

**NCR**

---

NCR DECISION MATE V

# **Service Manual**

## SCOPE

This manual is designed to assist a trained engineer in locating and correcting problems that may occur with the NCR DECISION MATE V. Specially developed self-study and audio-visual training courses are available from NCR, and before attempting to service the computer, the engineer should have completed one of these courses.

017-0032312  
ST 5105-01

Copyright © 1983, 1984 by NCR Corporation  
Dayton, Ohio  
All Rights Reserved  
Printed in the Federal Republic of Germany

### Fourth Edition, October 1984

It is the policy of NCR Corporation to improve products as new technology, components, software, and firmware become available. NCR Corporation, therefore, reserves the right to change specifications without prior notice.

All features, functions, and operations described herein may not be marketed by NCR in all parts of the world. In some instances, photographs are of equipment prototypes. Therefore, before using this document, consult your dealer or NCR office for information that is applicable and current.



NCR DECISION MATE V  
SERVICE MANUAL

## CONTENTS

## SYSTEM OVERVIEW

|                                    |     |
|------------------------------------|-----|
| Introduction . . . . .             | 1-1 |
| General Description . . . . .      | 1-1 |
| 96 TPI Flexible Disk . . . . .     |     |
| Model Number Description . . . . . | 1-2 |
| Tools . . . . .                    | 1-2 |
| Site Preparation . . . . .         | 1-6 |

## REMOVAL/REPLACEMENT

|   |      |
|---|------|
| Cabinet . . . . .                         | 2-1  |
| Fan . . . . .                             | 2-3  |
| Power Supply . . . . .                    | 2-4  |
| Flexible Disk Drives . . . . .            | 2-8  |
| Controller Module . . . . .               | 2-10 |
| Monochrome CRT Deflection Board . . . . . | 2-11 |
| Fixed (Winchester) Disk Drive . . . . .   | 2-12 |
| Fixed Disk Controller Board . . . . .     | 2-15 |
| Color CRT Deflection Board . . . . .      | 2-17 |

## PROBLEM ISOLATION

|                                      |     |
|--------------------------------------|-----|
| Startup . . . . .                    | 3-1 |
| Power Supply . . . . .               | 3-2 |
| Level 0 Diagnostics . . . . .        | 3-4 |
| Flexible Disk Drives . . . . .       | 3-4 |
| Adapter Diagnostics (K225) . . . . . | 3-5 |

## LEVEL 1 DIAGNOSTICS

|   |      |
|---|------|
| General Description . . . . .                   | 4-1  |
| Operation . . . . .                             | 4-2  |
| Switch Function . . . . .                       | 4-2  |
| Diagnostic Tests . . . . .                      | 4-4  |
| Messages . . . . .                              | 4-9  |
| Flexible Disk Controller Status Codes . . . . . | 4-12 |
| Fixed Disk Controller Status Codes . . . . .    | 4-17 |

|   |      |
|---|------|
| ADJUSTMENTS                               |      |
| CRT (Monochrome) . . . . .                | 5-1  |
| CRT (Color) Adjustments . . . . .         | 5-6  |
| Flexible Disk Drive Adjustments . . . . . | 5-14 |

#### PIN ASSIGNMENTS & STRAPPING

|  |      |
|--|------|
| Controller Boards . . . . .                        | 6-2  |
| Graphics Boards . . . . .                          | 6-7  |
| Power Supply . . . . .                             | 6-10 |
| Keyboard . . . . .                                 | 6-11 |
| Flexible Disk Drive . . . . .                      | 6-12 |
| Fixed Winchester Disk Drive (ST412) . . . . .      | 6-13 |
| Fixed Disk Drive . . . . .                         | 6-14 |
| Memory Expansion . . . . .                         | 6-15 |
| Centronics Peripheral Adapter (K210) . . . . .     | 6-17 |
| RS-232 Peripheral Adapter (K211/212/213) . . . . . | 6-19 |
| Buffered Sync/Async Adapter (K215) . . . . .       | 6-22 |
| SCC Communication Interface (K216) . . . . .       | 6-24 |
| Integrated Modem (K219) . . . . .                  | 6-27 |
| DLC Inhouse Interface (K223) . . . . .             | 6-29 |
| External 16-Bit Processor (K231) . . . . .         | 6-32 |
| Shared RAM (K233) . . . . .                        | 6-33 |
| 68008 Processor Board (K234) . . . . .             | 6-34 |
| 16-Bit Processor with PIC (K235) . . . . .         | 6-35 |
| Omninet Adapter (K600) . . . . .                   | 6-37 |
| Switchable RS-232 Adapter (K801) . . . . .         | 6-40 |
| Real Time Clock (K803) . . . . .                   | 6-43 |
| IEEE-488 Adapter (K804) . . . . .                  | 6-45 |
| Mouse Interface (K806) . . . . .                   | 6-47 |

#### NCR WINCHESTER DISK UNITS

|                                    |      |
|------------------------------------|------|
| General Description . . . . .      | 7-1  |
| Model Number Description . . . . . | 7-1  |
| Installation . . . . .             | 7-2  |
| Hardware Description . . . . .     | 7-4  |
| Fault Finding . . . . .            | 7-9  |
| Interface Board . . . . .          | 7-12 |
| Level 1 Diagnostics . . . . .      | 7-12 |

#### SCHEMATICS

|   |     |
|---|-----|
| Wiring Block Diagram Monochrome Dual Flexible Disk System . . . . . | 8-1 |
| Wiring Block Diagram Color Dual Flexible Disk System . . . . .      | 8-2 |
| Wiring Block Diagram Flexible/Fixed Disks . . . . .                 | 8-3 |
| PCB and Schematic Compatibility . . . . .                           | 8-4 |

# SYSTEM OVERVIEW

## INTRODUCTION

This manual is arranged in the following sections:

1. General information about the NCR DECISION MATE V including model number and feature kit descriptions.
2. Information on how to remove and replace the major assemblies that make up the computer.
3. How to locate problems without the aid of the diagnostic module. How to make use of the level 0 diagnostics which function automatically each time the computer is switched on.
4. How to use the diagnostic module (level 1 diagnostics), and an explanation of the diagnostic messages.
5. Adjustment information for the CRT and disk drives.
6. Tables and charts showing plug/pin assignments, strapping information, test points, and the location of the major components on the controller board.
7. Free-standing Winchester Disk Drives
8. Schematics

For detailed information on how to repair the disk drives, printers, or any other peripherals, refer to the appropriate service publication.

For information on parts identification refer to either the appropriate microfiche or the printed version of the parts catalog.

## GENERAL DESCRIPTION

The basic version of the NCR DECISION MATE V consists of a processor unit and a cable-connected keyboard. The processor contains the following assemblies:

- 12-inch CRT monitor
- One or two disk drives
- Power supply and cooling fan
- Controller board with processor and memory
- User-accessible connectors for peripherals and features

Various versions of the NCR DECISION MATE V are available. The processor may be either 8-bit, capable of using only 8-bit software, or, with the addition of the 16-bit processor board, it becomes a dual 8/16-bit processor, capable of using either 8- or 16-bit software.

The memory capacity of the main board is 64K bytes, this may be increased, up to a maximum of 512K bytes, by adding one of the various memory modules that are available. However, the 8-bit operating system is capable of addressing only 64K bytes of main memory. Attached to the main board is a graphics controller board: for monochrome systems the graphics controller board has an additional 32K bytes of memory, for color systems the graphics controller board has an additional 96K bytes of memory. The additional memory is used for operating in the graphics mode and leaves the main memory fully available for the normal software.

The CRT may be either monochrome with a green display on a dark background, or color, with the following range of colors: black, white, red, green, blue, yellow, magenta, and cyan.

The disk drives may be either one or two 5 1/4-inch flexible disk drives, each with a formatted capacity of either 320 Kbytes or 360 K bytes depending on the type of operating system that is used, or one flexible disk and one Winchester style fixed disk unit with a capacity of 10 megabytes.

Keyboards are available for most languages, and the different peripheral adapters allow the connection of a wide range of printers, modems, and terminals.

## **96 TPI FLEXIBLE DISK**

This feature (F410) increases the storage capacity of the disk drive models to 800 K bytes arranged in 5-sector format with 160 tracks each. Sectors are laced in the order 1 - 4 - 2 - 5 - 3.

Performance: F410 can read from disks with a recording density of 96 TPI as well as 48 TPI, thus permitting 48 and 96 TPI data transfer from 48 TPI systems to F410-improved systems. However, since F410 recording capability is limited to 96 TPI only, no data can be written to files in 48 TPI format.

A system with F410 requires the following new operating systems:

- \* D006 - 0051 - 2000 when using CP/M-80
- \* D006 - 0052 when using MS-DOS
- \* D006 - 0181 when using p-System

The following operating systems are not suitable for F410 operation:

- \* D006 - 0065 - 0000 = CP/M-86
- \* D006 - 0177 - 1000 = CP/M-80 Arabic
- \* D006 - 0194 - 0200 = MS-DOS Arabic.

## MODEL NUMBER DESCRIPTION

The configuration of the equipment is defined by the model number. The standard arrangement of the model number is shown below.

The model number of the NCR DECISION MATE V is shown in Figure 1.1. The optional features are shown in Figure 1.2. An asterisk (\*) indicates a planned development not released at the time of printing and included for future reference. This information allows you to determine the exact configuration of the equipment you are servicing and helps in ordering spare parts.

## TOOLS

A normal set of hand tools for an electronic engineer is sufficient to service the computer. A meter with a minimum internal resistance of 20,000 ohms per volt should be used for any electrical measurements. For flexible disk adjustments only disk 603-9009167 (48 TPI) or disk 603-9009169 (96 TPI) must be employed.

| Class       | 3273                       | NCR Class Number  |
|-------------|----------------------------|---|
| Major Model | 01<br>11<br>12             | 8-bit Proc./12" CRT Monochrome<br>8/16-bit Proc./12" CRT Monochrome<br>8/16-bit Proc./12" CRT Color                             |
| Sub-Model   | 01<br>02<br>03             | One 5 1/4" Flex Disk Drive<br>Two 5 1/4" Flex Disk Drives<br>One 5 1/4" Flex Disk Drive and one<br>5 1/4" Winchester Fixed Disk |
| Power Code  | 60<br>65<br>70<br>74<br>75 | 120 V, 50/60 Hz<br>220 V, 50/60 Hz<br>100 V, 50/60 Hz<br>230 V, 50/60 Hz<br>240 V, 50/60 Hz                                     |

Figure 1.1 Model number description 1 of 2

|   |                        |                       |
|---|------------------------|-----------------------|
| Language Code                                       | 00                     | U.S. English          |
|   | 01                     | International English |
|   | 02                     | U.K. English          |
|   | 03                     | Spanish               |
|   | 04                     | Portuguese            |
|   | 05                     | French                |
|   | 06                     | German                |
|   | 07                     | Dutch                 |
|   | 08                     | Flemish               |
|   | 09                     | Swedish               |
|   | 10                     | Danish                |
|   | 11                     | Norwegian             |
|   | 12                     | Italian               |
|   | 13                     | Greek                 |
|   | 14                     | Yugoslavian           |
|   | 15*                    | Japanese/Katakana     |
|   | 16*                    | Taiwanese             |
|   | 17                     | Arabic                |
|   | 18*                    | Iranian               |
|   | 19*                    | Hebrew                |
| 20  | Finnish                |                       |
| 25  | Latin American/Spanish |                       |
| 42  | Canadian               |                       |
| 33  | South African          |                       |
| 40  | Swiss                  |                       |
| * Not yet released but shown for reference purposes |                        |                       |

Figure 1.1 Model number description 2 of 2

| Kit Number | Description                              |
|------------|--|
| 3273-K018  | Second flexible disk upgrade             |
| 3273-K200  | 64 to 128 KB memory upgrade              |
| 3273-K202  | 64 to 256 KB memory upgrade              |
| 3273-K208  | 64 to 512 KB memory upgrade              |
| 3273-K210  | Centronics parallel I/F & cable          |
| 3273-K211  | RS-232C serial I/F & modem cable         |
| 3273-K212  | RS-232C serial I/F & printer cable       |
| 3273-K213  | RS-232C serial I/F & plotter cable       |
| 3273-K214  | Blank interface adapter & bus connector  |
| 3273-K215  | Buffered Sync/Async RS-232C adapter      |
| 3273-K216  | SCC communication cartridge              |
| 3273-K219  | Integrated modem                         |
| 3273-K220  | Diagnostic module                        |
| 3273-K223  | DLC inhouse I/F adapter                  |
| 3273-K225  | Diagnostic diskette                      |
| 3273-K231  | Dual 8/16-bit processor upgrade          |
| 3273-K232  | Numeric Coprocessor                      |
| 3273-K233  | Shared RAM cartridge                     |
| 3273-K234  | 68008 processor board                    |
| 3273-K235  | 16-bit processor with interr. controller |
| 3273-K240  | Tilt device                              |
| 3273-K250  | Arabic upgrade                           |
| 3273-K600  | Omninet transporter                      |
| 3273-K801  | Switchable RS-232C adapter               |
| 3273-K803  | Real-time clock                          |
| 3273-K804  | IEEE-488 adapter                         |
| 3273-K806  | Mouse adapter                            |
| 3273-K880  | Cartridge lock                           |

Figure 1.2 Kits

**CAUTION**

Electrostatic discharge can cause damage to some of the components used in this computer. Before starting to work on the computer, with the covers removed, move the computer to a static-free area. Use special wrist-grounding straps, or other means to be sure that you do not cause a static discharge problem. When handling the circuit boards avoid touching the components or the printed circuits as much as possible: handle the boards by their edges.

**SITE PREPARATION**

Normally special site preparation is not necessary, however, the following data is provided for reference purposes.

