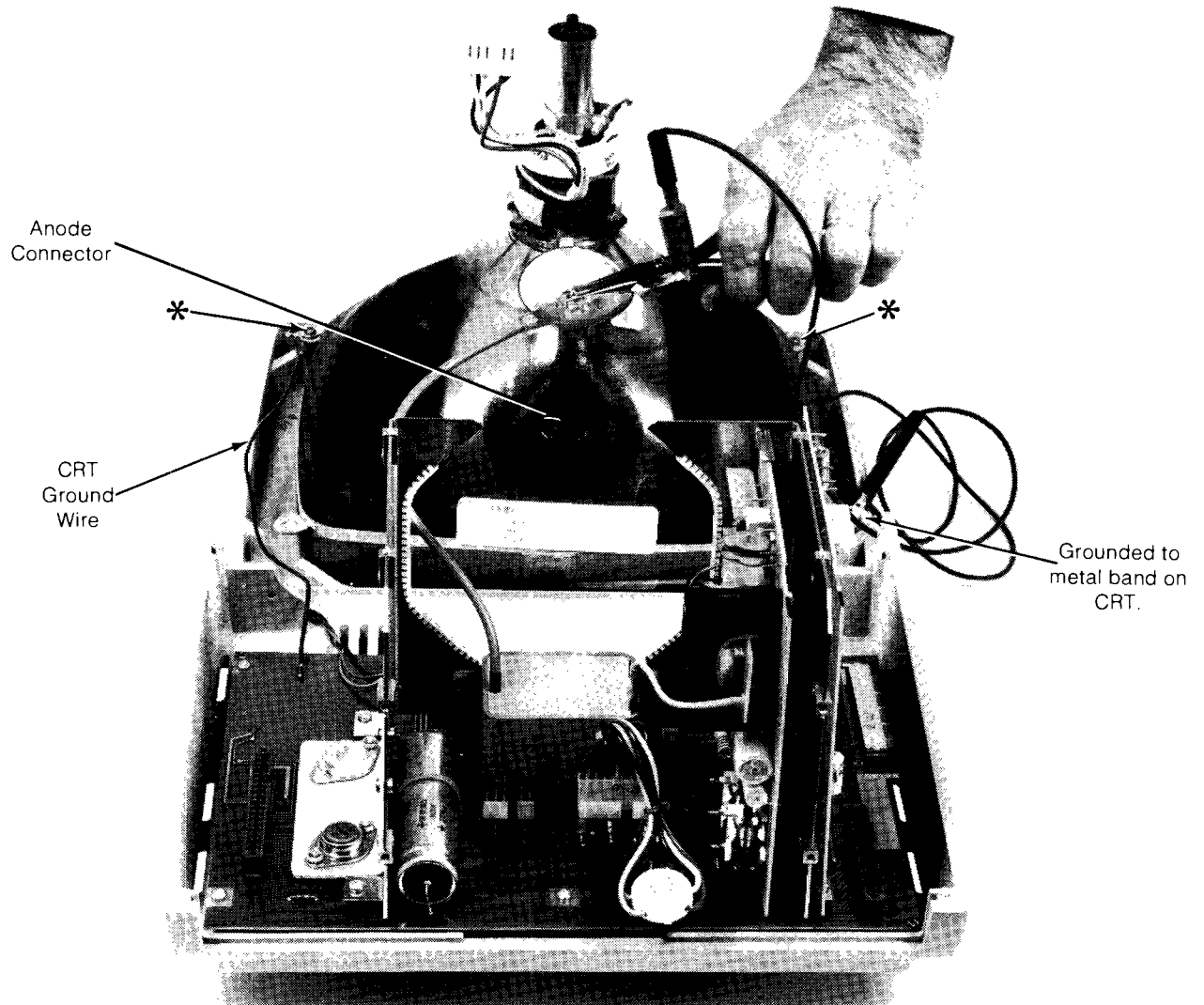


Figure 3-5. Anode Connector Removal

Computer Mainframe

The 9835 Computer mainframe can be divided into three major assemblies; the shell, bezel and base. The three major assemblies of the computer are shown below.

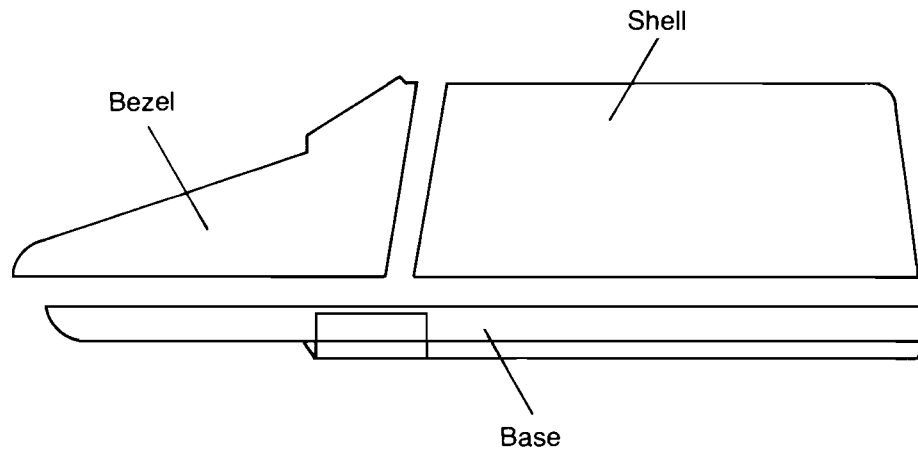


Figure 3-6. Computer Assemblies

The major assemblies found in the bezel and base are listed below. The shell does not contain any major assemblies.

Bezel

- Printer (optional)
- Tape Cartridge Drive Assembly
- Key Switch Assembly
- Display Assembly (9835B only)
- Internal I/O Assembly

Base Assemblies

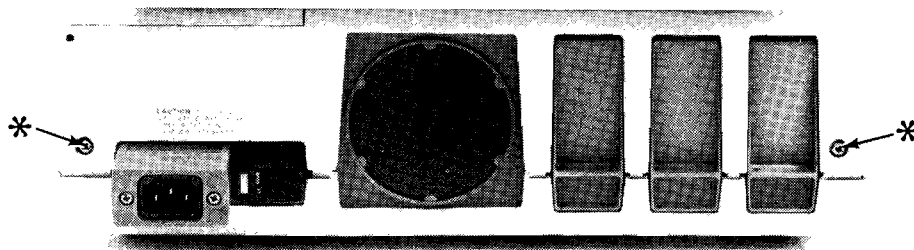
- Processor Assembly
- RWM (Read/Write Memory) Assemblies
- System ROM (Read Only Memory)
- I/O Bus Assembly
- ROM Bus Assembly

- Power Supply Assembly
- Power Supply Module
- Fan
- CRT Interface (9835A only)

Shell Removal

To access any computer assembly, the shell must be removed.

To remove the shell, remove two screws from the rear panel that hold the shell to the base assembly, then remove the shell by lifting the back of the shell first.



* Shell Removal Screws

Figure 3-7. Shell Removal Screws

Bezel

To access any bezel assemblies and some of the base assemblies, the bezel has to be removed. In some cases, complete removal is not necessary, that is, the assemblies on the base assembly can be accessed if the bezel is moved forward.

Bezel Removal

CAUTION

REMOVE ALL PLUG-IN ROMS FROM THE FRONT OF THE COMPUTER
BEFORE ATTEMPTING TO REMOVE THE BEZEL.

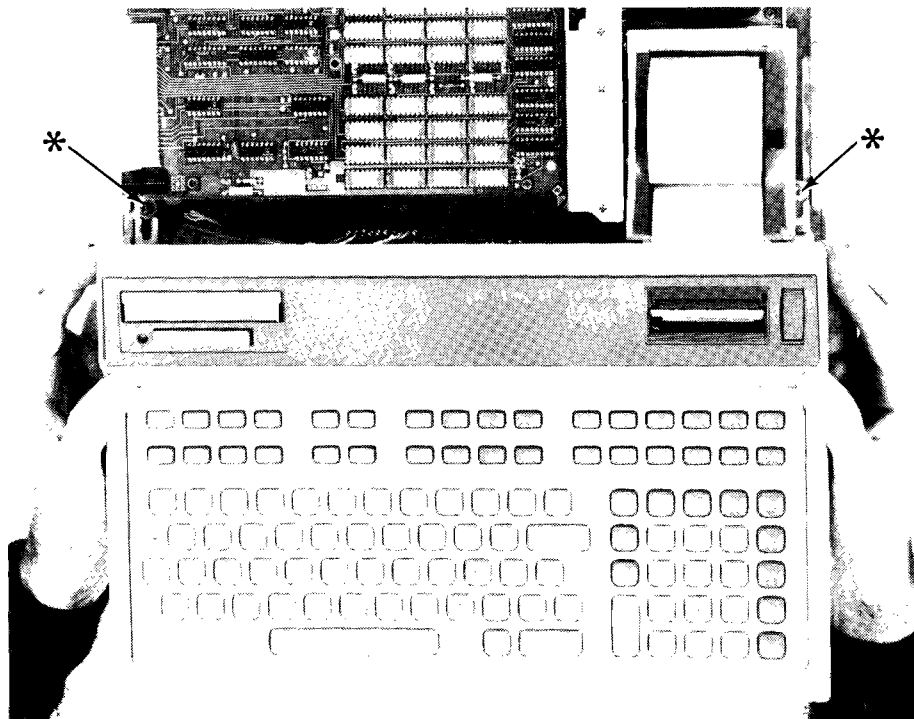
Before attempting to remove the bezel, remove all plug-in ROMs from the front of the computer. If the ROMs are not removed, the hinged ROM doors will bind, causing damage to the door or the bezel assemblies.

3-10 Assembly Access

Loosen the two screws shown in Figure 3-8 about four turns; it is not necessary to remove the screws completely.

1. Remove any Plug-In ROMs

2. Loosen these Screws (*)



3. Slide the Bezel Forward



Figure 3-8. Bezel Removal

Slide the bezel forward with respect to the base. The easiest way to do this is by holding the base in position with the lower part of the palms of your hands (Figure 3-8) and then pulling the bezel forward with your fingers until it stops (about 1cm).

Lifting the bezel slightly will allow you to move it forward (about 9cm). The bezel can be lowered to rest on the base in this position. The cables may have to be disconnected.

ROMs can now be reinstalled and power applied for operating or troubleshooting the computer.

If access to the underside of the bezel is required, while the bezel is still connected, stand the bezel on its edge beside the base as shown in Figure 3-9.