**WEIGHT**

|                           | Net                 | Shipping            |
|---------------------------|---------------------|---------------------|
| 3273 (Mono, single flex.) | 22 kg<br>(48.5 lb.) | 28 kg<br>(61.7 lb.) |
| 3273 (Mono, dual flex.)   | 23 kg<br>(50.7 lb.) | 29 kg<br>(63.9 lb.) |
| 3273 (Mono, fixed/flex.)  | 28 kg<br>(61.7 lb.) | 36 kg<br>(79.3 lb.) |
| 3273 (Color, dual flex.)  | 28 kg<br>(61.7 lb.) | 36 kg<br>(79.3 lb.) |
| 3273 (Color, fixed/flex.) | 30 kg<br>(66.1 lb.) | 38 kg<br>(83.8 lb.) |
| Keyboard                  | 1.9 kg<br>(4.2 lb.) | Included<br>in 3273 |
| 3282 (All models)         | 12 kg<br>(26.5 lb.) | 16 kg<br>(35.3 lb.) |

**DIMENSIONS**

|                     | Width                | Height               | Depth                |
|---------------------|----------------------|----------------------|----------------------|
| 3273                | 460 mm<br>(18.1 in.) | 350 mm<br>(13.8 in.) | 365 mm<br>(14.4 in.) |
| 3273<br>(footprint) | 460 mm<br>(18.1 in.) |                      | 255 mm<br>(10.0 in.) |
| Keyboard            | 430 mm<br>(16.9 in.) | 38 mm<br>(1.5 in.)   | 216 mm<br>(8.5 in.)  |
| 3282                | 260 mm<br>(10.2 in.) | 183 mm<br>(7.2 in.)  | 380 mm<br>(14.9 in.) |

## CABLES

|          | Power               | Interconnection   |
|----------|---------------------|---|
| 3273     | 3.5 m<br>(11.5 ft.) | 2.0 m (Adapters)<br>(6.6 ft.)                             |
| Keyboard |                     | 0.5 m (Extendable)<br>(1.6 ft.)                           |
| 3282     | 3.5 m<br>(11.5 ft.) | 2.0 m (3282 to 3273)<br>(6.6 ft.)<br>0.5 m (3282 to 3282) |

## VOLTAGE AND FREQUENCY

|                      | Voltage<br>Nominal<br>(Vac) | Voltage<br>Range<br>(Vac) | Frequency<br>(Hz) |
|----------------------|-----------------------------|---------------------------|-------------------|
| 3273<br>(All models) | 100                         | 90-107                    | 49-61             |
|                      | 120                         | 104-127                   | 49-61             |
| 3282<br>(All models) | 220                         | 198-235                   | 49-61             |
|                      | 230                         | 207-246                   | 49-61             |
|                      | 240                         | 216-257                   | 49-61             |

## POWER

|                           |                                    |
|---------------------------|------------------------------------|
| 3273 (Mono, single flex.) | 70 Watts<br>250 Watts<br>300 Watts |
| 3273 (Mono, dual flex.)   |                                    |
| 3273 (Mono, fixed/flex.)  |                                    |
| 3273 (Color, dual flex.)  |                                    |
| 3273 (Color, fixed/flex.) |                                    |
| 3282 (Single or Master)   | 65 Watts<br>55 Watts               |
| 3282 (Secondary)          |                                    |

For information on fuse ratings see Section 6.

## REMOVAL/REPLACEMENT

This section describes how to remove and replace the major assemblies of the NCR DECISION MATE V.

Remember that this manual is designed to include all assemblies that may be used in the NCR DECISION MATE V, therefore be sure that the correct procedure is used since not all features are in every system.

In some of the figures, assemblies are not shown for reasons of clarity. It is only necessary to remove what is described in the text.

When a complete assembly is replaced, contact your supplier or NCR office for information concerning the possible repair of the defective assembly.

### WARNING

Disconnect the power cord before removing the cabinet. Dangerous voltages are present when working on NCR DECISION MATE V with the covers removed. Only trained engineers should attempt to work on the computer with the covers removed.

Do not leave the computer unattended with power applied and the covers removed.

### CABINET

To remove the cabinet refer to Figure 2.1 and use the following procedure.

1. Be sure the on/off switch is in the off position.
2. Disconnect the power cable A.
3. Disconnect any peripheral adapters B.
4. Remove the four retaining screws C.
5. Remove rear cover.
6. Slide the front cover forwards and upwards.

To re-assemble, use the above procedure in the reverse order.

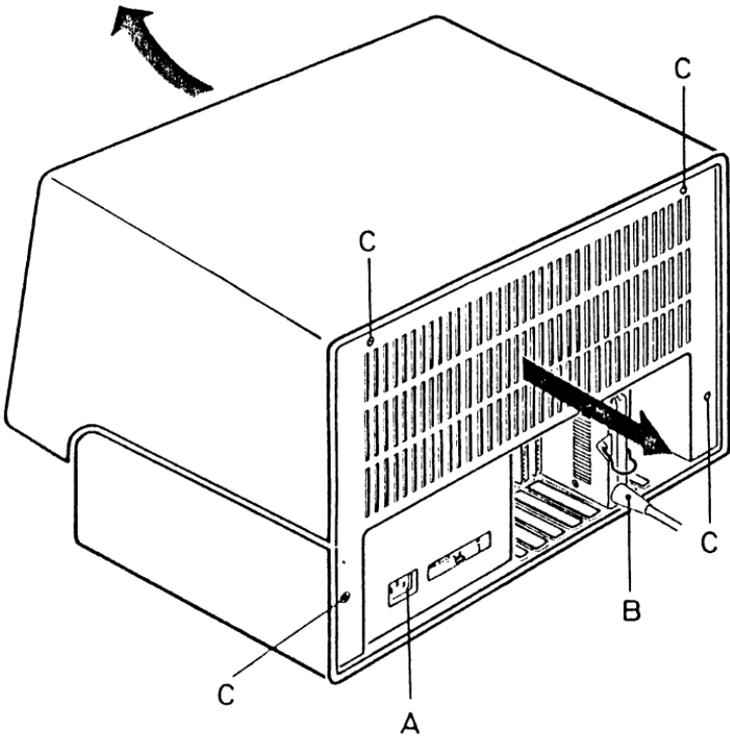


Figure 2.1 Cabinet removal

## FAN

Remove cabinet, refer to Figure 2.2 and use the following procedure:

1. Disconnect two wires A from the fan.
2. Remove two screws B and remove fan.

To replace the fan, ensure that the fan is the correct way round and use the above procedure in the reverse order. Be sure to connect the red lead to the positive terminal and the blue lead to the negative terminal.

Before handing the computer back to the operator, check that the fan is blowing air out of the back of the cabinet.

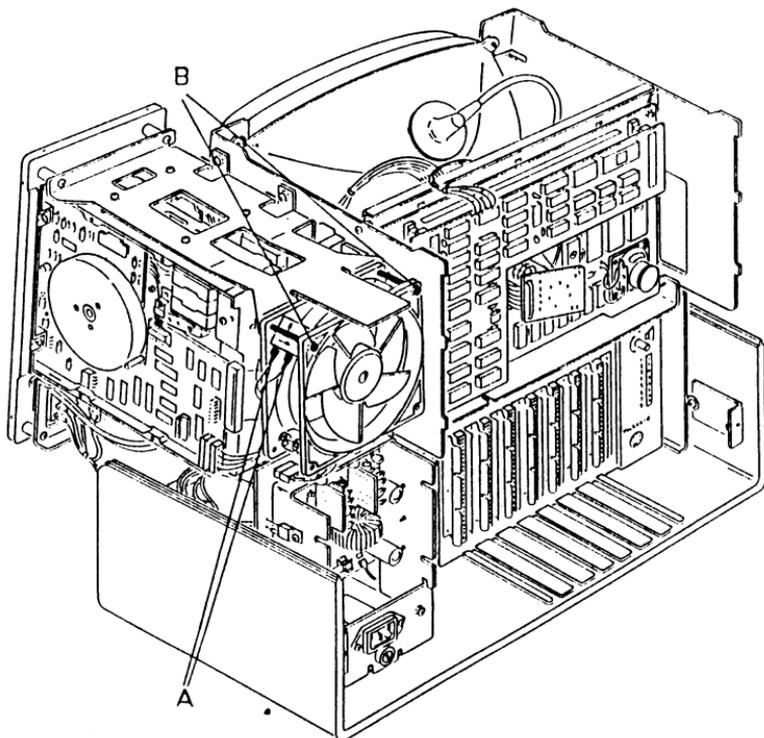


Figure 2.2 Fan removal

## POWER SUPPLY

Two styles of power supply are used on the NCR DECISION MATE V:

1. With separate rectifier and regulator boards.
2. With rectification and regulation combined on one board.

Procedures for both types are given; use the appropriate procedure.

### REGULATOR BOARD (SEPARATE)

Remove cabinet, refer to Figure 2.3 and use the following procedure:

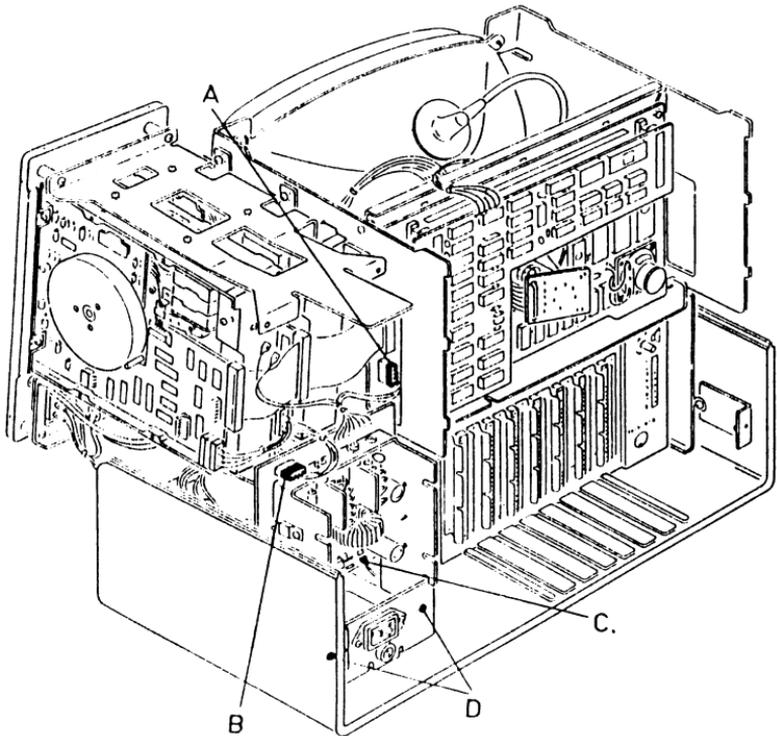


Figure 2.3 Regulator board (separate) removal

1. Disconnect connector A from controller board
2. Disconnect connector B from regulator board
3. Disconnect wire C from regulator board
4. Remove two screws D and lift out regulator board.

To replace the regulator board, use the above procedure in the reverse order.

### REGULATOR/RECTIFIER BOARD (COMBINED)

Remove cabinet, refer to Figure 2.4 and use the following procedure:

1. Disconnect connector A from controller board
2. Identify and disconnect four wires B from the board
3. Disconnect connector C from regulator/rectifier board
4. Remove two screws D and remove board

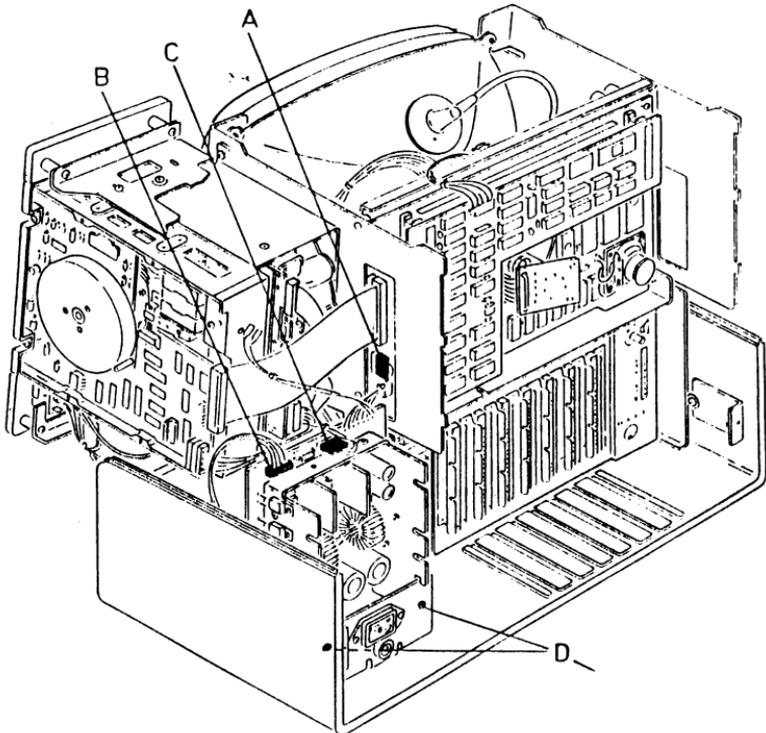


Figure 2.4 Regulator/rectifier board removal

To replace board, use the above procedure in the reverse order.  
Be sure to replace the four wires (B) in the correct locations:

- TB11-1 Green
- TB11-2 Red
- TB11-3 Black
- TB11-4 White

**RECTIFIER BOARD**

Remove cabinet, refer to Figure 2.5, and use the following procedure:

1. Disconnect the lead A from the rectifier board.
2. Press the ends of the metal band B together and remove it.
3. Remove two screws C.
4. Partially remove the board so that you can reach the screws on TB1 D and TB2 E: loosen the screws and disconnect the four leads. The board may now be removed.

To reassemble, use the above procedure in the reverse order. Make sure that the wires are connected correctly.

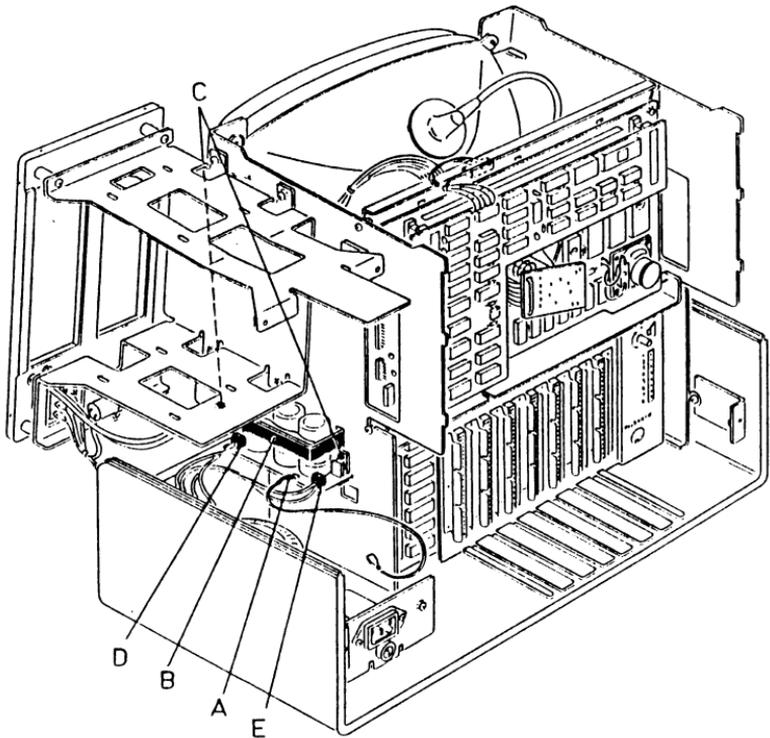


Figure 2.5 Rectifier board removal

## FLEXIBLE DISK DRIVES

The procedure for the removal of either flexible disk drive is similar. Remove cabinet, refer to Figure 2.6 and use the following procedure:

1. Disconnect connector A
2. Disconnect connector B
3. Remove three screws C and slide disk drive out through the front cover (see Figure 2.7).

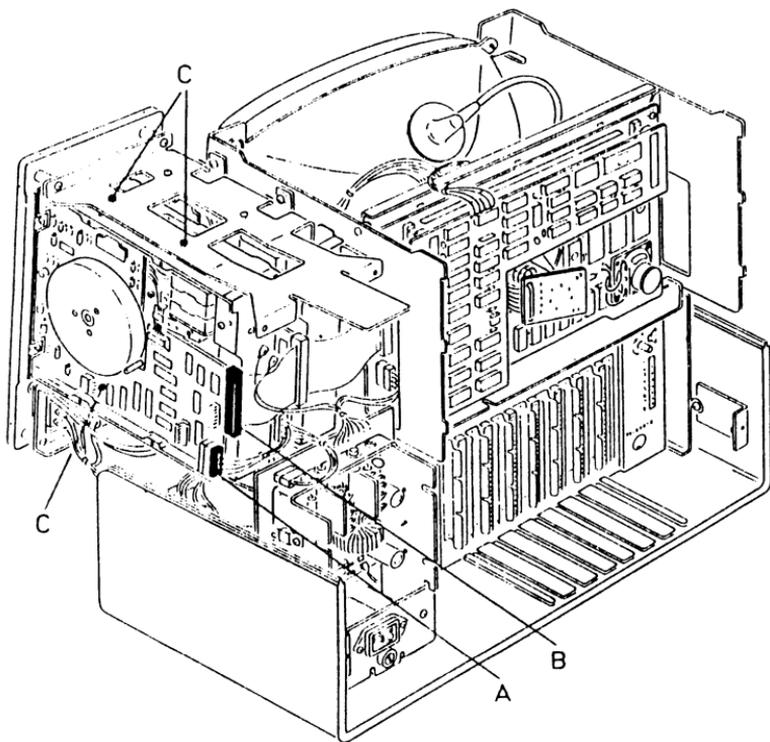


Figure 2.6 Disconnect flexible disk drive

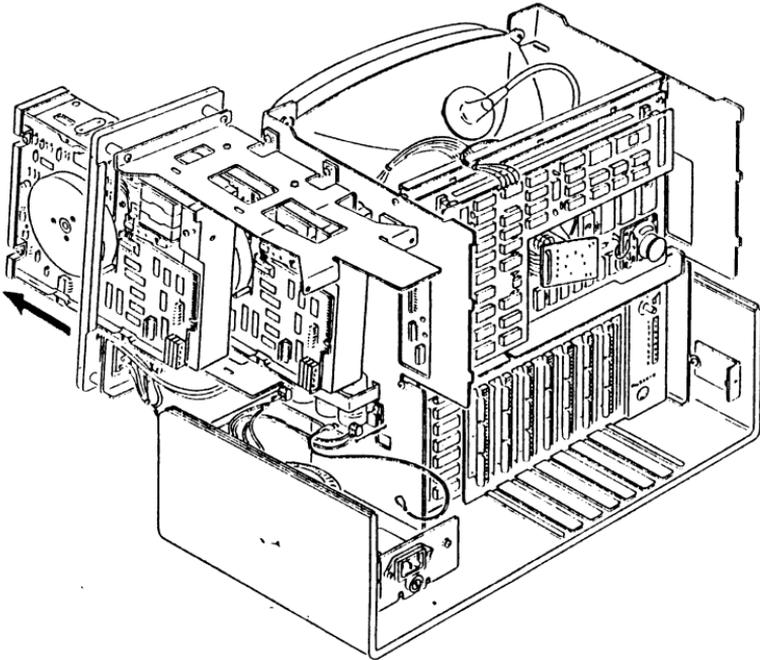


Figure 2.7 Flexible disk drive removal

**NOTE:** Be sure that the disk drives are replaced in the correct positions: the drive that is strapped DS0 nearest to the CRT, the drive that is strapped DS1 nearest to the side of the cabinet.

On systems that have a fixed disk (Winchester) drive, the flexible disk drive is always strapped DS0, and has a terminator resistor installed.

To replace a disk drive, use the above procedure in the reverse order. Do not forget to check the following points.

1. If both drives have been removed, then they must be replaced in their respective positions.
2. The front of the drive unit should be aligned with the front of the cabinet.

## CONTROLLER MODULE

The controller module consists of two or three parts:

- Controller board
- Graphics board
- 16-bit board (optional)

This description shows how to remove the complete module; the separate parts of the module can then be easily separated.

To remove the controller module, remove the cabinet, refer to Figure 2.8 and use the following procedure:

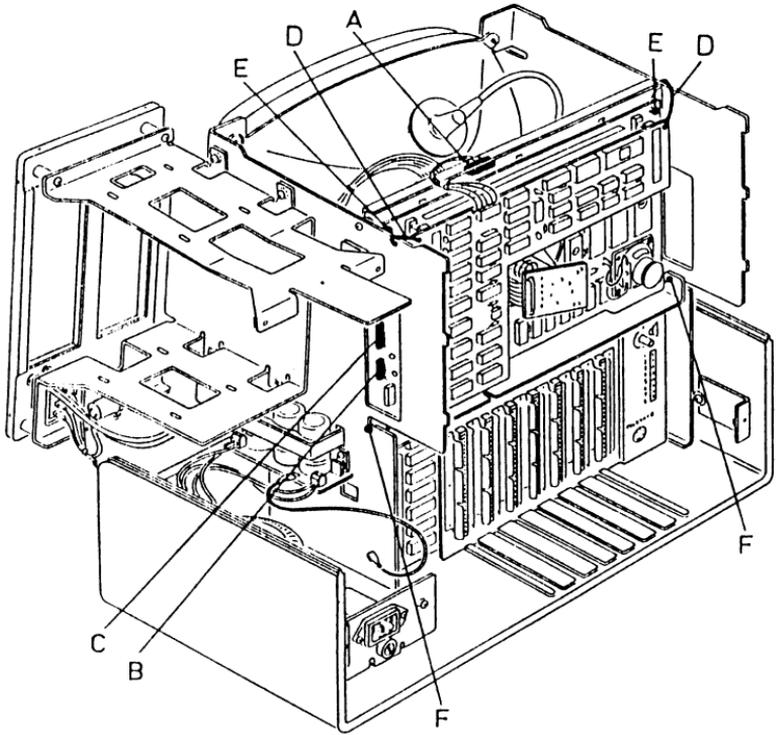


Figure 2.8 Controller module removal

1. Disconnect connector on CRT board A.
2. Disconnect connector B from controller PCB.
3. Disconnect connector C from controller PCB.
4. Remove two plastic ties D.
5. Remove two screws E.
6. Loosen two screws F and lift out controller board.

NOTE: On systems with a fixed (Winchester) disk drive, disconnect Fixed Disk Interface P2A on the solder side of the controller board before it is completely removed.

To reassemble use the above procedure in the reverse order.

### MONOCHROME CRT DEFLECTION BOARD

To remove the deflection board remove the cabinet, refer to Figure 2.9 and use the following procedure:

1. Remove the small circuit board A from the rear end of CRT.
2. Disconnect the lead B from the circuit board, and feed the board through the holes in the controller board and the frame.
3. Disconnect the connectors C, D, and E. (It may help to lift the deflection board slightly to assist in reaching connector E.)
4. Discharge the CRT High Tension lead by connecting a 1 megohm resistor between the high tension lead and ground for a minimum of 10 seconds.
5. Disconnect high tension lead F.
6. Push the three plastic clips G out of the frame, remove, and lift out deflection board.

The deflection board is replaced by using the above procedure in the reverse order.

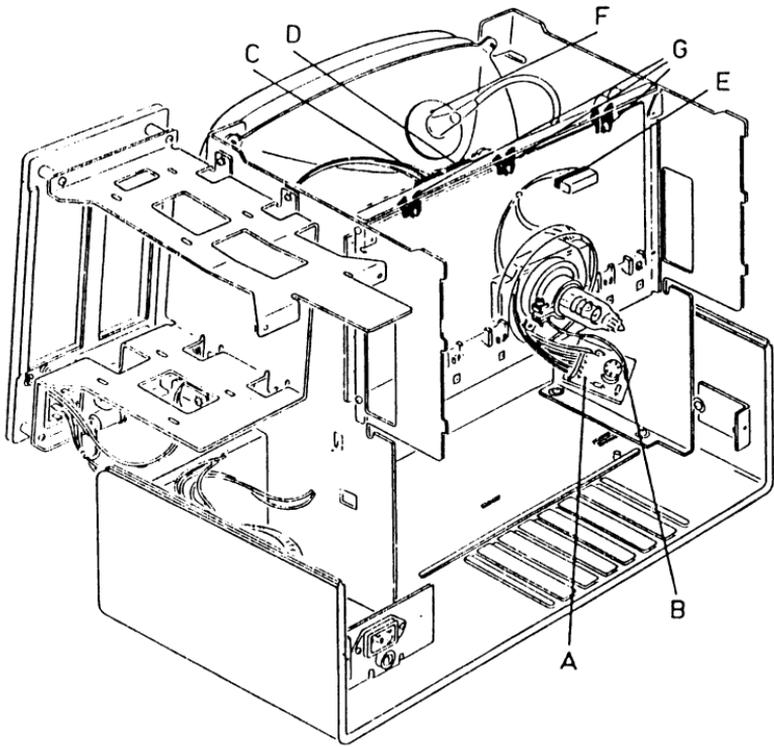


Figure 2.9 CRT deflection board removal

### FIXED (WINCHESTER) DISK DRIVE

Remove cabinet, and flexible disk drive. Refer to Figure 2.10 and use the following procedure:

1. Remove plastic insulator A, between the flexible and fixed disk drives.
2. Disconnect the three connections B, C, and D from the disk drive.
3. Remove 3 screws E, see Figure 2.11.
4. Carefully slide the drive unit out of the side of the housing; take care not to damage the paper insulator F surrounding the drive unit (if installed).

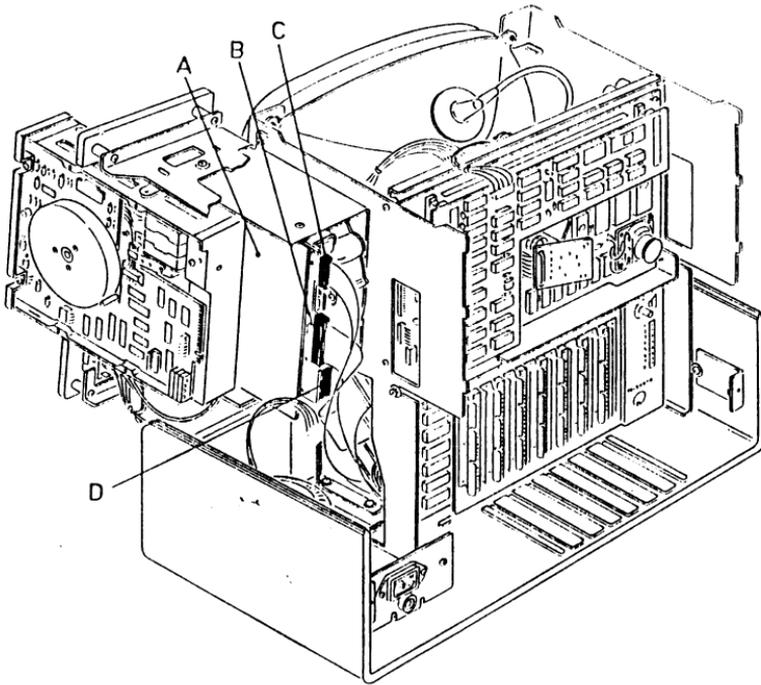


Figure 2.10 Disconnecting fixed disk

Use the above procedure, in reverse order, to replace the disk drive. Be sure that the paper insulator is fitted around the disk drive, and the plastic insulator is fitted between the disk drives.

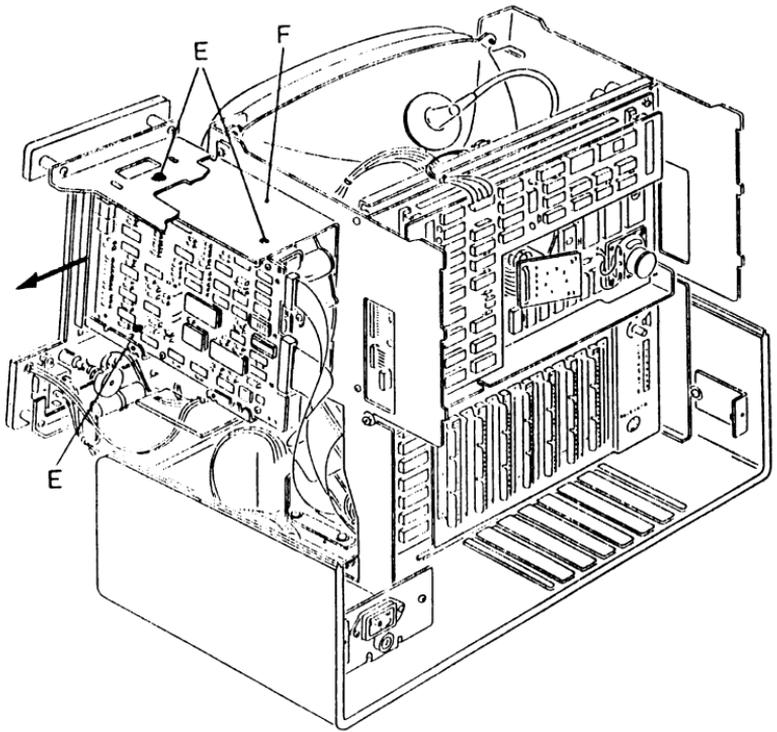


Figure 2.11 Fixed disk removal

## FIXED DISK CONTROLLER BOARD

Remove cabinet and controller module, refer to Figure 2.12, and use the following procedure:

1. Disconnect the connectors A, B, C, and D.
2. Press in the retaining detents of the plastic stand-offs E, and carefully lift the fixed disk controller board off the mounting plate, see Figure 2.13.

To reassemble, use the above procedure in the reverse order.