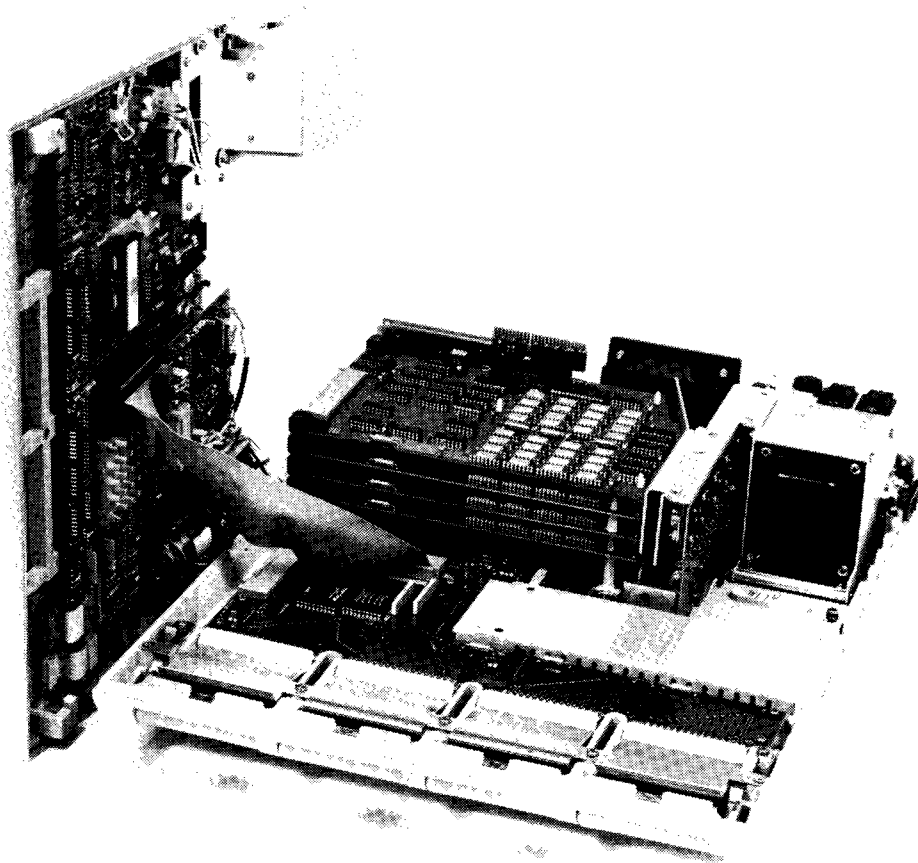


Figure 3-9. Bezel Assembly Access

To completely remove the bezel, disconnect the two interconnecting cables from the A36 or A37 assembly. Use the ribbon cable removal tool provided in the PSP to remove the ribbon cables.

Figure 3-10 shows the bezel assemblies.

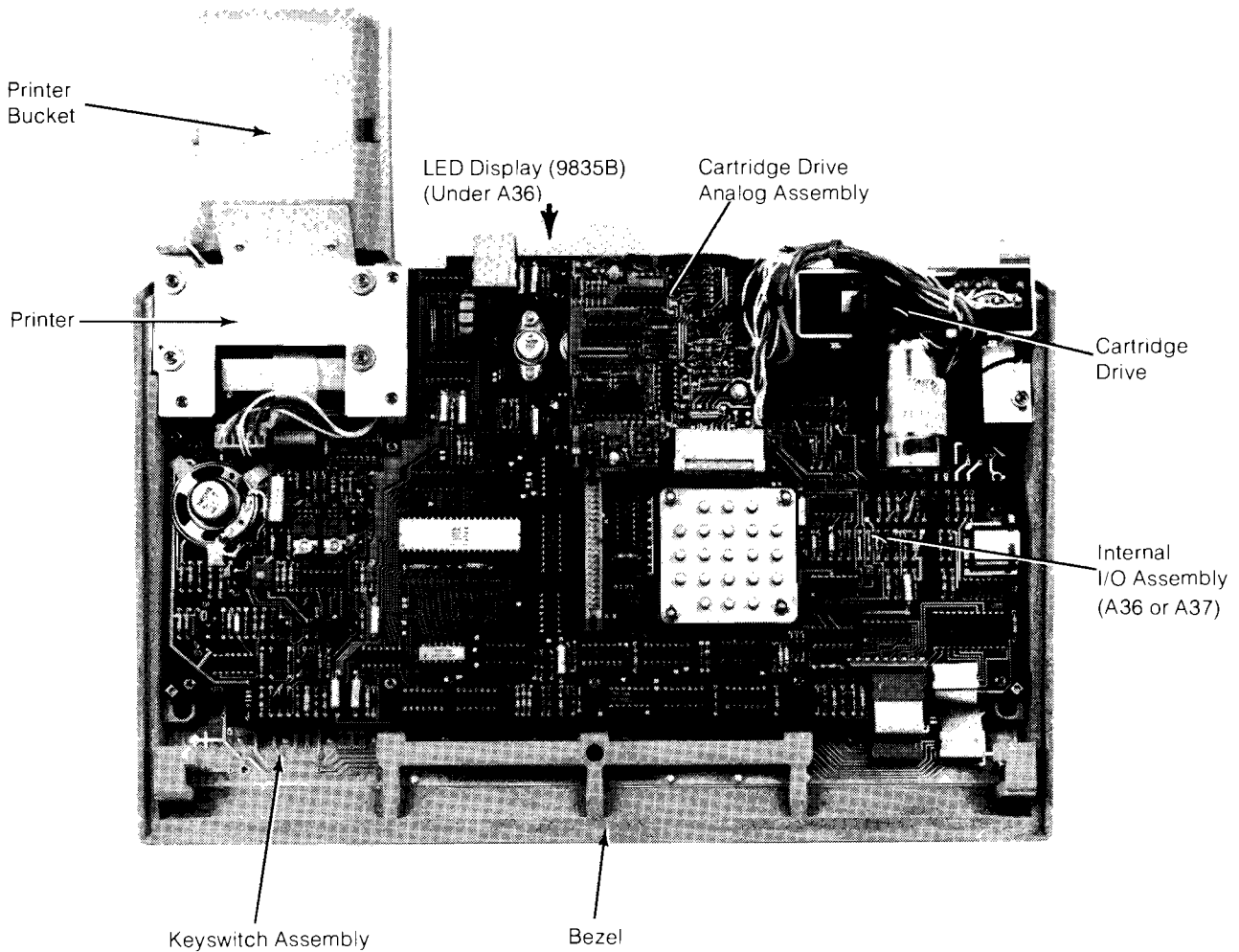


Figure 3-10. Bezel Assemblies

Cartridge Drive Assembly

The cartridge drive and its analog assembly should be removed and replaced as one assembly. To remove the cartridge drive, first remove the connector from the analog assembly, then use the paper spindle from the printer bucket as a removal tool to remove the analog assembly from the three plastic keepers (see Figure 3-11). After placing the hollow end of the removal tool over the keeper, lift the assembly up to unlock the keeper.

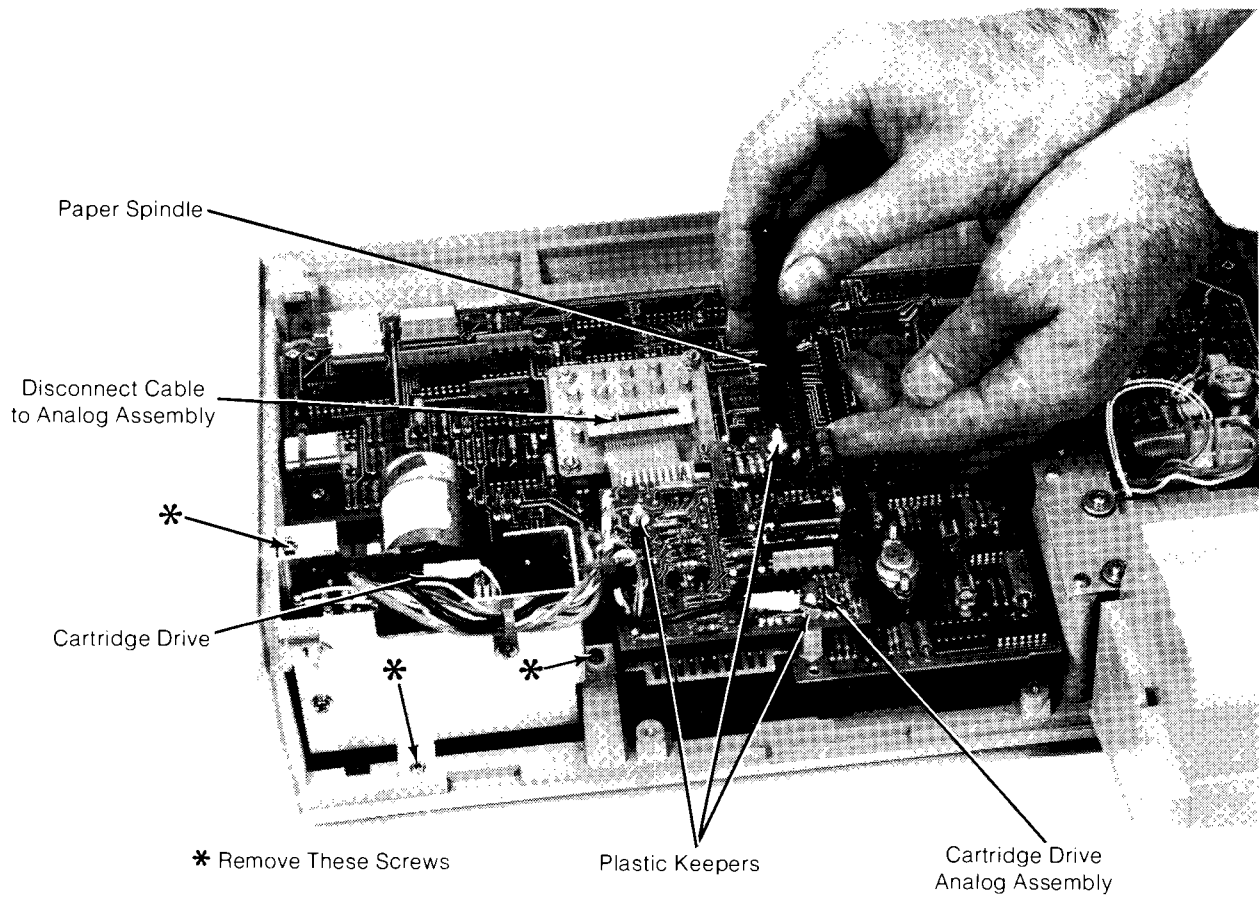


Figure 3-11. Cartridge Drive Removal

Remove the three screws shown in Figure 3-11 that hold the cartridge drive to the bezel and remove the cartridge drive assembly

Internal I/O Assembly Removal (A36 or A37)

To remove the Internal I/O assembly, first remove the cartridge analog assembly then disconnect the interconnecting cables and remove the 10 screws shown in Figure 3-12.