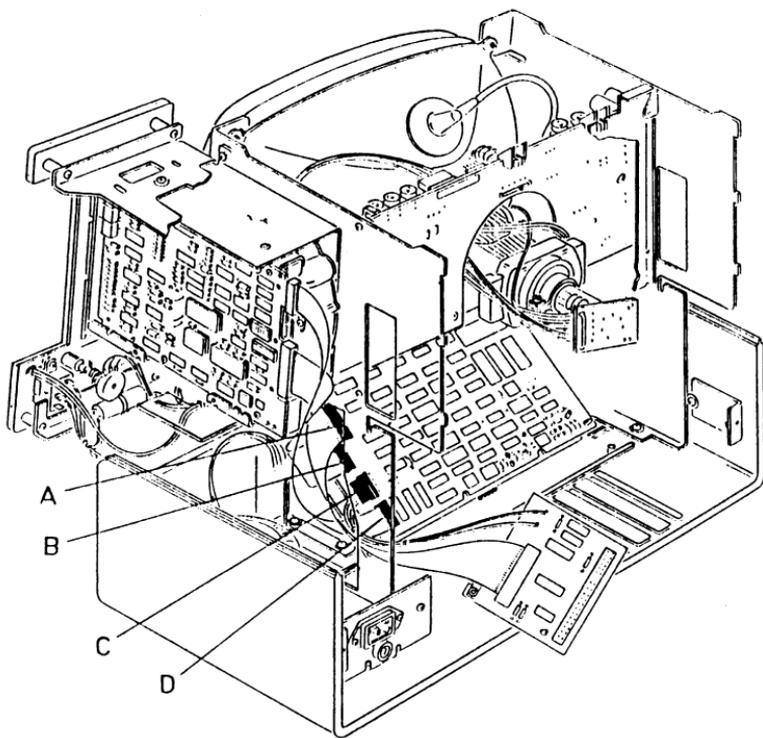


Figure 2.12 Disconnecting fixed disk controller

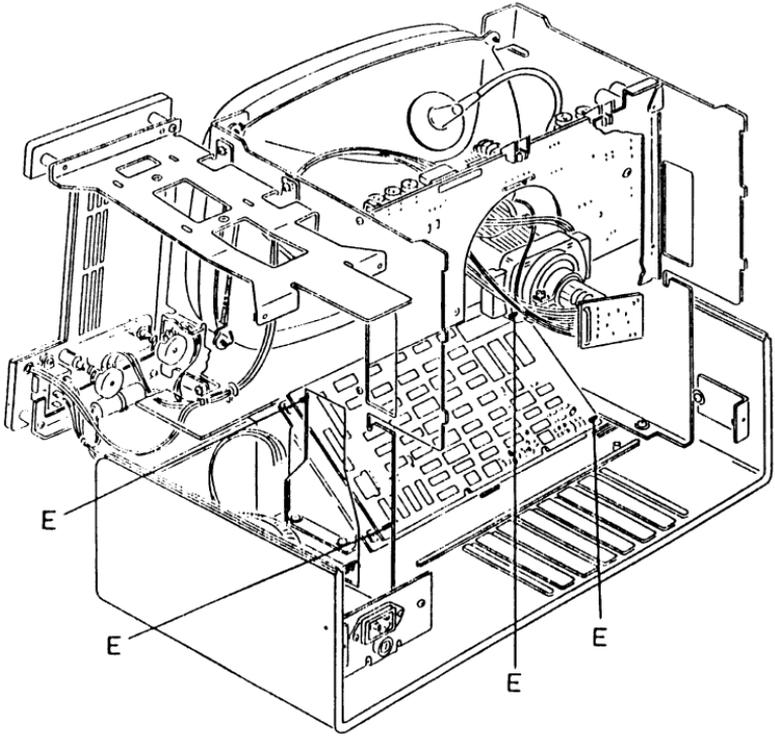


Figure 2.13 Fixed disk controller removal

**COLOR CRT DEFLECTION BOARD**

To remove the color deflection board remove the cabinet, refer to Figure 2.14 and use the following procedure:

1. Remove the circuit board A from the rear of the CRT.
2. Disconnect connectors B and C from the top of the deflection board.
3. Disconnect the connector D from the graphics PCB.
4. Disconnect ground connector E from the CRT.
5. Remove plastic tie F from the top left corner of the controller board assembly.
6. Remove plastic tie G from lower front corner of CRT.
7. Discharge the CRT High Tension lead by connecting a 1 megohm resistor between the high tension lead and ground for a minimum of 10 seconds.
8. Remove the high tension lead from the CRT.
9. Remove the four plastic clips H from the top of the deflection board.
10. Partially lift the deflection board and disconnect the connector J from the deflection board. The board may now be completely removed.

Replace the deflection board by using the above procedure in the reverse order.

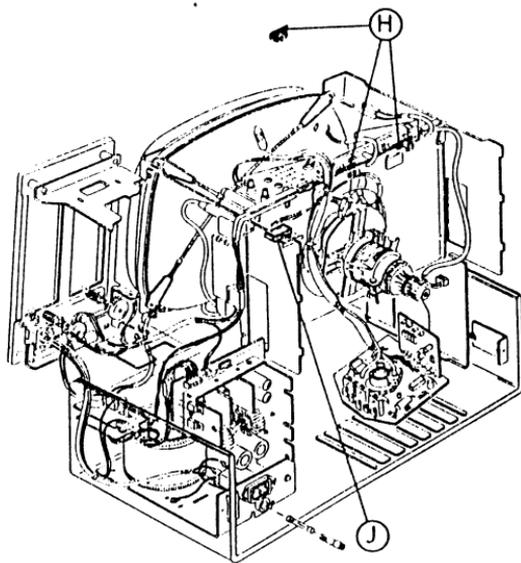
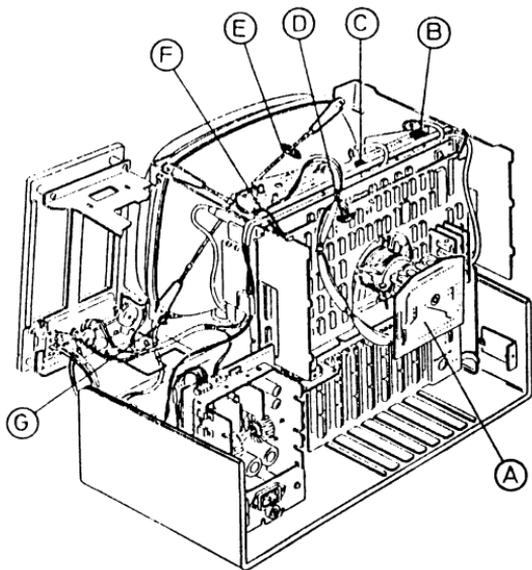


Figure 2.14 Color Deflection Board Removal

## PROBLEM ISOLATION

This section describes fault finding procedures without the use of the diagnostic module. For a description of how to use the diagnostic module refer to section 4.

### STARTUP

With no flexible disk installed, when the NCR DECISION MATE V is switched on the normal responses are:

- The power LED (green) turns on and a long "beep" tone sounds.
- Air flow from the rear of the processor can be detected (indicating that the fan is functioning, the fuse F1 is intact, and the power supply is providing raw dc).
- All level 0 diagnostic LEDs are off.
- After a few moments the following message is displayed:

DISK A: NOT READY (CR)

With a problem during startup, there may be one or more of the following responses:

- Power LED does not turn on.
- "Beep" tone does not sound.
- One or more of the level 0 diagnostic indicators are lit.
- Incorrect or no display on the CRT screen.

Push the power on/off switch to the off position, wait for two or three seconds, and then push the on/off switch to the on position. If the computer does not respond in the normal manner check and make a note of the level 0 diagnostic LEDs. If any of the level 0 diagnostic LEDs are lit refer to the description under "Level 0 Diagnostics" in this section. If the level 0 diagnostic LEDs do not turn on, refer to the description under "Power Supply" in this section.

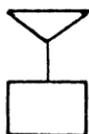
## POWER SUPPLY

If the NCR DECISION MATE V fails to perform a correct startup, check the power supply as described below. It is assumed that the wall outlet and the condition of the power cable have been verified.

Start

Connect meter between transformer secondary terminals – Green lead and Red lead, or Black lead and White lead

Is voltage approximately 24 Vac?



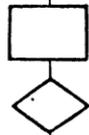
No  
Yes

Possible causes:

- Primary fuse F1 blown
- On/Off switch S1 faulty
- Transformer T1 faulty
- Input wiring faulty

Connect meter between P10 on regulator board and ground

Is voltage approximately 24 Vdc?



No  
Yes

Possible causes:

- Connection between regulator board (P10) and rectifier board (P2) faulty
- CR1/CR2 faulty (old style power supply)
- C1, C2, C3 or R1 faulty

Disconnect J11 from regulator board, disconnect J112 from controller board

Connect negative lead of meter to P11-2/3 (Gnd)

Are voltages at P11-1 (+12V) and P11-4 (+5V) correct?



No  
Yes

Possible causes:

- Regulator board fuse F10 blown
- Faulty regulator board

Figure 3.1 Power problem flowchart (1 of 2)

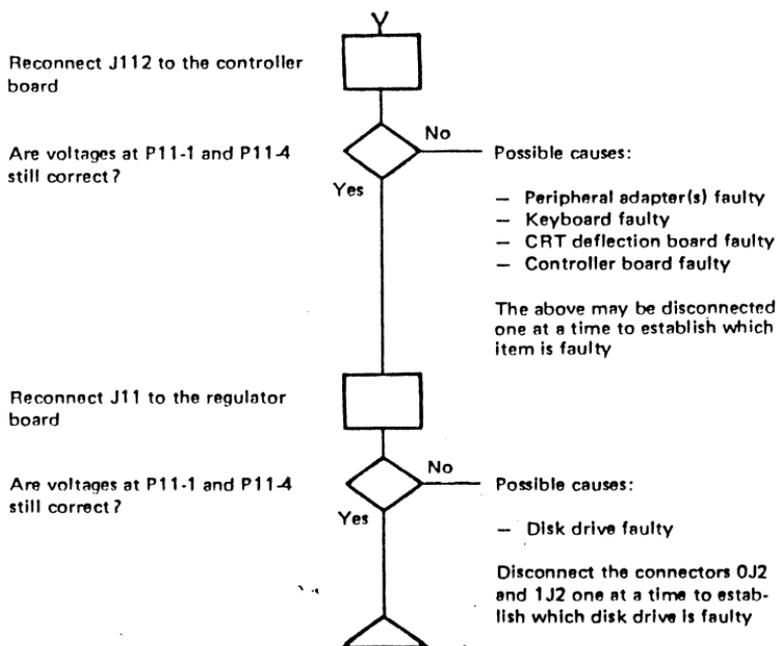


Figure 3.1 Power problem flowchart (2 of 2)

For bench testing the regulator board may have power applied without connecting any load to the board outputs.

## LEVEL 0 DIAGNOSTICS

The level 0 diagnostics are contained in the ROM firmware and check the controller hardware and microprocessor functions necessary for the operation of the level 1 diagnostics.

The level 0 diagnostics are automatically performed every time the unit is switched on. Eight LEDs are located at the back of the processor cabinet; these indicate the failing area as shown in Figure 3.2.

| LEDs       | Failing Area                       | Suspected Components |                 |
|------------|------------------------------------|----------------------|-----------------|
|            |                                    | Up to<br>T/N 255     | From<br>T/N 256 |
| 1 and 8 On | Sumcheck error                     | C15                  | D14             |
| 2 and 8 On | CRT controller                     | C20                  | GDC Board       |
| 3 and 8 On | Flexible disk controller           | D7                   | D6              |
| 4 and 8 On | 16-bit processor                   | —                    | 16-Bit Board    |
| 5 and 8 On | Keyboard controller                | C22                  | C19             |
| 6 and 8 On | DMA controller                     | C17                  | C16             |
| 7 and 8 On | Memory (RAM)                       | F2 - N2              | G2 - P2         |
| All On     | Processor                          | C18                  | C17             |
| All Off    | Diagnostics completed successfully |                      |                 |

Figure 3.2 Level 0 diagnostics

## FLEXIBLE DISK DRIVES

If similar failures are occurring with both flexible disk drives, then the problem is most likely to be the flexible disk interface on the controller board. Replace the controller board using the procedure given in section 2.

If only one flexible disk drive is suspected, then the functioning of the disk drive can be quickly checked by exchanging the two drives with each other. Use the following procedure to exchange the disk drives.

1. Remove both disk drives, referring to section 2 for the correct procedure.
2. Refer to Figure 3.3 and remove the terminator resistors from drive 1. Re-install the resistors in the same location in drive 0.
3. Change the strapping on both drives so that the original drive 0 is strapped as drive 1: the original drive 1 is strapped as drive 0.

4. Re-install the drives with drive 0 in the leftmost position, and drive 1 in the rightmost position.

If the suspected drive unit still gives problems after being moved, replace the unit. The new unit must be strapped correctly before installation.

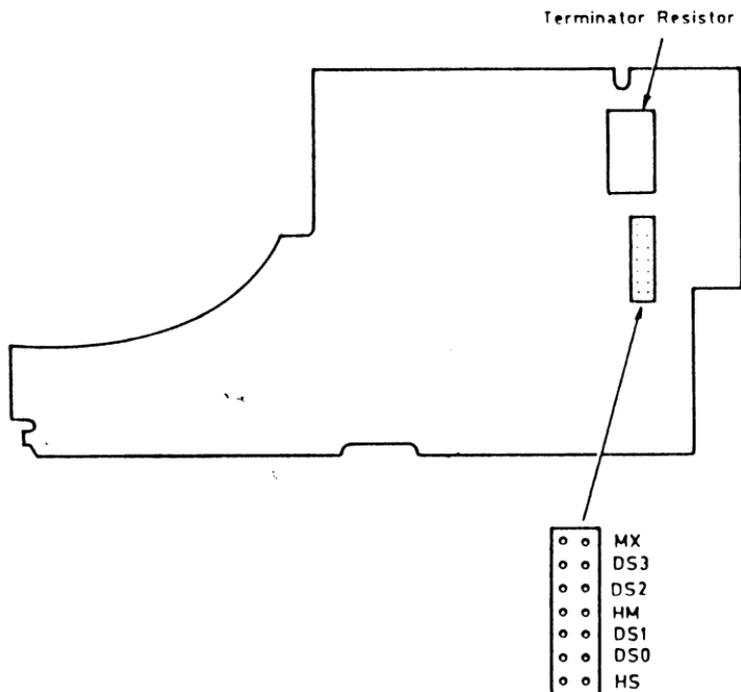


Figure 3.3 Strapping locations

### ADAPTER DIAGNOSTICS (K225)

A diagnostic disk, complete with description, is available for testing the optional adapters that can be used with the NCR DECISION MATE V.

To order this kit, use part number 998 - 0612480.



## LEVEL 1 DIAGNOSTICS

### GENERAL DESCRIPTION

The level 1 diagnostic facility is contained in a module which can be plugged into the system bus at slot 7 on the rear of the cabinet. A small control panel on the module contains eight function and mode switches, one reset switch, nine LEDs, and two 7-segment displays. Refer to Figure 4.1.

The NCR DECISION MATE V +5V and +12V power supplies are monitored by the diagnostic module, and under, over ( $\pm 6\%$ ), or correct voltages are indicated by 6 LEDs. A memory read indicator (MEMR/) is illuminated if memory read cycles are being performed by the NCR DECISION MATE V. Another LED (PCLK), is lit if the microprocessor clocks are running. A hold acknowledge indicator (HOLDA), is lit if the microprocessor is not in a hold state.

These indicators are lit if the NCR DECISION MATE V is running, even if the diagnostic module is switched off.

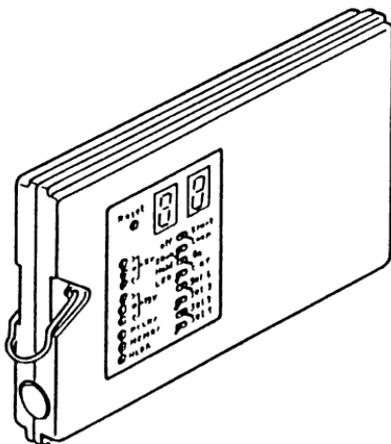


Figure 4.1 Diagnostic module

## OPERATION

### SWITCH FUNCTIONS

There are eight function/test switches (Figure 4.2) on the diagnostic module, four switches to control the mode of operation, and four switches to select the various tests.

| OFF  | ON    |
|------|-------|
| Off  | Start |
| Run  | Loop  |
| Hold | Go    |
| LED  | CRT   |
|      | Sel 4 |
|      | Sel 3 |
|      | Sel 2 |
|      | Sel 1 |

Figure 4.2 Diagnostic module switches

#### Off/Start Switch

- Off — diagnostic module not active (LEDs active)
- Start — diagnostic module active and operational

#### Single Run/Loop Switch

- Used together with the Hold/Go switch
- This switch is only active if the LED/CRT switch is in the LED position
- Single Run — together with the Hold/Go switch in the Hold position, the selected test is performed. If an error is detected, the error code is displayed. Momentarily switching the Hold/Go switch to the Go position allows the test to continue
- Loop — together with the Hold/Go switch in the Hold position, the selected test is performed. If an error is detected, the error code is displayed. If no errors are detected, the entire test sequence is repeated
- Loop — together with the Hold/Go switch in the Go position, the entire test sequence is repeated without halting when an error is detected.

## Hold/Go Switch

- Used together with the Single Run/Loop switch
- This switch is only active if the LED/CRT switch is in the LED position

## LED/CRT Switch

- LED — tests are selected by the diagnostic module switches; error messages are shown on 7-segment displays (LEDs); the selected test is displayed on the CRT
- CRT — a test menu is shown on the CRT; the tests are selectable by keyboard; error messages are shown on the CRT and LEDs

## Select Switches

The binary configuration of these four switches selects which test is performed. The switch settings are shown in Figure 4.3. These switches are only active if the LED/CRT switch is in the LED position.

| Test No. | Function Switch |   |   |   | Test Name              | Mode |      |
|----------|-----------------|---|---|---|------------------------|------|------|
|          | 4               | 3 | 2 | 1 |                        | LED  | CRT  |
| 0        | 0               | 0 | 0 | 0 | Firmware ROM sumcheck  | Yes  | Yes  |
| 1        | 0               | 0 | 0 | 1 | CRT controller         | Yes  | Yes* |
| 2        | 0               | 0 | 1 | 0 | Keyboard controller    | Yes  | Yes  |
| 3        | 0               | 0 | 1 | 1 | Memory                 | Yes  | Yes  |
| 4        | 0               | 1 | 0 | 0 | DMA controller         | Yes  | Yes  |
| 5        | 0               | 1 | 0 | 1 | Flex disk controller   | Yes  | Yes  |
| 6        | 0               | 1 | 1 | 0 | Main board             | Yes  | Yes  |
| 7        | 0               | 1 | 1 | 1 | Memory extension       | Yes  | Yes  |
| 8        | 1               | 0 | 0 | 0 | Keyboard               | Yes  | Yes  |
| 9        | 1               | 0 | 0 | 1 | CRT                    | Yes  | Yes  |
| A        | 1               | 0 | 1 | 0 | CRT adjustment         | Yes  | Yes  |
| B        | 1               | 0 | 1 | 1 | Disk drive             | No   | Yes  |
| C        | 1               | 1 | 0 | 0 | Disk drive adjustment  | No   | Yes  |
| D        | 1               | 1 | 0 | 1 | Hard disk              | No   | Yes  |
| E        | 1               | 1 | 1 | 0 | Centronics I/F printer | Yes  | Yes  |
| F        | 1               | 1 | 1 | 1 | Not used               | —    | —    |

\* Error codes are only displayed on the seven segment display.

Figure 4.3 Diagnostic module (version 3.00) test selection

## DIAGNOSTIC TESTS

### Test 0 – Sumcheck Test

This is a sumcheck test of the system firmware.

### Test 1 – CRT Controller Test

Write/Read of the Graphic RAM with pattern 55/AA, AA/55, 00/FF, FF/00, and 01/01 and 00/00 is performed. The faulty RAM bank number is displayed.

### Test 2 – Keyboard Controller Test

A self check command is sent to the keyboard controller on the main board and the returned status is checked for error.

### Test 3 – Memory Test

The memory is checked with 01, 02, 04, 08, 10, 20, 40, and 80. Directly following a Memory Address Decode Test is performed. The memory address is written into the addressed memory location. Processor waits for automatic refresh from dynamic RAM controller. After one second, all memory locations are read and verified with the written values.

### Test 4 – DMA Controller Test

A register Read/Write test with different bit pattern is performed and if the bit pattern does not match, an error code is displayed.

### Test 5 – Disk Controller Test

An invalid command is sent to the Disk Controller and the status register is checked.

### Test 6 – Main Board Test

It performs the entire set of component tests on the main board.

- Sumcheck Test
- CRT Controller
- Keyboard Controller
- Memory Test
- DMA Controller
- Flex Disk Controller

### Test 7 – Memory Extension Test

Checks first the amount of implemented extension memory. Next, every memory bank of 64 K Bytes is tested as described in Test 3.

After all banks are tested, a bank switching test is performed in the way that a memory location in every bank is written with the bank address. Then the values are read back and compared.

### Test 8 – Keyboard Test

Performs first the Keyboard Controller Test (Test 2). Next, the language code is read and displayed on the CRT. You can additionally test each key by pressing the key. The HEX code value and the character is displayed on the CRT. A keytone is also generated. If the LED/CRT switch is in the CRT position, terminate this test with the return key ( ↵ ).

### Test 9 – CRT Test

A series of test patterns are displayed on the CRT screen:

- A rectangle formed with asterisks
- A full screen display, with the character E
- A full screen display, using the complete character set
- A full screen display of any character entered through the keyboard if Loop is not selected.

Pressing any key (except Return) changes one of the above test patterns to the next.

### Test A – CRT Adjustment

An adjustment pattern is displayed on the CRT screen.

On color systems the test pattern is displayed in four different colors against a black background: press any key (except P) to display the next color. Also, color systems display a full screen in each of the eight colors against the black background: press any key (except P) to display the next color.

Pressing the P key displays the previous color pattern.

### Test B – Disk Drive Test

Only Version 4.0 and above will support testing of both 48 TPI (320/360K byte storage capacity) and 96 TPI drives (800K byte storage capacity). All other versions allow testing of 48 TPI drives only.

NOTE: Wrong selection of 48/96 TPI causes fatal program errors.

To check the drive, a scratch disk must be inserted. The selectable options are:

0. Change head to be tested
1. Recalibrate drive: position to track 0
2. Write format: track 27 (Hex) for 48 TPI, track 4F (Hex) for 96 TPI
3. Read ID
4. Write data: track 27 (Hex) for 48 TPI, track 4F (Hex) for 96 TPI
5. Read data and compare
6. Run tests 1-5
7. Format and verify whole disk
8. Write and read whole disk
9. Run tests 7 and 8
- A. Run tests 7 and 8 on both heads
- C. Change unit to be tested

### **Test C – Disk Adjustment**

For this diagnostic phase use alignment disk 603-9009167 (48 TPI) or disk 603-9009169 (96 TPI). As applicable to Test B above, only Version 4.0 and up will support both 48 and 96 TPI.

**NOTE:** Wrong selection of 48/96 TPI causes fatal program errors.

The following tests are performed on the selected drive and head:  
48 TPI (96 TPI)

1. Rotational speed, accurate to  $\pm 0.2$  ms
  2. Index timing measured on tracks 3 and 36 (3 and 74) on both heads
  3. Linearity of tracks 5, 19, and 39 (6, 41, and 71)
  4. Hysteresis measured on track 19 (41) after a seek from tracks 0, 18, 20, and 39 (0, 40, 42, and 79)
  5. Azimuth angles measured on track 34 (not measured) 6/7/8.
- Eccentricity
9. Head alignment on track 5 (6)
  - A. Track seek on tracks 0-9 (0-9)

### **Test D – Winchester Disk Drive Test**

(Version 4.0 and up allow testing with Winchester Controller WD 1002 (008-0072630). Test is divided into two parts; the menu for the first part contains the following options and tests:

0. Change head
1. Winchester disk controller test
2. Recalibrate, position to track 0
3. Write format (track 305)
4. Write data (track 305)
5. Read data and compare (track 305)
6. Run tests 2-5
7. Run test 2-5 on both heads
8. Run tests 2-5 on both platters
- C. Change platter
- D. Change drive
- E. Extended diagnostic

The menu for the second part (extended diagnostic) contains the following options and tests:

0. Change head
1. Format whole disk
2. Write whole disk
3. Read whole disk with verify
4. Run tests 1-3
5. Run tests 1-3 on both heads
6. Run tests 1-3 on both platters
7. Random read
- C. Change platter
- D. Change drive

**NOTE:** Extended diagnostic tests destroy all Winchester disk files.

When test D is used with the NCR 3282 Free-standing Disk Drive, the drives are selected as shown below.

- Single Drive — Drive C (Drive D for second platter)
- Primary Drive — Drive C (Drive D for second platter)
- 1st Secondary Drive — Drive E (Drive F for second platter)
- 2nd Secondary Drive — Drive G (Drive H for second platter)

To select desired drive and platter use following procedure:

- Select Winchester Disk Drive Test (Test D)
- (this automatically selects Drive C)
- Press C to select Drive D
- Press D to select Drive E, then press C to select Drive F
- Pressing D and C a second time selects Drives G and H

## Test E – Centronics Printer Interface Test

- Test if printer is ready, not busy and error status line reset
- A table is sent to the printer containing all characters from 20 to 7F (Hex) and A0 to FF (Hex).
- The paper advances and the test pattern prints as shown in Figure 4.4

|   | 0                     | 1 | 2 | 3  | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|-----------------------|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | NO CHARACTERS PRINTED |   |   |    |   |   |   |   |   |   |   |   |   |   |   |   |
| 1 | NO CHARACTERS PRINTED |   |   |    |   |   |   |   |   |   |   |   |   |   |   |   |
| 2 | !                     | " | # | \$ | % | & | ' | ( | ) | * | + | , | - | . | / |   |
| 3 | 0                     | 1 | 2 | 3  | 4 | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| 4 | @                     | A | B | C  | D | E | F | G | H | I | J | K | L | M | N | O |
| 5 | P                     | Q | R | S  | T | U | V | W | X | Y | Z | [ | \ | ] | ^ | _ |
| 6 | '                     | a | b | c  | d | e | f | g | h | i | j | k | l | m | n | o |
| 7 | p                     | q | r | s  | t | u | v | w | x | y | z | { |   | } | ~ |   |
| 8 | NO CHARACTERS PRINTED |   |   |    |   |   |   |   |   |   |   |   |   |   |   |   |
| 9 | NO CHARACTERS PRINTED |   |   |    |   |   |   |   |   |   |   |   |   |   |   |   |
| A | !                     | " | # | \$ | % | & | ' | ( | ) | * | + | , | - | . | / |   |
| B | 0                     | 1 | 2 | 3  | 4 | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| C | @                     | A | B | C  | D | E | F | G | H | I | J | K | L | M | N | O |
| D | P                     | Q | R | S  | T | U | V | W | X | Y | Z | [ | \ | ] | ^ | _ |
| E | '                     | a | b | c  | d | e | f | g | h | i | j | k | l | m | n | o |
| F | p                     | q | r | s  | t | u | v | w | x | y | z | { |   | } | ~ |   |

Figure 4.4 Printer test pattern

## MESSAGES

NOTE: Some tests may show the result of an internal retry performed during normal operation of the computer. This is not an error condition: only the displays shown in Figure 4.5 indicate an error condition.

Two types of messages are available with the Diagnostic Module.

- Error codes, shown on the two 7-segment displays of the Diagnostic Module. These are only displayed with the LED/CRT switch in the LED position.
- CRT error messages, shown on the CRT screen and providing detailed information of the failure.