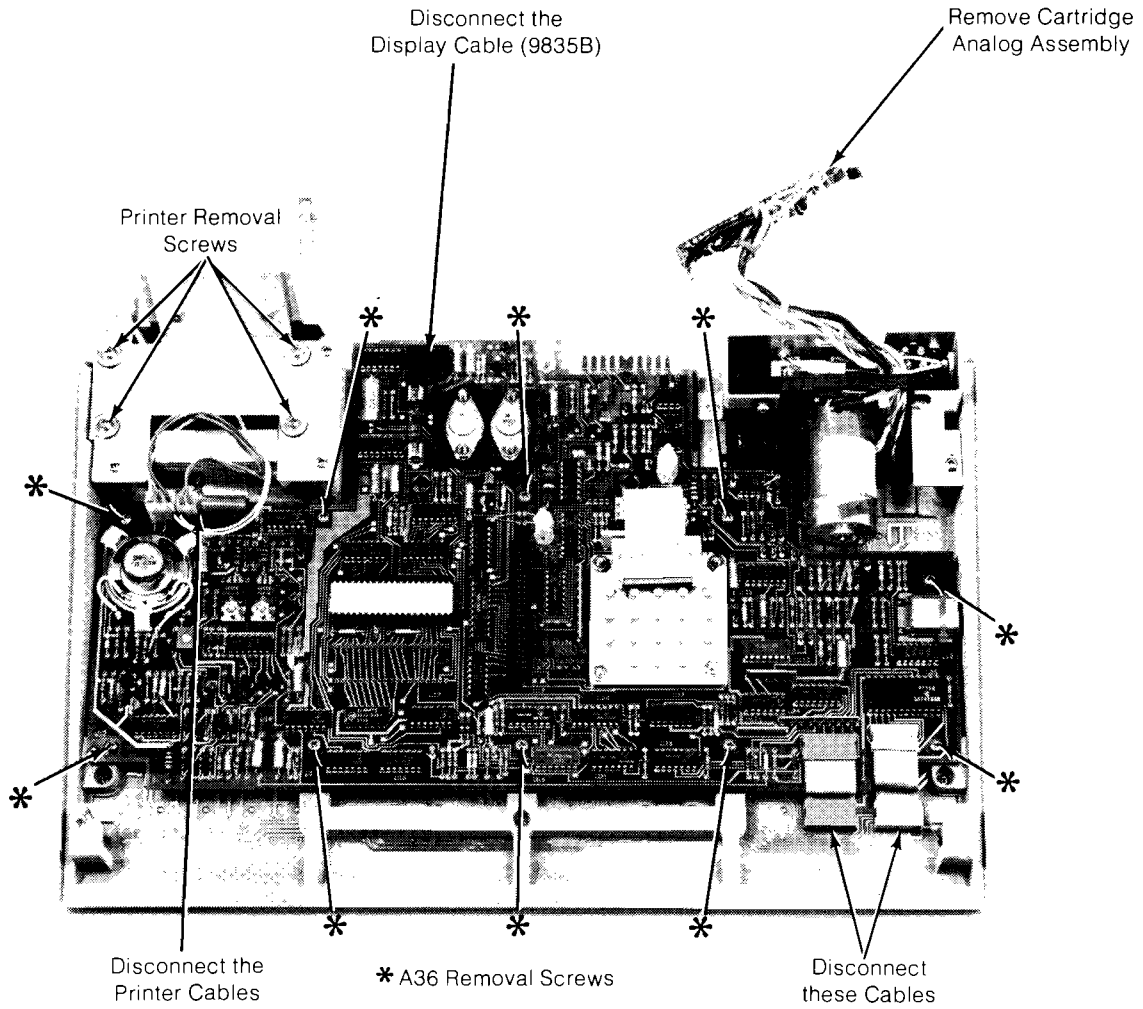


Figure 3-12. A36 or A37 Assembly Removal

Display Assembly (9835B only)

With the Internal I/O assembly removed, the display assembly can be accessed by removing four screws as shown below.

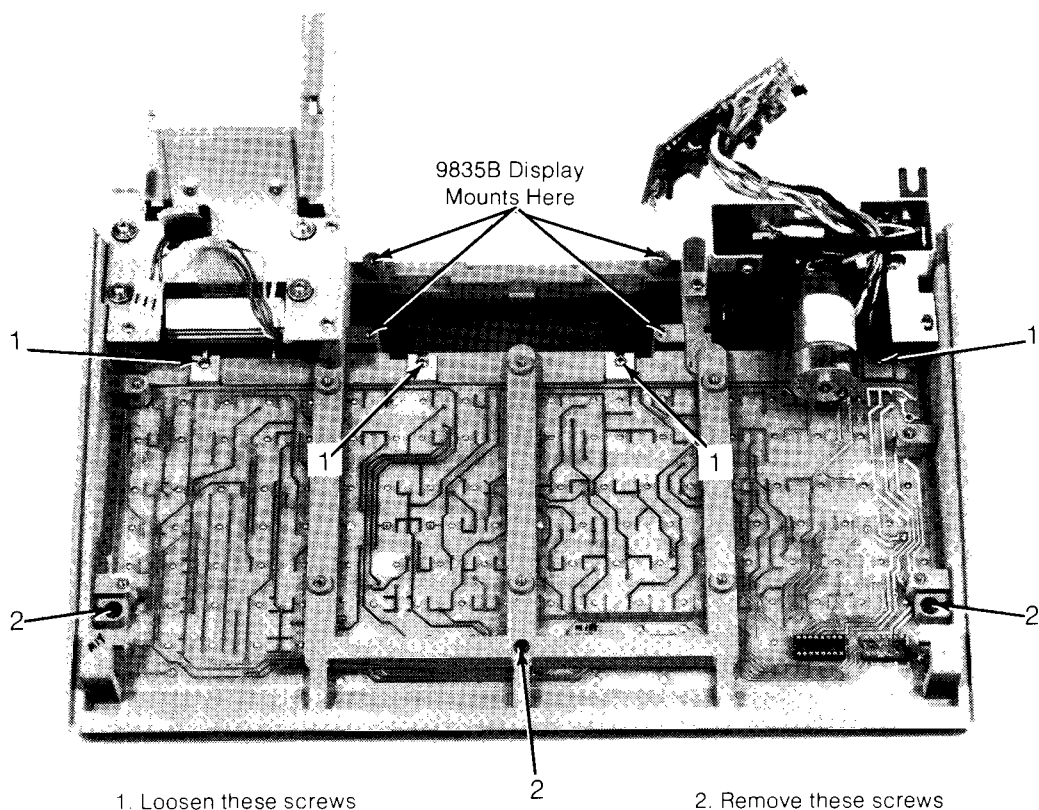


Figure 3-13. Assembly Removal Screws

Key Switch Assembly

The key switch assembly can be removed by disconnecting the two interconnecting cables, loosening four screws and removing three others (refer to Figure 3-13). The internal I/O assembly does not have to be removed to remove the key switch assembly.

The key switch assembly can now be removed from under the bezel by pressing the front edge down.

Printer

The printer can be removed by removing four screws and disconnecting four interconnecting cables shown in Figure 3-12.

Bezel Insert

Four plastic tabs hold the top of the bezel insert in place. Using a pocket knife blade or a thin screwdriver, pry the top of the insert out of the bezel (see Figure 3-14). Once the insert is removed, the display window (9835B only) can be removed by pressing it out from the back of the insert.

There are four different bezels for the 9835, here is a summary;

9835A:

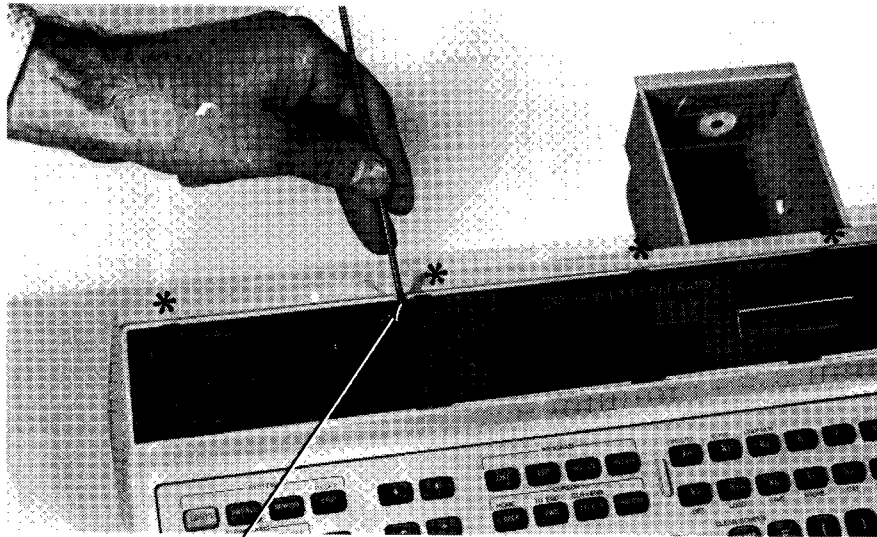
09835-64405 no display, no printer window

09835-64415 no display, printer window

9835B:

09835-64425 display, no printer window

09835-64435 display, printer window



Carefully pry out the top edge (close to the tabs) to remove.

* Insert tab position



Insert this edge first when installing.

Figure 3-14. Bezel Insert Removal

Base Assemblies

Figure 3-15 shows the base assemblies with the shell and bezel removed.

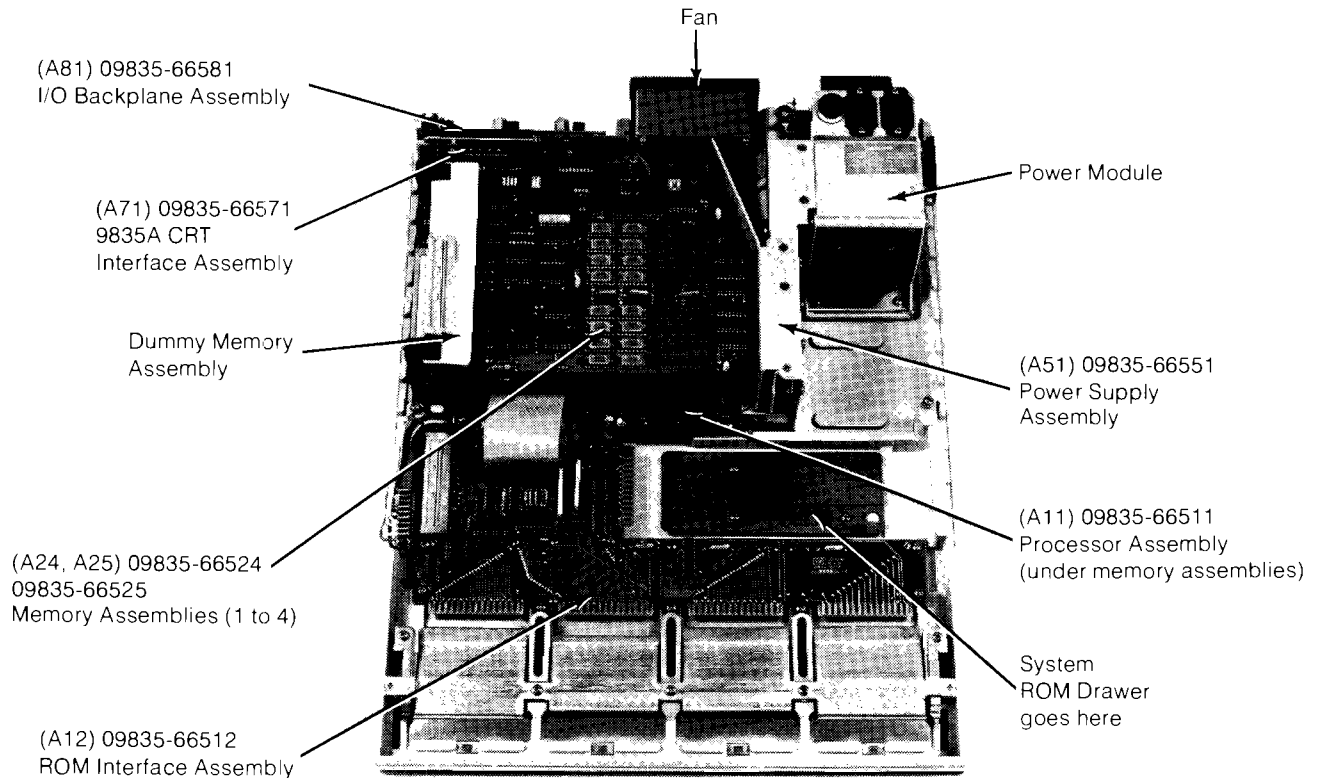


Figure 3-15. Base Assemblies

Read/Write Memory Assemblies (A24 and A25)

With the shell removed, the read/write memory assemblies can be accessed. They are the A24 and A25 assemblies in the hinged stack (see Figure 3-15).

Each of the memory assemblies can be pivoted on its hinge, to access the next memory assembly. To do this, press the removal tool (paper spindle) down over the three white keepers, one at a time, while lifting that area of the memory assembly (see Figure 3-16). When the three keepers are loose, raise the assembly.

Remove the top A24 or A25 assembly by disconnecting its connector and raising the assembly to a 45 degree angle. Then move it toward the front of the computer to disconnect the hinge.

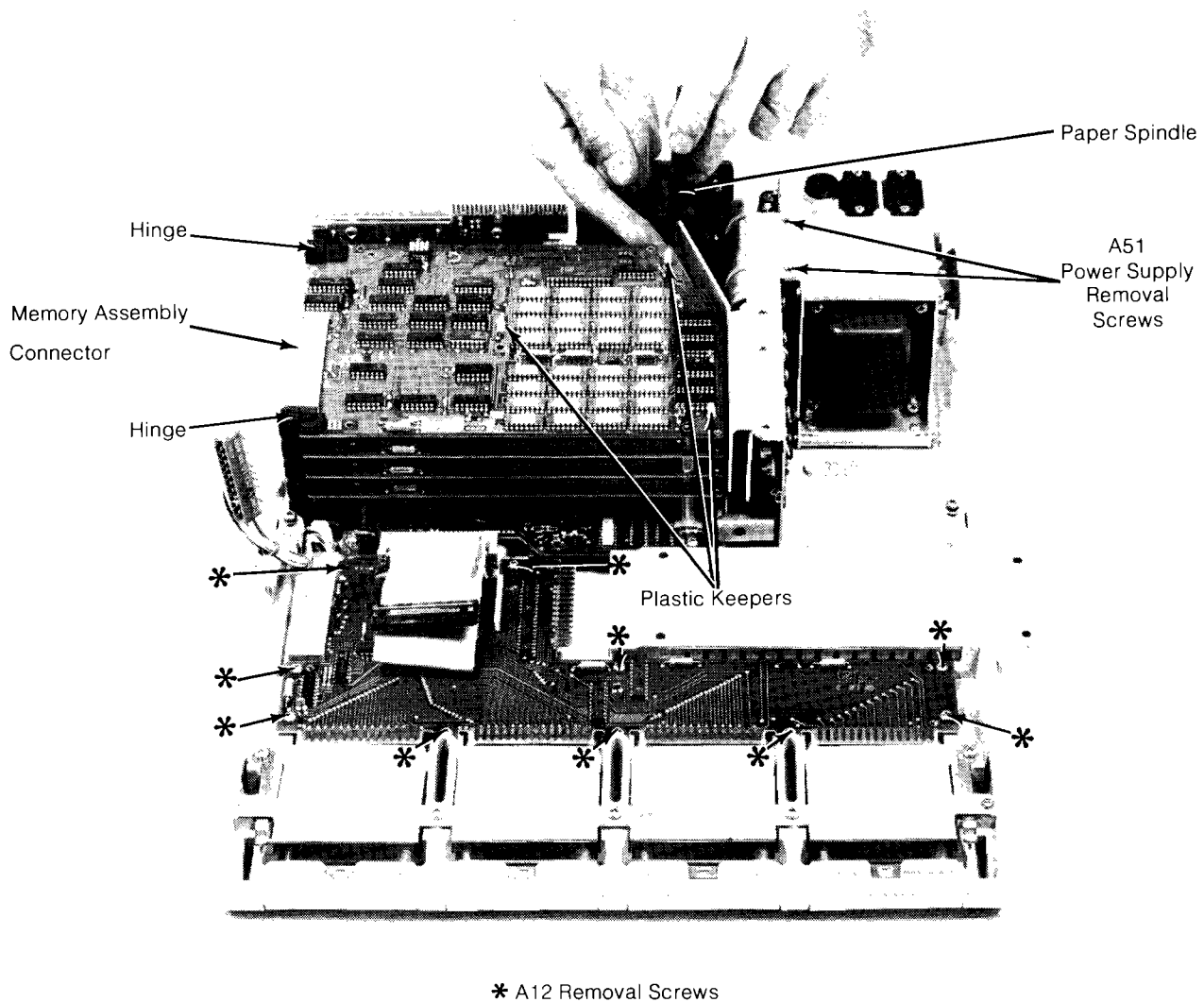


Figure 3-16. Read/Write Memory Access

Power Supply (A51)

To remove the power supply assembly, first swing out the A24 and A25 memory assemblies; then remove the two screws shown in Figure 3-16.

9835A CRT Interface (A71)

To remove the CRT interface, swing out the memory stack, remove the power cable and remove the four screws that hold the A71 assembly to the metal bracket (see Figure 3-17); then lift the CRT interface from its connector on the A11 assembly.

Processor Assembly (A11).

The processor assembly is underneath the hinged read/write memory stack. With the memory stack swung out and the A51 and A71 (9835A only) assemblies removed, the processor assembly can be removed. Disconnect three cables and ground wire from the processor assembly. Remove the screws from the four corners and lift the processor out of the base (see Figure 3-17).

Fan

With the memory stack swung out and the A11, A51 and A71 assemblies removed, the fan can be removed. Remove the four, long screws from the corners of the fan, remove the screw from the fan cable tie down and disconnect the fan wires.

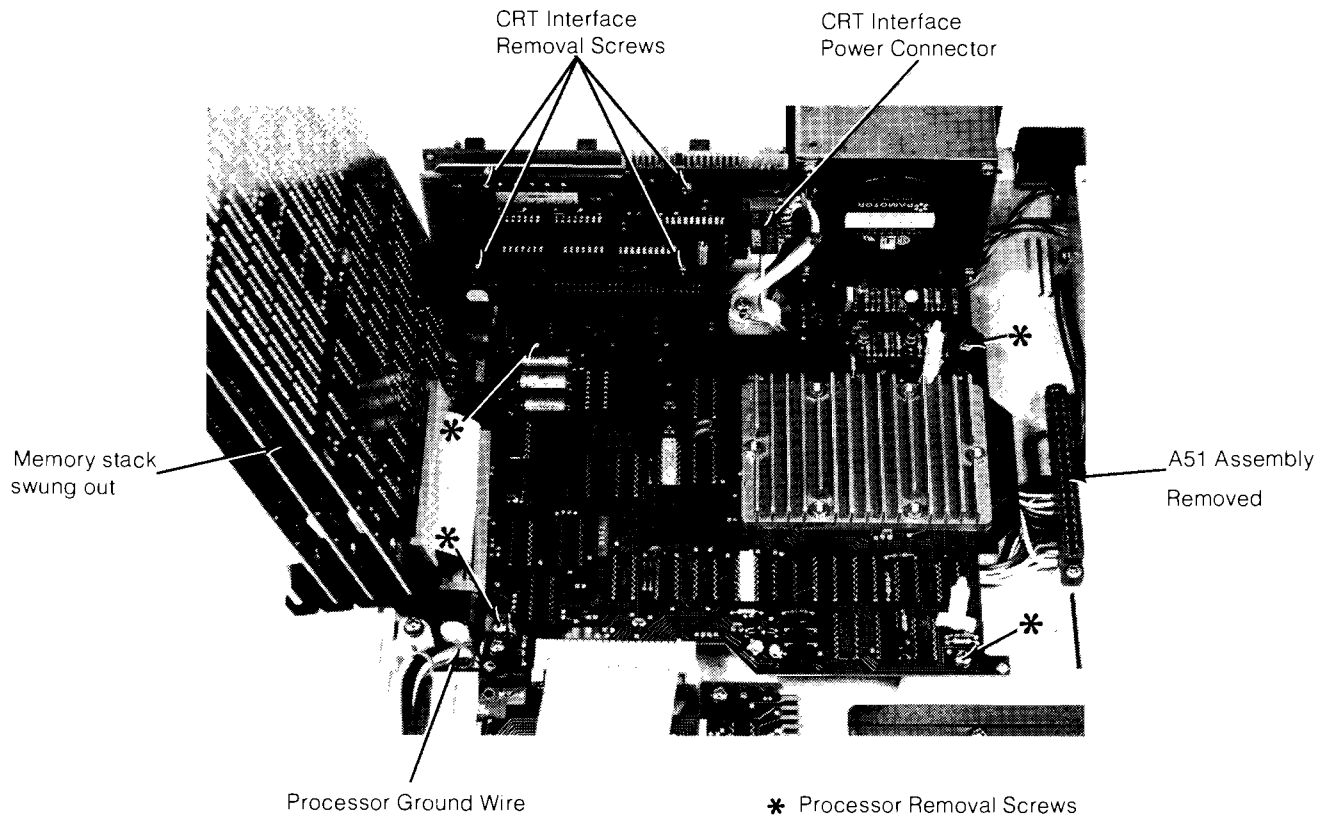


Figure 3-17. Processor Removal

ROM Interface Assembly (A12)