Figure 4.5 shows the various LED and CRT messages.

| LED Code | CRT Message   | Explanation  |
|----------|---|--|
| 01       | SUMCHECK ERROR  | Firmware ROM sumcheck error  |
| 11       |   | CRT Controller error   |
| 12       |   | (GDC Graphic Display Controller)   |
| 13       |   | GDC RAM bank # 0 error   |
| 14       |   | # 1 error  |
| 15       |   | # 2 error  |
| 16       |   | # 3 error  |
| 17       |   | GDC Color plane # 0  |
| 18       |   | GDC Color plane # 1  |
|          |   | GDC Color plane # 2  |
| 21       | KEYBOARD CONTROLLER ERROR                                     |  |
| 31       | MEMORY DATA ERROR<br>ADDRESS EXP. OBS.<br>iiii xx xx          | iiii = RAM Address from<br>0 to FFFFH<br><br>xx = Data                         |
| 32       | MEMORY ADDRESS ERROR<br>EXP. ADDRESS OBS. ADDRESS<br>iiii iii |  |
| 41       | DMA CONTROLLER ERROR  | DMA controller error   |
| 41       | DMA CONTROLLER ERROR ON CHANNEL n<br>EXP. OBS.<br>xx xx       | DMA controller error<br>n = 0 to 3<br>xx = Data                                |
| 51       | FLEX DISK CONTROLLER ERROR                                    |  |
| 71       | MEMORY DATA ERROR<br>ADDRESS EXP. OBS.<br>iiii xx xx          | iiii = RAM address from<br>0 to FFFFH  |
| 72       | MEMORY ADDRESS ERROR<br>EXP. ADDRESS OBS. ADDRESS<br>iiii iii |  |
| 73       | BANK SWITCHING ERROR<br>EXP. OBS.<br>xx xx                    |  |
| 81       | KEYBOARD NOT CONNECTED  |  |
| 82       | KEYBOARD PROCESSOR ERROR                                      | This message may also be shown<br>in case of a keyboard controller<br>failure. |

Figure 4.5 LED and CRT messages (1 of 3)

| LED Code | CRT Message  | Explanation  |
|----------|--|--|
| ▷ 1      | RECALIBRATE ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx                   xx |  |
| ▷ 2      | SEEK ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx                   xx        | ST0 = Status Register 0<br>ST1 = Status Register 1<br>ST2 = Status Register 2<br>ST3 = Status Register 3   |
| ▷ 3      | FORMAT ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx xx xx xx xx xx xx xx      | H = Head Number 0 or 1<br>T = Track Number 0 to 27 Hex<br>S = Sector Number 1 to 8<br>N = Sector Length 02 |
| ▷ 4      | READ ID ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx xx xx xx xx xx xx xx     | The special character displayed as first digit on the Diagnostic Module stands for Test No. B              |
| ▷ 5      | WRITE ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx xx xx xx, xx xx xx xx      |  |
| ▷ 6      | READ ERROR<br>DISK STATUS VALUES:<br>ST0 ST1 ST2 ST3 H T S N<br>xx xx xx xx xx xx xx xx        |  |
| ▷ 7      | READ DATA COMPARE ERROR<br>EXP. OBS.<br>xx   xx  |  |

Figure 4.5 LED and CRT messages (2 of 3)

| LED Code | CRT Message  | Explanation   |
|----------|--|---|
| ⊖ 1      | WINCHESTER DISK CONTROLLER ERROR<br>EXP. OBS.<br>xx xx | The special character displayed as first digit on Diagnostic Module stands for Test No. D |
| ⊖ 2      | RECALIBRATE ERROR<br>STATUS ERROR<br>xx xx             |   |
| ⊖ 3      | FORMAT ERROR<br>STATUS ERROR<br>xx xx                  |   |
| ⊖ 4      | WRITE ERROR<br>STATUS ERROR<br>xx xx                   |   |
| ⊖ 5      | READ ERROR<br>STATUS ERROR<br>xx xx                    |   |
| ⊖ 6      | READ DATA COMPARE ERROR<br>EXP. OBS.<br>xx xx          |   |
| ⊖ 1      | CENTRONICS PRINTER NOT READY                           | The special character displayed as first digit on Diagnostic Module stands for Test No. E |
| ⊖ 2      | CENTRONICS PRINTER BUSY                                |   |
| ⊖ 3      | CENTRONICS PRINTER ERROR                               |   |
| 99       |  | Test passed OK  |

Figure 4.5 LED and CRT messages (3 of 3)

## FLEXIBLE DISK CONTROLLER STATUS CODES

When an error occurs during Test B, Disk Drive Test, the flexible disk controller status codes are shown on the CRT screen. These codes are shown in the form of two hexadecimal characters. The leftmost character represents the values of the data lines D7, D6, D5, and D4. The rightmost character represents the values of the data lines D3, D2, D1, and D0.

Figure 4.6 shows all possible values of the data lines D0 through D7 and their respective hexadecimal codes.

| Hex Code | Data Lines |    |    |    | Hex Code | Data Lines |    |    |    |
|----------|------------|----|----|----|----------|------------|----|----|----|
|          | D7         | D6 | D5 | D4 |          | D3         | D2 | D1 | D0 |
| 0        | 0          | 0  | 0  | 0  | 0        | 0          | 0  | 0  | 0  |
| 1        | 0          | 0  | 0  | 1  | 1        | 0          | 0  | 0  | 1  |
| 2        | 0          | 0  | 1  | 0  | 2        | 0          | 0  | 1  | 0  |
| 3        | 0          | 0  | 1  | 1  | 3        | 0          | 0  | 1  | 1  |
| 4        | 0          | 1  | 0  | 0  | 4        | 0          | 1  | 0  | 0  |
| 5        | 0          | 1  | 0  | 1  | 5        | 0          | 1  | 0  | 1  |
| 6        | 0          | 1  | 1  | 0  | 6        | 0          | 1  | 1  | 0  |
| 7        | 0          | 1  | 1  | 1  | 7        | 0          | 1  | 1  | 1  |
| 8        | 1          | 0  | 0  | 0  | 8        | 1          | 0  | 0  | 0  |
| 9        | 1          | 0  | 0  | 1  | 9        | 1          | 0  | 0  | 1  |
| A        | 1          | 0  | 1  | 0  | A        | 1          | 0  | 1  | 0  |
| B        | 1          | 0  | 1  | 1  | B        | 1          | 0  | 1  | 1  |
| C        | 1          | 1  | 0  | 0  | C        | 1          | 1  | 0  | 0  |
| D        | 1          | 1  | 0  | 1  | D        | 1          | 1  | 0  | 1  |
| E        | 1          | 1  | 1  | 0  | E        | 1          | 1  | 1  | 0  |
| F        | 1          | 1  | 1  | 1  | F        | 1          | 1  | 1  | 1  |

Example: Hexadecimal code **4B**

D7,D6,D5,D4
D3,D2,D1,D0

0 1 0 0
1 0 1 1

Therefore: D7,D5,D4, and D2 are set to 0  
D6,D3,D1, and D0 are set to 1

Figure 4.6 Data line codes

The values of the four status registers ST0, ST1, ST2, and ST3 are displayed on the CRT screen, however, the significant register(s) is always displayed in full intensity, inverse video. Figures 4.7 through 4.10 show the meaning of the flexible disk controller status registers.

|                  |  |
|------------------|--|
| D0 = 1           | UNIT SELECT 0 – This flag is used to indicate a Drive Unit Number at Interrupt.  |
| D1 = 1           | UNIT SELECT 1 – This flag is used to indicate a Drive Unit Number at Interrupt.  |
| D2 = 1           | HEAD ADDRESS – This flag is used to indicate the state of the head at Interrupt.   |
| D3 = 1           | NOT READY – When the FDD is in the not-ready state and a read or write command is issued, this flag is set. If a read or write command is issued to Side 1 of a single-sided drive, then this flag is set. |
| D4 = 1           | EQUIPMENT CHECK – If a fault signal is received from the FDD, or if the Track 0 Signal fails to occur after 77 Step Pulses (Recalibrate Command), then this flag is set.                                   |
| D5 = 1           | SEEK END – When the FDC completes the Seek Command, this flag is set to 1 (high).  |
| D6 = 1<br>D7 = 1 | INTERRUPT CODE – Abnormal termination because during Command execution the ready signal from the FDD changed state.  |
| D6 = 0<br>D7 = 1 | INTERRUPT CODE – Invalid Command issue, (IC). Command which was issued was never started.  |
| D6 = 1<br>D7 = 0 | INTERRUPT CODE – Abnormal termination of Command (AT). Execution of Command was started, but was not successfully completed.   |
| D6 = 0<br>D7 = 0 | INTERRUPT CODE – Normal termination of Command, (INT). Command was completed and properly executed.  |

Figure 4.7 Status register 0

|        |   |
|--------|---|
| D0 = 1 | <p><b>MISSING ADDRESS MARK</b> — If the FDC cannot detect the ID Address Mark after encountering the index hole twice, then this flag is set.</p> <p><b>D0 Missing Address Mark</b> — If the FDC cannot detect the Data Address Mark or Deleted Data Address Mark, this flag is set. Also at the same time, the MD (Missing Address Mark in Data Field) of Status Register 2 is set.</p>  |
| D1 = 1 | <p><b>NOT WRITABLE</b> — During execution of WRITE DATA, WRITE DELETED DATA, or Format A Cylinder Command, if the FDC detects a write protect signal from the FDD, then this flag is set.</p>   |
| D2 = 1 | <p><b>NO DATA</b> — During execution of READ DATA, WRITE DELETED DATA, or SCAN Command, if the FDC cannot find the Sector specified in the IDR Register, this flag is set.</p> <p><b>No Data</b> — During execution of READ ID Command, if the FDC cannot read the ID field without an error, the this flag is set.</p> <p><b>No Data</b> — During execution of READ A Cylinder Command, if the starting sector cannot be found, then this flag is set.</p> |
| D3 = 0 | Not used — This bit is always 0 (low).  |
| D4 = 1 | <p><b>OVER RUN</b> — If the FDC is not serviced by the main systems during data transfers, within a certain time interval, this flag is set.</p>  |
| D5 = 1 | <p><b>DATA ERROR</b> — When the FDC detects a CRC error in either the ID field or the data field, this flag is set.</p>   |
| D6 = 0 | Not used — This bit is always 0 (low).  |
| D7 = 1 | <p><b>END OF CYLINDER</b> — When the FDC tries to access a Sector beyond the final Sector of a Cylinder, this flag is set.</p>  |

Figure 4.8 Status register 1

|        |  |
|--------|--|
| D0 = 1 | MISSING ADDRESS MARK IN DATA FIELD – When data is read from the medium, if the FDC cannot find a Data Address Mark or Deleted Data Address Mark, then this flag is set.                  |
| D1 = 1 | BAD CYLINDER – This bit is related with the No Data bit; when the content of C on the medium is different from that stored in the IDR and the content of C is FF, then this flag is set. |
| D2 = 1 | SCAN NOT SATISFIED – During execution of the SCAN Command, if the FDC cannot find a Sector on the cylinder which meets the condition, then this flag is set.                             |
| D3 = 1 | SCAN EQUAL HIT – During execution of the SCAN Command, if the condition of "equal" is satisfied, this flag is set.   |
| D4 = 1 | WRONG CYLINDER – This bit is related with the No Data bit, and when the contents of C on the medium is different from that stored in the IDR, this flag is set.                          |
| D5 = 1 | DATA ERROR IN DATA FIELD – If the FDC detects a CRC error in the data field then this flag is set.   |
| D6 = 1 | CONTROL MARK – During execution of the READ DATA or SCAN Command, if the FDC encounters a Sector which contains a Deleted Data Address Mark, this flag is set.                           |
| D7 = 0 | Not used – This bit is always 0 (low).   |

Figure 4.9 Status register 2

|        |   |
|--------|---|
| D0 = 1 | UNIT SELECT 0 – This bit is used to indicate the status of the Unit Select 0 signal to the FDD.     |
| D1 = 1 | UNIT SELECT 1 – This bit is used to indicate the status of the Unit Select 1 signal to the FDD.     |
| D2 = 1 | HEAD ADDRESS – This bit is used to indicate the status of Side Select signal to the FDD.            |
| D3 = 1 | TWO SIDE – This bit is used to indicate the status of the Two Side signal from the FDD.             |
| D4 = 1 | TRACK 0 – This bit is used to indicate the status of the Track 0 signal from the FDD.               |
| D5 = 1 | READY – This bit is used to indicate the status of the Ready signal from the FDD.                   |
| D6 = 1 | WRITE PROTECTED – This bit is used to indicate the status of the Write Protect signal from the FDD. |
| D7 = 1 | FAULT – This bit is used to indicate the status of the Fault signal from the FDD.                   |

Figure 4.10 Status register 3

## FIXED DISK CONTROLLER STATUS CODES

Figures 4.11 and 4.12 show the meaning of the codes for the fixed disk controller status and error registers.

| Bit |   |
|-----|---|
| 0   | ERROR – When set, indicates that a bit is set in the Error register.  |
| 1   | Not used.   |
| 2   | CORRECTED – Indicates that there was a read error condition either in the data field or the ECC check bits themselves, and that the controller was able to correct the condition.   |
| 3   | DATA REQUEST – When set, it indicates that the sector buffer is ready to accept data or contains data to be read out by the host. The Data Request bit is reset when the sector buffer has been fully read from or written to. Normally, the host need not consult this bit to determine if a byte should be transferred. |
| 4   | SEEK COMPLETE – Indicates the condition of the Seek Complete line on the selected drive.  |
| 5   | WRITE FAULT – Indicates the condition of the Write Fault line on a selected drive. The WD1001 will not execute any command if this bit is set.  |
| 6   | READY – Indicates the condition of the Ready line of the selected drive. The WD1001 will not execute any commands unless this bit is set.   |
| 7   | BUSY – After issuing a command, this bit will be set, indicating that the WD1001 is busy executing a command. No other bits or registers are valid when this bit is set.  |

Figure 4.11 Status register

NOTE: Usually diagnostic program should not indicate an error with a good unit. However, an error encountered during diagnostic program does not necessarily mean that disk drive is unusable. To check whether disk can be used by operating system, run formatting utility. Disk formatting utilities (FORMAT, DISCIT) will assign up to 8 alternate sectors before displaying message BAD MEDIA.

| Bit |   |
|-----|---|
| 0   | DAM NOT FOUND – Set during a Read Sector command if, after successfully identifying the ID field, the Data Address mark was not detected within 16 bytes of ID field.   |
| 1   | TR000 ERROR – Set during a Restore command if, after issuing 1024 stepping pulses, the Track 000 line was not asserted by the drive.  |
| 2   | ABORTED COMMAND – Indicates that a valid command has been received that cannot be executed, based on status information from the drive. For example, if a write sector command has been issued while the Write Fault line is set, the Aborted Command bit will be set. Interrogation of the Status and/or Error registers by the host can be performed to determine the cause of failure. |
| 3   | Not used.   |
| 4   | ID NOT FOUND – When set, this bit indicates that an ID field containing a specified cylinder, head, sector number, or sector size was not found.  |
| 5   | CPC ERROR ID – Indicates that a CRC error was encountered in an ID field.   |
| 6   | UNCORRECTABLE – Indicates that an error was detected while reading the data field or ECC check bits, and the error was so severe that the controller was not able to correct the condition.   |
| 7   | BAD BLOCK DETECT – Indicates that a Bad Block Mark has been detected in the specified ID field. If the command issued was a write sector command, no writing will be performed. If generated from a read sector command, the data field will not be read. Note that bad block will not be detected if the flaw is in the ID field unless multiple ID fields were written.                 |

Figure 4.12 Error register

## ADJUSTMENTS

### CRT (MONOCHROME)

If the CRT screen display cannot be adjusted satisfactorily with the Brightness and Contrast controls then check for the following conditions (Figure 5.1 shows the position of the adjustment controls).