With the bezel removed, the ROM interface assembly (A12) can be removed. Ensure that all plug-in ROMs and the system ROM drawer are removed. Remove the ribbon cable and the ground wire going from the ROM interface to the processor assembly. Remove the nine screws and lift out the assembly (see Figure 3-16).

NOTE

The front center screw of the A12 assembly is used to align the assembly. The hole in the PC assembly is smaller providing a convenient PC alignment point.

Power Module

To remove the power module, first remove the A51 assembly then disconnect the fan wires, remove the two screws from the power supply connector and the four corner screws in the base of the power module (note: one screw has a ground lug). Unsolder the three (two red and one black) power module wires at the power supply connector, and lift the power module from the chassis.

I/O Backplane (A81)

To remove the I/O backplane, use this procedure and refer to Figure 3-18;

1. Swing out the memory stack.
2. Remove the A51 and A71 assemblies.
3. Remove the A11 assembly.
4. Disconnect the power connector and the ribbon cable.
5. Remove the six screws that hold the I/O backplane to the sheet metal bracket.

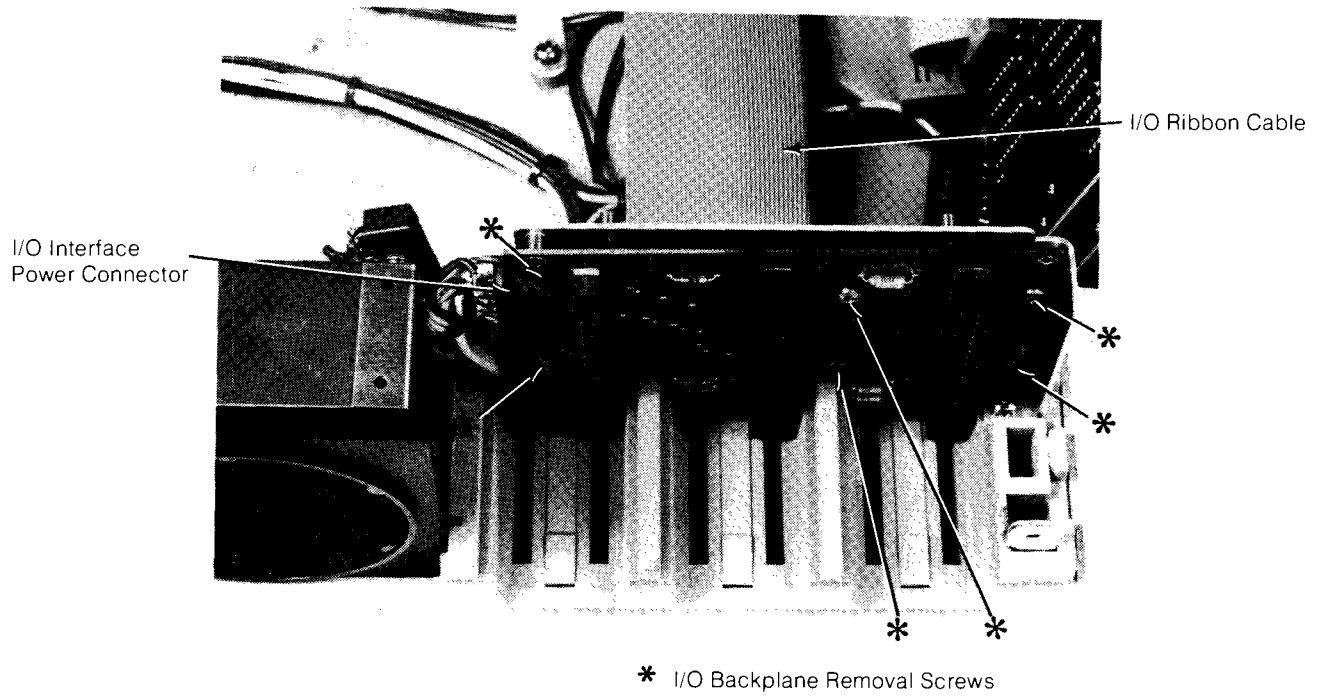


Figure 3-18. I/O Backplane Removal



Chapter 4

Replaceable Parts

Introduction

Table 4-1 lists the 9835A/B replaceable parts. Each part listed is given a level number in the first column. The levels indicate which items are part of a particular sub-assembly and which sub-assemblies are part of major assemblies.

A "1" level item is a major assembly. The major assembly may have sub-assemblies and other parts listed as "2" and "3" levels after the "1" level part number. This gives you a choice as to which level of assembly you wish to order and also tells you what you get with a major assembly. Remember all parts listed after a "1" level are associated with that "1" level part until the next "1" level part appears. Likewise with "2" and "3" level parts. Electrical components on a particular pc assembly are listed in the order of their component designators.

The total quantity of a part is listed only the first time it is used on a particular assembly. The major assemblies are pointed out in the figures following Table 4-1.

4-2 Replaceable Parts

Table 4-1. Replaceable Parts

	REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION
1		0400-0106	1	Channel Grommet
1		0400-0203	2	Grommet
1		0403-0106	5	Rubber Foot
1		09825-00601	1	Transport Wire Shield
1		09825-01201	1	Right Shell Bracket
1		09825-01205	1	Left Shell Bracket
1		09825-01206	2	Hinge Bracket
1		09825-01209	1	Printer Mounting Bracket
1		09825-01210	1	Bezel Mounting Clip
1		09835-64403	1	9835A Shell
1		09835-64421	1	Base
1		09835-64422	1	Bezel
1		09825-64413	1	9835B Shell
1		09825-64414	1	Printer Door
1		09825-66541	1	9835B Display Assembly
1		09835-01203	1	I/O Backplane Bracket
1		09835-01204	1	Transport Mounting Bracket
1		09835-01210	1	Face Plate Bracket
1		09835-61601	1	I/O Cable Assembly
1		09835-61602	1	Memory Bus Cable
1		09835-61603	1	Power Cable Assembly
1		09835-64403	1	CRT Shield
1	A11	09835-66511	1	Processor Assembly
1	A12	09835-66512	1	ROM Interface Assembly
1	A36	09835-66536	1	Internal I/O Assembly
1	A51	09835-66551	1	Power Supply Assembly
1	A71	09835-66571	1	CRT Interface Assembly (9835A)
1	A81	09835-66581	1	I/O Backplane Assembly
1		09835-67904	1	Power Module
2		7120-3185	1	Warning Label
1		09835-67905	1	9835A Language ROM Drawer Assembly
2		1818-2800	1	ROM #0
2		1818-2801	1	ROM #1
2		1818-2802	1	ROM #2
2		1818-2803	1	ROM #3
2		1818-2804	1	ROM #4
2		1818-2805	1	ROM #5
2		1818-2806	1	ROM #6
2		1818-2807	1	ROM #7
2		1818-2808	1	ROM #8
2		1818-2809	1	ROM #9
2		1818-2810	1	ROM #10
2		1818-2811	1	ROM #11
2		1818-2812	1	ROM #12
2		1818-2813	1	ROM #13
1		09835-67915	1	9835B Language ROM Drawer Assembly
1		09835-67920	1	9835A CRT Assembly
2		0371-0816	2	Pushbutton Knob
2		0430-0270	4	Rubber Foot
2		0510-0595	1	Retainer Clip
2		0624-0403	4	Tapping Screw
2		0624-0404	11	Tapping Screw
2		0624-0427	6	Screw
2		0960-0480	1	Tripler
2		09835-00201	1	Rear Panel
2		09835-00202	1	Rear Sub-Panel
2		09835-00601	1	High Voltage Shield
2		09835-00603	1	CRT Magnetic Shield

Table 4-1. Replaceable Parts (Cont.)

	REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION
2		09835-00605	1	CRT Yoke Shield
2		09835-01207	1	Front PC Support Bar
2		09835-61672	1	CRT Cable Assembly (CRT rear connector)
2		09835-64401	1	CRT Base
2		09835-64408	1	CRT Bezel
2	A70	09835-66570	1	CRT Motherboard
2	A72	09835-66572	1	Alpha Control Assembly
2	A73	09835-66573	1	Display Logic Assembly
2	A74	09835-66574	1	CRT Analog Assembly
2	A75	09835-66575	1	High Voltage Assembly
2		09835-67972	1	CRT and Yoke Assembly
2		09845-04103	1	High Voltage Cover
2		09845-04406	1	CRT Top Cover
2		09845-04407	1	CRT Bottom Cover
2		1251-0627	1	Connector Polarizing key
2		1251-3277	1	4 Pin Connector
2		2100-3156	1	R-Variable 200 10% (Intensity)
2		5040-8149	1	Thumb Wheel
2		7120-6157	1	Danger Label
1		7120-6248	1	Information Label
1		09835-68001	1	9835A Keyboard Insert
1		09835-68002	1	9835B Keyboard Insert
1		09835-81201	1	32k-Byte Memory Assembly with Spacers
2		0380-1055	3	Snap-in Spacers
2	A24	09835-66524	1	32k-Byte Memory Assembly
1		09835-04701	3	Dummy Memory Assembly
1		09835-81500	1	Standard Bezel(No Printer)
2		0400-0203	1	Grommet
2		09831-04101	1	Cover Plate
2		09835-64405	1	Bezel Insert-9835A,no printer
2		09835-64425	1	Bezel Insert-9835B,no printer
2		2200-0521	3	Machine Screw
1		09835-87901	1	9835 Miscellaneous Material Kit
2		09835-90000	1	Operating and Programming Manual
2		09835-90001	1	Beginners Guide
2		09835-90002	1	Programmer Introduction
2		09835-90005	1	Owners Manual
2		09835-90010	1	9835 Reference Manual
2		09835-90040	1	System Test Manual
2		09835-90041	1	System Test Cartridge
2		2110-0003	1	3 Amp NB Fuse
2		2110-0043	1	1.5 Amp NB Fuse
2		2110-0544	1	Fuse Holder Cap
2		5041-1403	1	I/O Slot Door
2		7120-6452	5	Function Key Overlay
2		7120-7096	1	Keyboard Overlay,CRT
2		8120-1378	1	AC Power Cable
2		8500-1251	1	Magnetic Tape Head Cleaner
2		9162-0061	2	Tape Cartridge
2		9222-0594	1	9835A Dust Cover
2		9222-0495	1	9835B Dust Cover
1		1251-2271	2	1 Pin Male Connector
1		1251-3826	1	4 Pin Plug Connector
1		1251-5001	2	Connector Contact

4-4 Replaceable Parts

Table 4-1. Replaceable Parts (Cont.)

	REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION
1		1460-1431	1	Left Bezel Spring
1		1460-1436	1	Right Bezel Spring
1		1460-1626	4	Torsion Spring
1		1480-0433	2	Spiral Pin
1		1600-0514	4	ROM Door Clip
1		1600-0524	1	Bezel Mounting Clip
1		1600-0703	1	ROM Guide Spring
1		1600-0716	1	Fan Shield
1		2200-0521	33	Machine Screw
1		2360-0368	12	Machine Screw
1		2360-0370	2	6-32 X .380 Screw
1		3160-0209	1	Fan
1		4040-1032	1	Cable Shield
1		4208-0110	1	Foam Filter
1		5040-7721	2	PC Hinge
1		5040-7787	2	PC Hinge Half
1		5040-7794	1	ROM Guide
1		5040-7813	1	9835B Display Window
1		5040-8155	4	ROM Door
1		5040-8286	1	Eject Button
1		5040-8287	1	Power Switch Bezel
1		5040-8289	1	EMI Filter Housing
1		09835-04701	1	Dummy Memory Assembly
1		5040-8362	1	Fan Bracket
1		5040-8607	6	PC Assembly Hinge
1		5041-1403	3	I/O Door
1		5061-3002	1	Cartridge Drive Assembly
1		7120-3528	1	Caution Label
1		7120-4930	1	Serial Plate Label
1		7120-5874	1	Label
1		7120-6165	1	Label
1		7120-6451	1	Filter Caution Plate
1		7120-6844	1	Nameplate Label
1		7120-7086	1	Information Label
1		7120-7087	1	Information Label
1		7120-7088	1	9835A Error Card
1		8120-2725	1	9835B Cable Assembly
1		7120-7089	1	Information Label
1	A51	09835-66551	1	Power Supply Assembly
2	C1,C2	0180-0583	2	C-F: 6000UF, 30V
2	C3	0180-0576	1	C-F: 3500UF, 30V
2	C4	0180-1846	1	C-F: 2.2UF, 35V
2	C5 thru C7	0180-2771	4	C-F: 110UF, 30V
2	C8	0180-1701	1	C-F: 6.8UF, 6V
2	C9	0180-2771	1	C-F: 110UF, 30V
2	C10	0180-2751	1	C-F: 470UF, 12V
2	C11	0180-2769	1	C-F: 680UF, 63V
2	C12,C13	0180-0210	3	C-F: 3.3UF, 15V
2	C14	0150-0071	1	C-F: 400PF, 1000V
2	C15	0180-0210	1	C-F: 3.3UF, 15V
2	C16	0160-0576	2	C-F: .1UF, 50V
2	C17	0180-0229	1	C-F: 33UF, 10V
2	C18	0160-0576	1	C-F: .1UF, 50V
2	R1	0698-3155	1	R-F: 4.64K, 1%
2	R2	0698-3161	1	R-F: 38.3K, 1%
2	R3	0757-0442	2	R-F: 10K, 1%

Table 4-1. Replaceable Parts (Cont.)

	REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION
2	R4	0698-3157	1	R-F: 19.6K, 1%
2	R5	0683-2205	1	R-F: 22Ω, 5%
2	R6	0683-2215	2	R-F: 220Ω, 5%
2	R7	0811-3069	1	R-F: 1Ω
2	R8	0698-4442	1	R-F: 4.42K, 1%
2	R9	0698-3150	1	R-F: 2.37K, 1%
2	R10	0698-4461	1	R-F: 698Ω, 1%
2	R11	0757-0418	1	R-F: 619Ω, 1%
2	R12	0757-0416	1	R-F: 511Ω, 1%
2	R13	0683-1025	1	R-F: 1K, 5%
2	R14	0698-4211	1	R-F: 158K, 1%
2	R15	0698-0085	1	R-F: 2.61K, 1%
2	R16	0757-0426	2	R-F: 1.3K, 1%
2	R17	0683-1005	1	R-F: 10Ω, 5%
2	R18	0757-0278	1	R-F: 1.78K, 1%
2	R19	0698-3438	1	R-F: 147Ω, 1%
2	R20	0812-0047	1	R-F: 5Ω, 5%
2	R21	0757-0274	1	R-F: 1.21K, 1%
2	R22	2100-2061	1	R-Variable: 200Ω, 10%
2	R23	0757-0421	1	R-F: 825Ω, 1%
2	R24	0812-0040	1	R-F: .27Ω, 5%
2	R25	0683-2215		R-F: 220Ω, 5%
2	R26	0757-0442		R-F: 10K, 1%
2	R27	0683-6205	1	R-F: 62Ω, 5%
2	R28	0811-1827	1	R-F: .1Ω, 10%
2	R29	0698-4424	1	R-F: 1.4K, 1%
2	R30	0757-0426		R-F: 1.3K, 1%
2	R31	0757-0419	2	R-F: 681Ω, 1%
2	R33	0757-0419		R-F: R-F: 681Ω, 1%
2	R34	0698-3151	1	R-F: 2.87K, 1%
2	R35	0757-0442	1	R-F: 10K, 1%
2	U1	1826-0138	1	IC: Comparator, LM339N
2	U2	1826-0123	1	IC: Regulator, LM320K
2	U3	1826-0423	1	IC: LM317K
2	U4,U5	1820-0196	2	IC: U5R7723393
1		09835-80201	1	Option 201 64K-Byte Memory
2		0380-1055	3	Snap-In Spacers
2	A25	09835-66525	1	64K-Byte Memory Assembly
2		09835-04701	3	Dummy Memory Assembly
2		7120-6454	1	Information Label
1		09835-80202	1	Option 202 128K-Byte Memory
2		0380-1055	6	Snap-In Spacer
2	A25	09835-66525	2	64K-Byte Memory Assembly
2		09835-04701	2	Dummy Memory Assembly
2		7120-6453	1	Information Label
1		09835-80203	1	Option 203 192K-Byte Memory
2		0380-1055	9	Snap-In Spacer
2	A25	09835-66525	3	64K-Byte Memory Assembly
2		09835-04701	1	Dummy Memory Assembly
2		7120-6456	1	Information Label

4-6 Replaceable Parts

Table 4-1. Replaceable Parts (Cont.)

	REFERENCE DESIGNATOR	PART NO.	TQ	DESCRIPTION
1	A25	09835-80204	1	Option 204
2		0380-1055	12	256K-Byte Memory
2		09835-66525	4	Snap-In Spacer
2		7120-6840	1	64K-Byte Memory Assembly Option 204 Label
1	A25	09835-80500	1	Option 500 Printer
2		09835-64415	1	Printer Option See exploded printer drawing for printer parts Bezel insert- printer, no display
1	A37	09835-80800	1	Option 800
2		09835-66537	1	Language assembly, English
2		1818-2809	1	Internal I/O Assembly, ASCII
2		7120-6998	1	ROM #9 Information Label
1	A36	09835-80810	1	Option 810
2		09835-66536	1	French Keyboard Assembly
2		1818-2823	1	Internal I/O Assembly
2		7120-6836	1	ROM (replaces ROM #9) Information Label
2		7120-6849	1	French Keyboard Overlay
1	A36	09835-80820	1	Option 820
2		09835-66536	1	Spanish Keyboard Assembly
2		1818-2824	1	Internal I/O Assembly
2		7120-6837	1	ROM (replaces ROM #9) Information Label
2		7120-6848	1	Spanish Keyboard Overlay
1	A36	09835-80830	1	Option 830
2		09835-66536	1	German Keyboard Assembly
2		1818-2822	1	Internal I/O Assembly
2		7120-6838	1	ROM (replaces ROM #9) Information Label
2		7120-6850	1	German Keyboard Overlay
1	A37	09835-80840	1	Option 840
2		09835-66537	1	Katakana Keyboard Assembly
2		1818-2825	1	Internal I/O Assembly, ASCII
2		7120-6839	1	ROM (replaces ROM #9) Information Label
2		7120-7104	1	Information Label

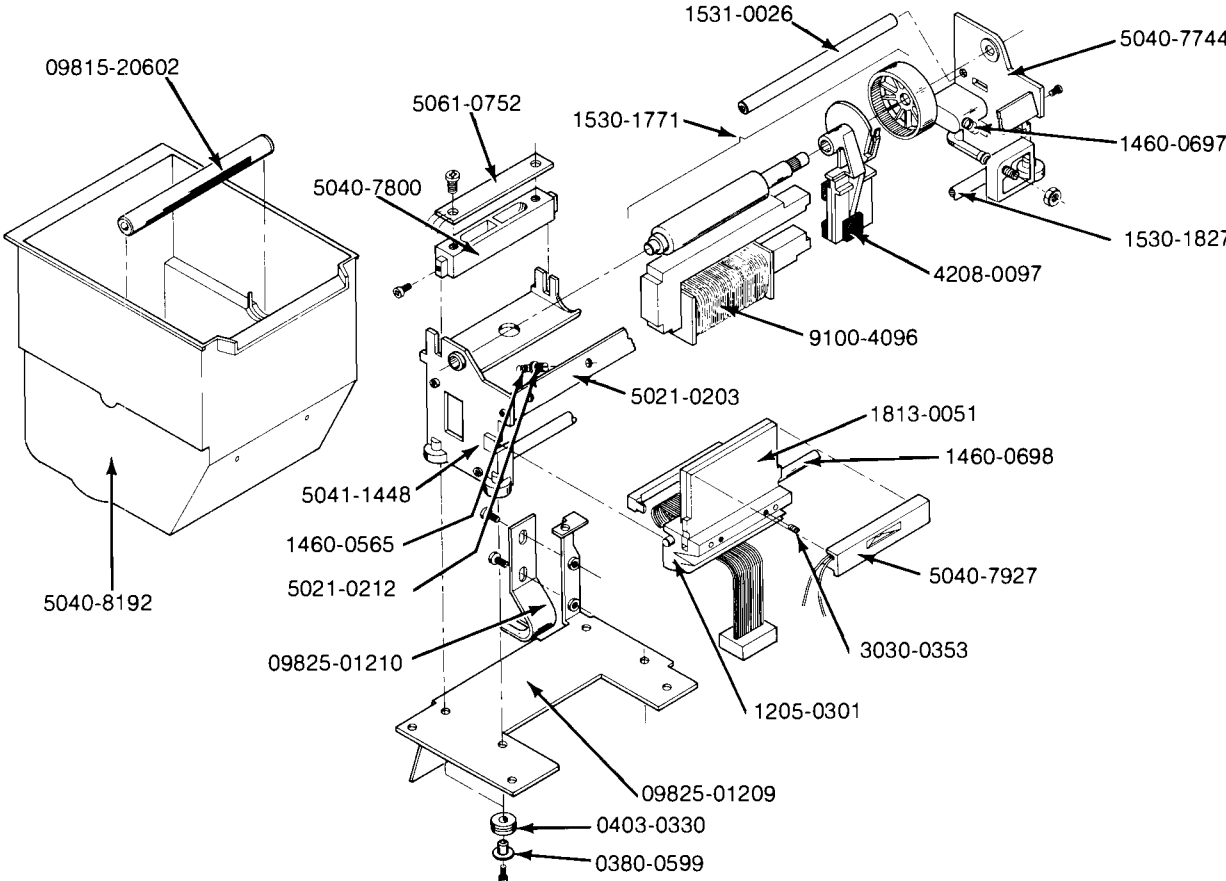
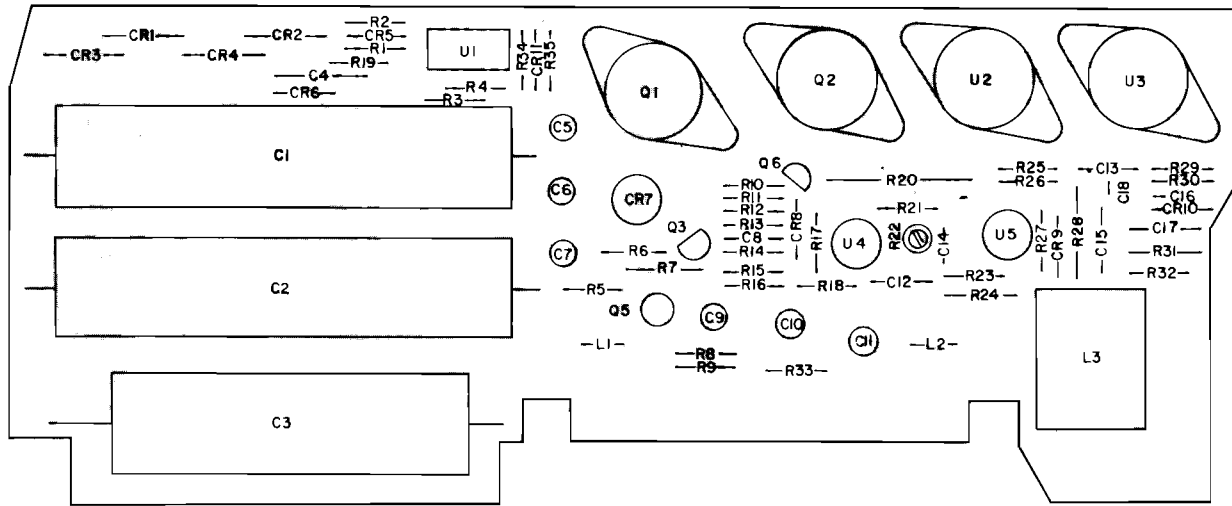