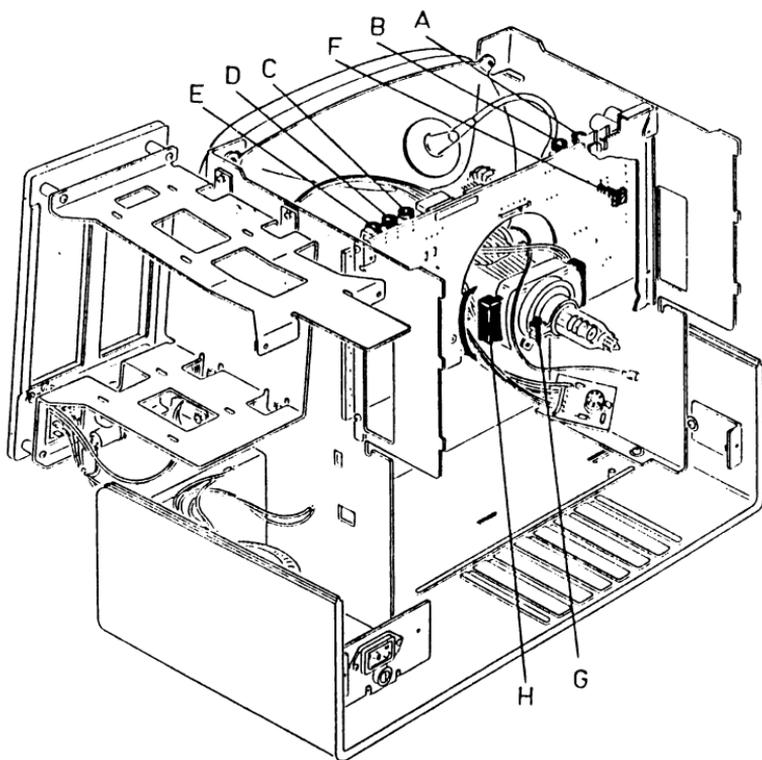
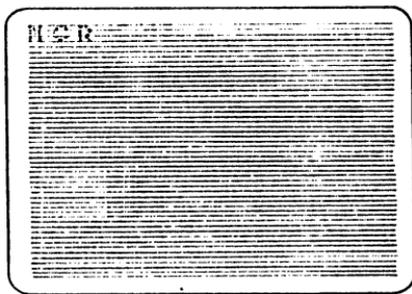


Figure 5.1 Monochrome CRT adjustment points

## WARNING

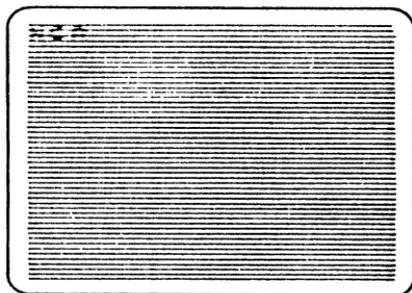
Very high voltages are present when the unit is operating. Although these voltages carry very low current, extreme care should be used when performing adjustments while the unit is operating. All adjustments should be made with plastic adjusting tools. Before removing the CRT High Tension lead, the tube should be discharged by connecting a 1 megohm resistor between the high tension connector and ground for a minimum of 10 seconds.

## DISPLAY OUT OF FOCUS



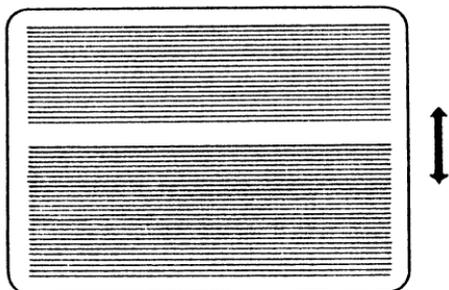
Adjust focus trimmer (A).

## DISPLAY TOO DIM



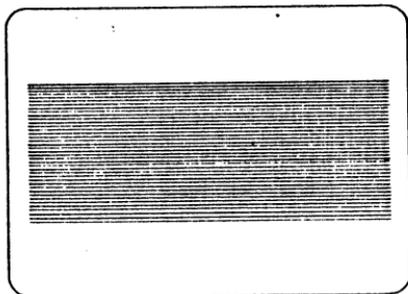
Adjust brightness preset trimmer (B). (Overadjusting this trimmer causes the display to change size when the Brightness control is turned.)

## DISPLAY ROLLS



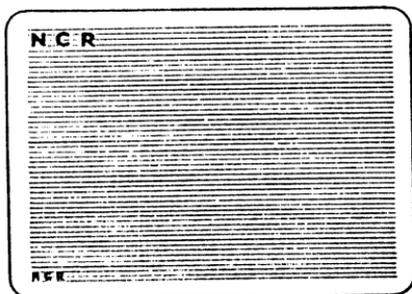
Adjust sync trimmer (C). (Turn trimmer until display stops rolling, turn trimmer in the opposite direction until display just starts to roll in the opposite direction, set the trimmer to the mid-point of these two positions.)

## DISPLAY TOO SHORT/LONG



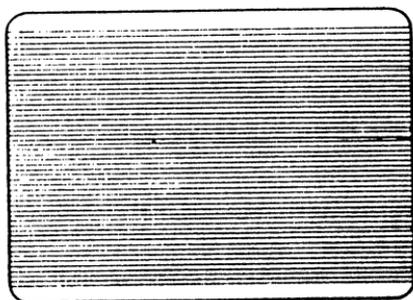
Adjust height trimmer (D), see Character Field Size.

## DISPLAY NOT LINEAR



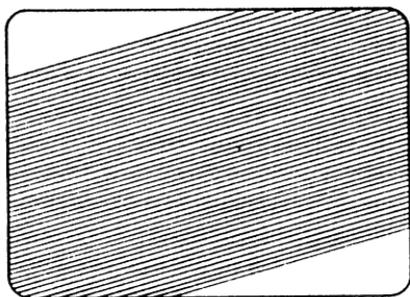
Adjust linearity trimmer (E).

## DISPLAY TOO WIDE/NARROW



Adjust amplitude coil (F), see Character Field Size.

## DISPLAY TILTED



Loosen locking screw (G) and rotate yoke assembly (H), tighten locking screw.

## CHARACTER FIELD SIZE

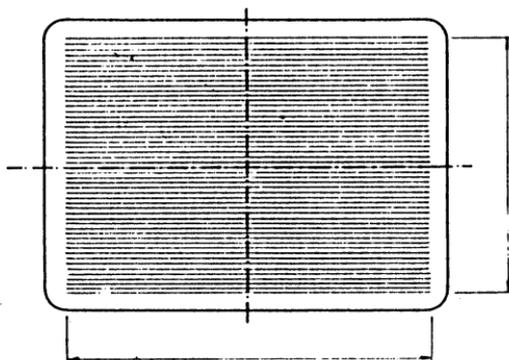


Figure 5.2 Character field size

With all adjustments correctly set, a full screen display of 25 lines each with 80 characters, occupies an area of 216 mm (8.5 in.) x 135 mm (5.3 in.), centered in the CRT as shown in Figure 5.2.

## CRT (COLOR) ADJUSTMENTS

Before carrying out these adjustments, the CRT assembly must reach normal working temperature. The unit should be switched on for at least half an hour with the brightness control turned to maximum.

Use only plastic tools for adjusting trimmers.

### WARNING

Very high voltages are present when the unit is operating. Although these voltages carry very low current, extreme care should be used when performing adjustments while the unit is operating. All adjustments should be made with plastic adjusting tools. Before removing the CRT High Tension lead, the tube should be discharged by connecting a 1 megohm resistor between the high tension connector and ground for a minimum of 10 seconds.

To display the desired test screens, use the CRT ADJUSTMENT routine of the Diagnostic Module.

## HORIZONTAL DEFLECTION

### OSCILLATOR ALIGNMENT

1. Display an all-white picture, refer to Figure 5.4.
2. Connect testpoint A and testpoint B together.
3. Turn H HOLD (R25) in a clockwise direction until the lines are approximately synchronized.
4. Disconnect testpoint A from testpoint B.

### HORIZONTAL POSITION

1. Display a white test grid, refer to Figures 5.3 and 5.4.
2. Adjust H CENT (S2) and H PHASE (R26) until the display is horizontally centered on the CRT screen. H PHASE (R26) should be set approximately to the mid-point position.

### PICTURE WIDTH

1. Display an all-white picture, refer to Figure 5.3.
2. Set contrast control to maximum.
3. Adjust H WIDTH (L3) until picture width is  $216\text{mm} \pm 2\text{mm}$  ( $8.5\text{in.} \pm 0.08\text{in.}$ ).

NOTE: This coil reaches temperatures of up to 100 degrees C.

## VERTICAL DEFLECTION

### OSCILLATOR ALIGNMENT

1. Display an all-white picture, refer to Figure 5.4.
2. Turn V HOLD (R27) counterclockwise until picture starts to roll.
3. Turn V HOLD (R27) clockwise until picture stops rolling, then continue turning R27 clockwise for 30 degrees.

### LINEARITY

1. Display a white test grid, refer to Figure 5.4.
2. Adjust HEIGHT (R24) until picture height is approximately 140mm (5.5 in.).
3. Adjust V LIN (R23) to obtain optimum linearity.

### PICTURE HEIGHT

1. Display a white test grid, refer to Figure 5.4.
2. Adjust HEIGHT (R24) until picture height is  $135\text{ mm} \pm 2\text{ mm}$  ( $5.3\text{ in.} \pm 0.08\text{ in.}$ )

### VERTICAL POSITION

1. Display a white test grid, refer to Figure 5.3.
2. Adjust V CENT (S3) until display is vertically centered on the CRT screen.

NOTE: If necessary, repeat Linearity, Picture Height, and Vertical Position adjustments.

## VIDEO

### CUTOFF ADJUSTMENT

1. Display an all-black picture, refer to Figures 5.3 and 5.5.
2. Turn R3 (blue), R4 (green), R5 (red), and SCREEN fully counterclockwise.
3. Turn R1 and R2 to their mid-positions.
4. Set brightness control to maximum.
5. Set Service switch to service position (left or right position).
6. Adjust SCREEN until one of the color lines is just visible.

7. Turn the potentiometer for the color that can be seen (R3 for blue, R4 for green, or R5 for red) 1/4 turn clockwise.
8. Turn SCREEN counterclockwise until line is just visible.
9. Adjust the remaining two color potentiometers until all colors have the same intensity and produce a white line.
10. Set the Service switch to the normal position (mid-position).

## WHITENESS

1. Display an all-white picture, refer to Figure 5.5.
2. Adjust R1 and R2 until a standard whiteness is obtained.

## BEAM CURRENT

The beam current is related to the current adjusted to the following procedure.

1. Display an all-white picture, refer to Figure 5.3.
2. Set meter to 1mA range and connect meter across R35.
3. With brightness control set to maximum, the current should be between 400 and 450  $\mu$ A.
4. If necessary, adjust SCREEN to achieve above.
5. With brightness control set to minimum, the CRT screen should be dark.

## FOCUS

1. Display a full CRT screen (25 lines, 80 characters per line) of H's, refer to Figure 5.3.
2. Set Brightness control to maximum.
3. Adjust FOCUS for optimum focusing over the entire CRT screen.

## CONVERGENCE

These adjustments are factory-set and are not normally required in the field. If making these adjustments, be sure that the system is not near any magnetic fields, and that the CRT screen faces either north or south.

The CRT is automatically degaussed on switch on. If necessary, switch off and wait at least five minutes, then switch on again.

### CAUTION

Do not move the color purity magnets.

### CONVERGENCE ADJUSTMENT

These adjustments are factory-set, and should only be made if absolutely necessary. Degauss system before carrying out these adjustments.

1. Display a violet grid pattern, refer to Figure 5.6.
2. Loosen magnet lock ring.
3. Adjust D12 so that the red and blue vertical lines are superimposed on each other (violet vertical lines).
4. Adjust c4 and d12 together so that the horizontal red and blue lines are superimposed on each other (violet horizontal lines).
5. If necessary, make minor adjustment to d12 to ensure all grid lines are violet.
6. Display white grid pattern.
7. Adjust e6 so that the vertical violet and green lines are superimposed on each other (white vertical lines).
8. Adjust f9 and e6 together so that the horizontal violet and green lines are superimposed on each other (white horizontal lines).
9. If necessary, make minor adjustments to e6 to ensure all grid lines are white.
10. Re-tighten lock ring.