Figure 4-1. Printer Parts 09835-67940

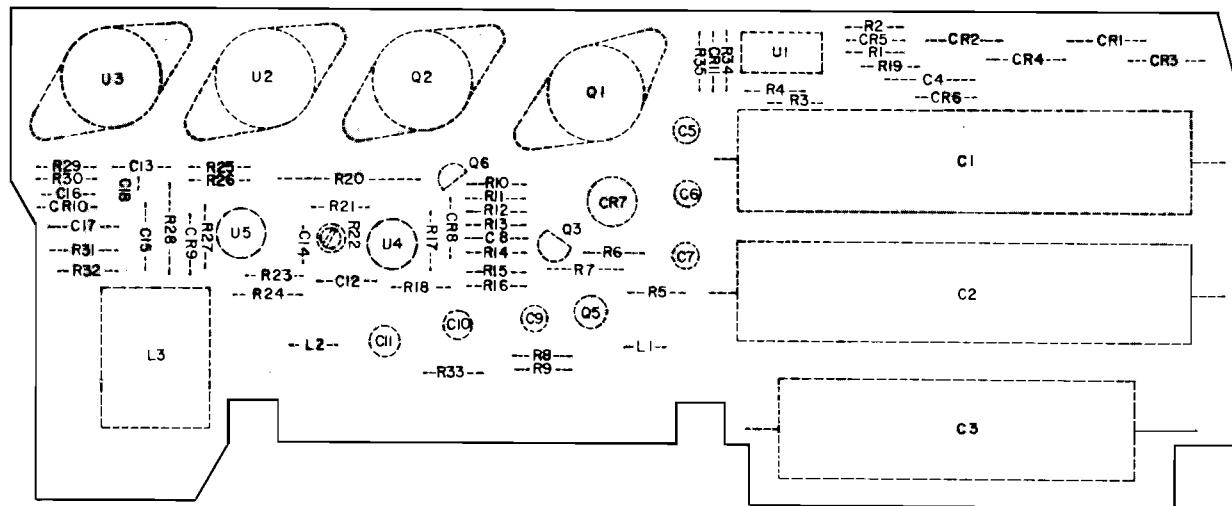


COMPONENT SIDE

R22 is the Power
Supply Adjustment

A51

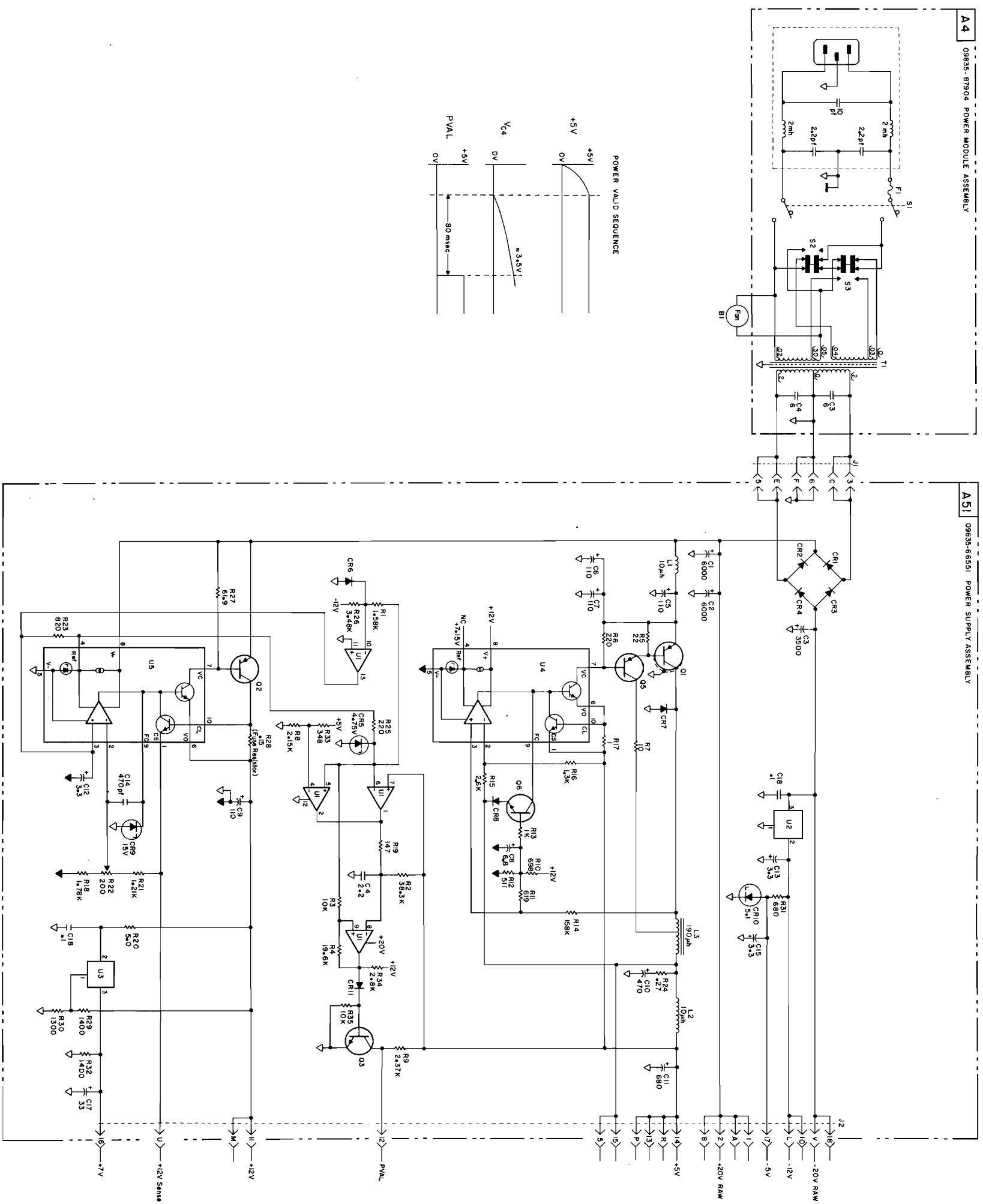
-hp- Part No. 09835-66551 Rev B



CIRCUIT SIDE

A51

-hp- Part No. 09835-66551 Rev B



9835A-J-51315

ORIGINAL

Figure 4-2. Power Supply Schematic Diagram

4-10 Replaceable Parts

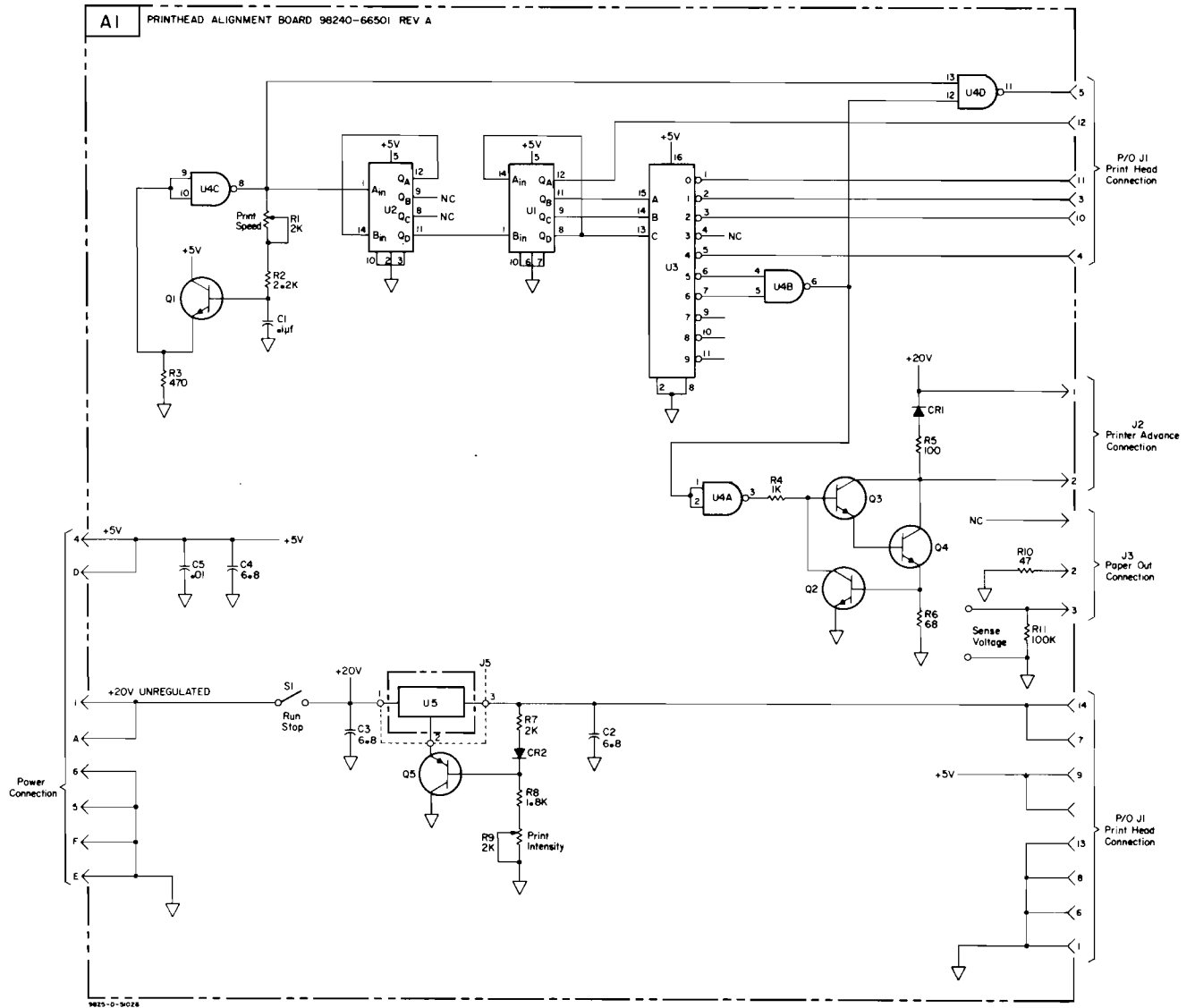
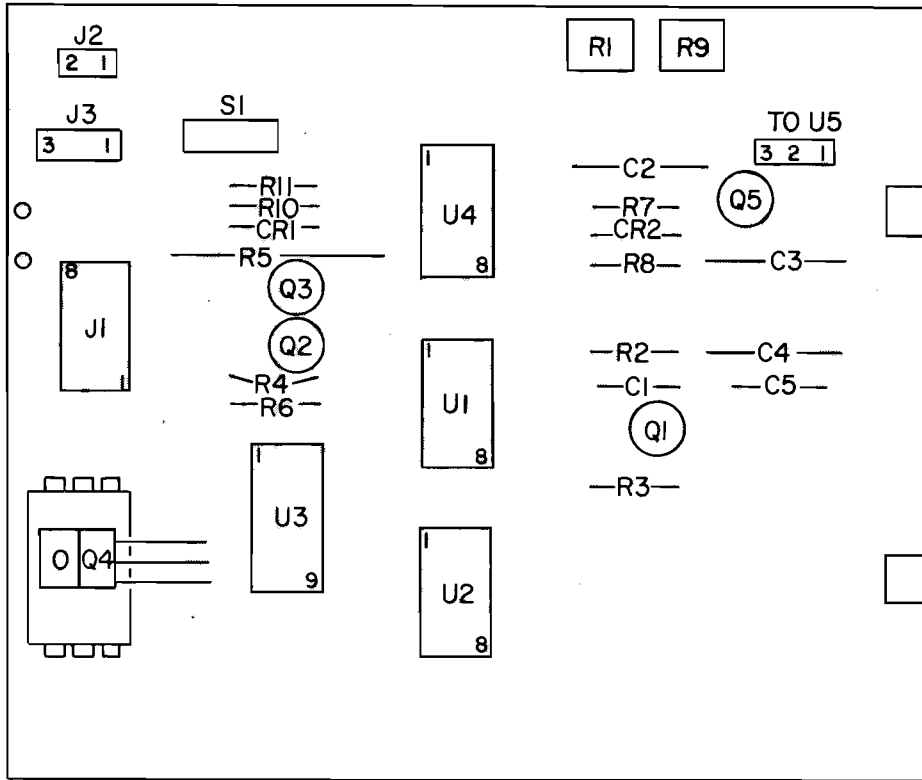


Figure 4-3. Alignment Fixture Schematic Diagram



COMPONENT SIDE

A1

-hp- Part No. 98240-66501 Rev A

Subject Index

a

Address Extension 2-11

b

Base Assemblies 3-8,3-17
 Beeper Operation 2-44
 Bezel 3-9
 Bezel Assemblies 3-8
 Bezel Insert Removal 3-16
 Bezel Removal 3-9

c

Cartridge Drive Exerciser 2-41
 Cartridge Drive Removal 3-12
 Cartridge Drive Test 2-39
 Cartridge Installation 1-13
 Cartridge Troubleshooting 2-41
 Character Set Options 1-19
 Cleaning, Computer 1-14
 Clock Generation 2-10
 Computer Control (K11) 2-5
 Computer Mainframe 3-8
 Control Logic Assembly (A72) 2-30
 CRT Assembly Removal 3-1
 CRT Bottle Removal 3-5
 CRT Display (A74,A75) 2-30
 CRT Display Circuits 2-29
 CRT Display Focus 2-28
 CRT Display Operation 2-30
 CRT Display Specifications 1-3
 CRT Installation 1-9
 CRT Intensity 2-29
 CRT Interface 2-29
 CRT Interface Removal 3-18
 CRT Packaging 3-4
 CRT Raster Size 2-27
 CRT Safety 3-4
 CRT Section 2-23
 CRT Self Test Switches 2-26
 CRT Subassemblies 3-2
 CRT Test 2-23

d

Data Storage Specifications 1-2
 Display Assembly Removal 3-14
 Display Logic Assembly (A73) 2-30
 Display Operation 2-44
 Display Test 2-34
 Dither Check 2-8

e

Environmental Range 1-2
 Equipment Supplied 1-4

f

Fan Removal 3-19
 Fuses 1-10

i

I/O Backplane Removal 3-20
 I/O Test 2-41
 Initial Turn-On 1-13
 Initialization, Computer 2-10
 Installation, Computer 1-9
 Internal I/O Operation 2-42
 Internal I/O Removal 3-13
 Internal I/O Section 2-33

k

Key Switch Assembly Removal 3-15
 Keyboard Operation 2-43
 Keyboard Test 2-33

l

LED Display Specifications 1-3

m

Memory Installation	1-22
Memory Options	1-22
Memory Section	2-13
Memory Troubleshooting	2-16

o

On-Site Service Procedure	2-3
Options	1-17

p

Paper Advance Adjustment	2-39
Power Cords	1-8
Power Module	2-48
Power Module Removal	3-20
Power Requirements	1-2,1-10
Power Supply Adjustment	2-50
Power Supply Assembly (A51)	2-48
Power Supply Operation	2-48
Power Supply Removal	3-18
Power Supply Section	2-48
Power-On Memory Test	2-15
Pre-Service Call Problem Isolation	2-1
Print Head Alignment	2-37
Printer Adjustments	2-36
Printer Installation	1-17
Printer Intensity	2-36
Printer Operation	2-44
Printer Option	1-17
Printer Paper	1-12
Printer Removal	3-15
Printer Test	2-35
Processor Clock Frequency Adjustment	2-7
Processor Operation	2-10
Processor Removal	3-19
Processor Section	2-7
Processor Test	2-7
Program Mode (Test ROM)	2-6

r

Read Write Memory Options	1-2,1-22
Read / Write Memory Exerciser	2-14
Read / Write Memory Operation	2-18
Read / Write Memory Removal	3-17
Read / Write Memory Test	2-13
Repair Philosophy	1-5
ROM Interface Removal	3-20
Read Only Memory Operation	2-19
ROM Options	1-20
ROM Test	2-15

s

Safety	1-6,3-4
Shell Removal	3-9
Size and Weight	1-2
Specifications	1-2
System Loader (K10)	2-5

t

Table Mounting	1-25
Tape Cartridge Considerations	1-15
Tape Cartridge Drive Operation	2-44
Tape Cartridge Specifications	1-3
Test Mode (Test ROM)	2-4
Test ROM	2-3
Test ROM Summary	2-0
Thermal Printer Specifications	1-3
Turn-On Mode (Test ROM)	2-4