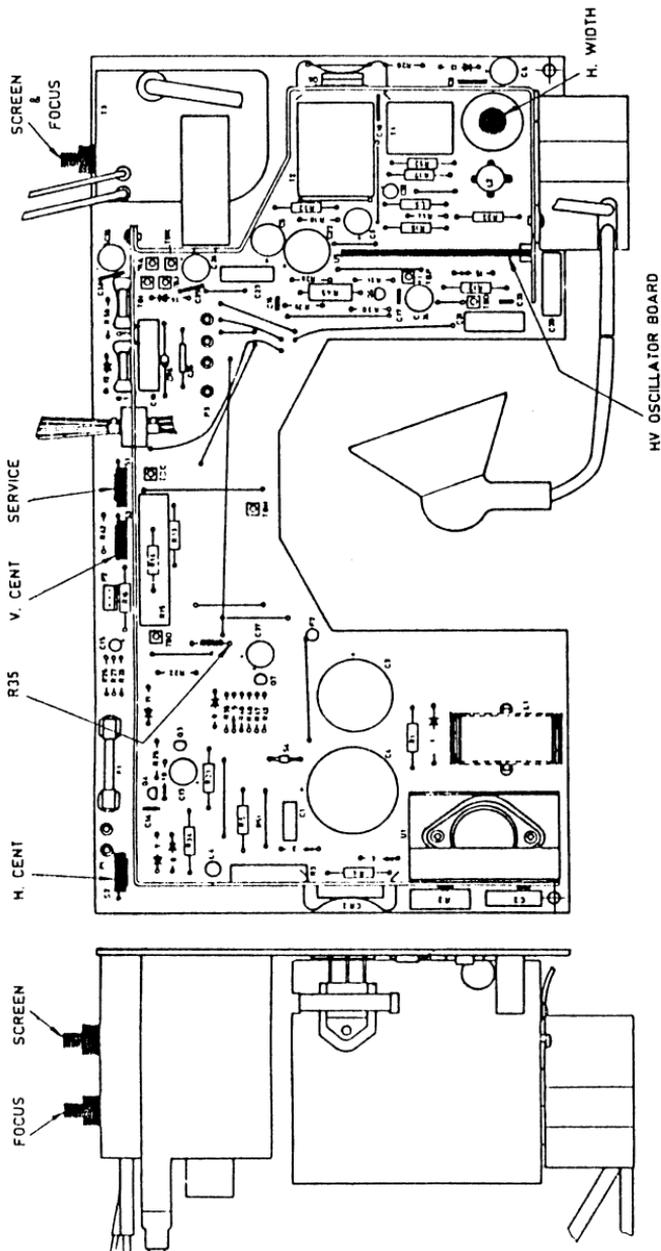


Figure 5.3 Color CRT deflection board

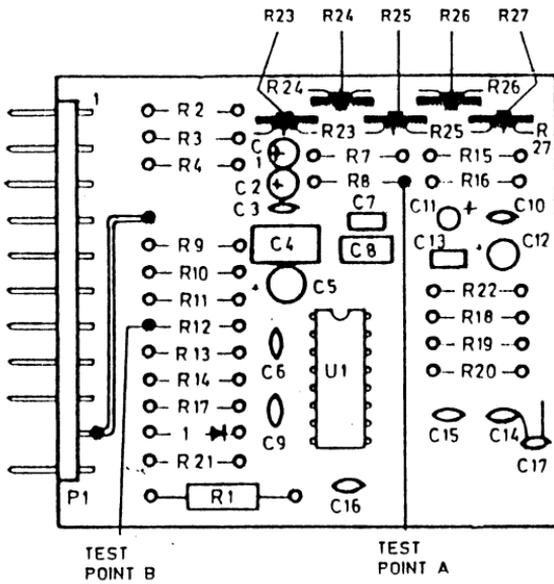


Figure 5.4 Color CRT HV oscillator board

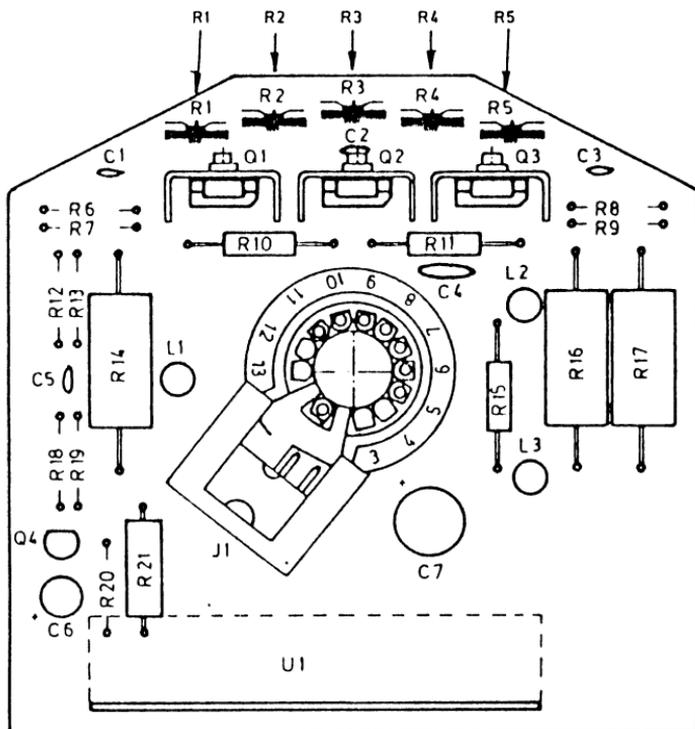


Figure 5.5 Color CRT video amplifier board

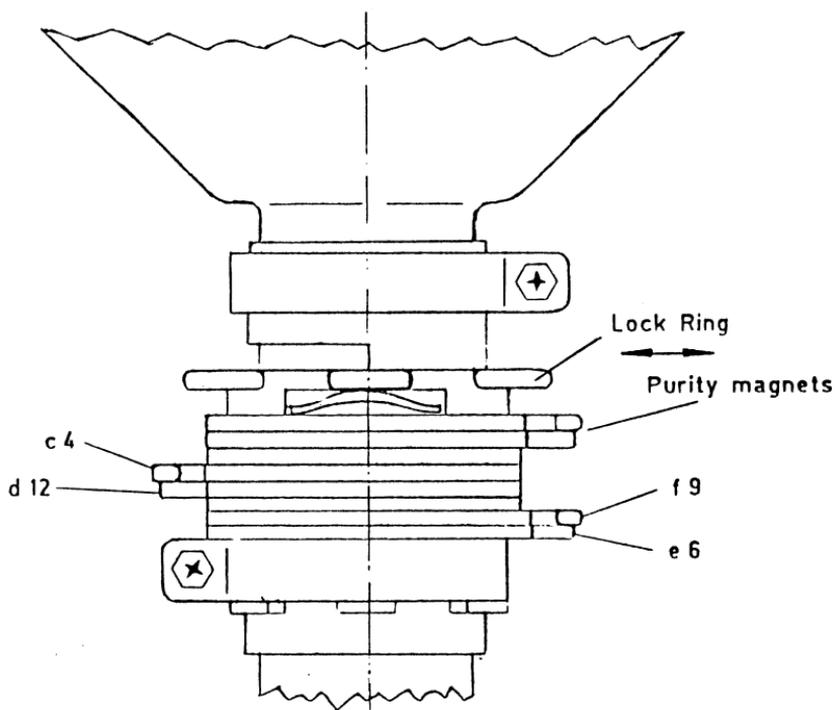


Figure 5.6 Color CRT convergence magnets

## FLEXIBLE DISK DRIVE ADJUSTMENTS

For this diagnostic phase use alignment disk 603-9009167 (48 TPI) or disk 603-9009169 (96 TPI) which are designed to quickly test alignment and performance characteristics of flexible disk drives. The specially recorded disk has test data fields which are progressively and alternately displaced from the track center lines. Diagnostic routines analyze the performance of the disk drive by its ability to read these data fields.

Access the Disk Drive Adjustment phase by selecting test C in the diagnostic menu. The following message appears on the screen:

..... WARNING .....

INSERT ALIGNMENT DISK INTO DRIVE TO BE TESTED  
DEPRESS RETURN KEY WHEN READY TO CONTINUE

Insert the alignment disk into the drive selected for test, and press the carriage return key. The following menu is displayed:

SELECT TRACK DENSITY:  
48 TPI (320/360KB) = 0  
96 TPI (780/800KB) = 1

### CAUTION

Wrong selection of track density causes fatal program errors. A hardware reset (switch unit off and on, or strike CONTROL and F20 keys) may become necessary to continue.

After selecting track density the actual alignment menu is displayed:

| HEAD: X                | UNIT: X               | YY TPI |
|------------------------|-----------------------|--------|
| 0. CHANGE HEAD         | 7. ECCENTRICITY TEST  |        |
| 1. ROTATIONAL SPEED    | (8.0/3.5 mils OFFSET) |        |
| 2. INDEX HEADER TIMING | 8. ECCENTRICITY TEST  |        |
| 3. LINEARITY           | (9.0/4.0 mils OFFSET) |        |
| 4. HYSTERESIS          | 9. HEAD ALIGNMENT     |        |
| 5. AZIMUTH ROTATION    | A. TRACK SEEK         |        |
| 6. ECCENTRICITY TEST   |                       |        |
| (7.0/3.0 mils OFFSET)  |                       |        |
| C. CHANGE UNIT         | X. EXIT TO MAIN MENU  |        |

SELECT TEST NUMBER:

NOTE: Values for 96 TPI are given in < >.

#### 0. CHANGE HEAD

This allows the selection of head 0 or 1 to be used in the test of the specified disk drive. The default value is head 0.

#### 1. ROTATIONAL SPEED

The speed of rotation of the disk is determined by measuring the time taken for two consecutive reads of the same sector. The time for one revolution ( $\pm 0.2$  ms) is displayed together with the expected time (200.0 ms  $\pm$  3.0 ms). The method of setting the rotational speed is described under "Adjustments."

#### 2. INDEX HEADER TIMING

(Applies only to main boards with firmware version 6.0 and up). Rotation time from photo index hole to ID header of sector 2 is measured on tracks 3 and 36 <3 and 74> using both heads; all four values are indicated on screen.

#### 3. LINEARITY (HEAD STEPPER MOTOR)

This test determines the ability of the head stepper motor to accurately position the head on the centerline of tracks 5, 19, and 39 <6, 41, 71>. In these tracks the sector data fields are progressively offset (displayed radially from the track centerline). The data fields in odd numbered sectors are progressively displaced towards the spindle, (positive values in mils) and in even numbered sectors displaced away from the spindle (negative values in mils). Perfect linearity is indicated when the positive offset displayed is equal to the negative offset for each track, and the same offset values are given for the three tracks. 1 mil = 1 millinch = 0.001 inch.

#### 4. HYSTERESIS (HEAD POSITIONING MECHANISM)

The hysteresis test checks for defects in the head positioning mechanism (backlash or binds) by performing long and short seeks to track 19 <41> from both directions. The readable offsets on track 19 <41> are displayed after a seek from track 0, 18, 20, and 39 <0, 40, 42, 79>. Perfect positioning is indicated when the positive offset displayed is equal to the negative offset for each of the four seeks.

## 5. AZIMUTH ROTATION (HEAD AXIS ALIGNMENT), 48 TPI ONLY

This test checks the alignment of the head axis relative to track 34 centerline. The track and sector ID fields are written at an azimuth angle of zero (recording axis aligned with track centerline). The sector data fields are written with progressive angles of azimuth ranging from  $\pm 21'$  (minutes) in sectors 1 and 2, to  $\pm 42'$  in sectors 15 and 16. Perfect head axis alignment is indicated when the displayed last readable positive angle is equal to the last readable negative angle.

## 6., 7., 8. ECCENTRICITY TEST (SPINDLE OR CLAMP ECCENTRICITY)

Tracks 21, 24, and 27 <44, 47, 50> are used for tests 6, 7, and 8 respectively. These tracks are recorded with alternate sector data fields displaced from the track centerline. Odd-numbered sector data fields have a positive offset (displaced towards the spindle), and even-numbered sector data fields have a negative offset (displaced away from the spindle). The offsets for a given track have a constant value in mils whether positive or negative.

The display shows two groups of numbers: one for sectors with positive offsets, and one for negative. The number of successful reads is displayed below each sector ID, enabling an eccentricity pattern to be determined.

Tests 6, 7, and 8 use radial offsets of 7, 8, and 9 <3.0, 3.5, 4.0> mils respectively.

## 9. HEAD ALIGNMENT

Track 5 <6>, which is recorded with progressive offsets, is repeatedly read during this test. A read failure is indicated by a TRACK ERROR display. If no read failure, the last readable radial offsets are displayed. The test is used to determine a requirement for head alignment to the track centerline. Refer to "Adjustments" for track/head alignment.

### A. TRACK SEEK

This test allows head positioning to tracks 0-9 <0-9> specified by keyboard input. It is used to align the track 00 sensor. See "Adjustments."

### C. CHANGE UNIT

This allows the selection of unit A or B to be used in the test sequence. The default value is unit A.

When selecting CHANGE UNIT be sure disk drive is ready (locking lever closed) as RESTORE function will be automatically performed. Not-ready state will cause RECALIBRATE ERROR.

## ADJUSTMENTS

### General

Adjustments must be performed with the diagnostic module installed, the DISK DRIVE ADJUSTMENT selected from the main menu, and the correct alignment disk installed in the drive to be adjusted.

If multiple adjustments are to be made on a disk drive, they should be performed in the sequence in which they are presented in the following text.

Before changing an adjustment, run all the tests available to build up a picture of the drive's performance. The alignment disk is designed to test a drive unit's capabilities to its very limit and possibly beyond. The tests are severe, and indicated errors in the diagnostic routines do not necessarily mean the drive is below standard in normal operation. If read/write errors have not been reported and different drive units are compatible in terms of media exchange, it is unlikely that readjustment is necessary or desirable.

Failure to consider logically the results of tests and their relationship can lead to the worsening of a problem or even the introduction of a problem that previously did not exist. If, for example, the head/track alignment is changed on the results of test 9 alone, but in reality the indication was caused by a minor eccentricity problem, the overall performance of the drive can be degraded. In another example, eccentricity tests 7 and 8 with offsets of 8 and 9 mils could fail, indicating an eccentricity problem. However, test 9 could indicate perfect track alignment with offsets of  $\pm 7$  mils. With a little thought, it will be obvious that eccentricity tests 7 and 8 with greater offsets than 7 mils must fail although the drive is good.

When the disk drives are installed in the NCR DECISION MATE V, only one side of the outside drive is accessible. If adjustments are to be made to the inside drive, reverse the physical positions of the two units as explained in "Section 3 Flexible Disk Drives." If an adjustment requires access to the other side of the outside drive, for example Track 00 sensor adjustment, remove the unit from the frame. Support the unit vertically on a stable platform with the cables still attached.

## Rotational Speed Adjustment

Select test 1 ROTATIONAL SPEED, from the test menu and install the alignment disk. If the test result indicates the speed of the disk is outside the specified range, adjust R1 on PCBA MOTOR SERVO (Figure 5.7) until the correct speed of rotation is shown on the screen.

## Track Alignment Adjustment

Before making this adjustment consider the following points:

1. The head/track alignment has been accurately set during assembly of the disk drive. It has also been checked before integration into the system. If it is now necessary to alter the adjustment, what circumstances have caused the change? This adjustment should only be necessary following replacement of parts in the head positioning mechanism.
2. Run tests 3-9 and collectively analyze the results before deciding whether head/track alignment requires alteration. Backlash or binds in the head positioning mechanism cannot be cured by track alignment.
3. Run the tests on both heads. Since head 0 cannot be moved relative to head 1, there is nothing to be gained by correcting slight displacement of head 0 if head 1 shows perfect alignment. Unavoidable manufacturing tolerances must show performance differences if the tests are critical enough.

The method of adjustment is as follows:

- Insert a screw (M3, 15 mm long) into the threaded portion of the stepping motor carriage as shown in Figure 5.8.
- Run test 9 HEAD ALIGNMENT in continuous run mode.
- Loosen the stepping motor carriage retaining screws (2).
- With the aid of the M3 screw, move the stepping motor in very small increments until the readable positive and negative offsets are equal as displayed on the screen.
- Gradually tighten the fixing screws while checking that the alignment does not change.
- Apply a small amount of locking paint to the fixing screw heads
- Remove the M3 screw.
- Check track 00 sensor.
- Check track 00 stopper.

### Track 00 Sensor Check and Adjustment

Install a scratch disk into the drive to be checked. Run Test A TRACK SEEK which enables the head to be stepped to any desired track from 0 to 9 by keyboard entry. Check the sensor as follows:

- Select track 00.
- Identify U208 on the PCBA MFD control board (see Figure 5.9).
- With a voltmeter, measure the voltage between U208 pin 7 (grid) and pin 8. In the track 00 position, the voltage at pin 8 should be TTL low level (0.4 V max.).
- By keyboard entry, move the head off track 00 position and measure the voltage again. Pin 8 should now read TTL high level (2.5 V min.).
- Move the head back to track 00 and check that the sensor responds.

If track 00 sensor requires adjustment, proceed as follows:

- Arrange the disk drive so that both sides are accessible.
- Loosen the fixing screw of the track 00 stopper (see Figure 5.10).
- Install a scratch disk in the drive and run Test A TRACK SEEK.
- Select track 00.
- Loosen the fixing screw of the track 00 sensor and adjust its position to satisfy the requirements described in the checking procedure (see Figure 5.11).
- Tighten the track 00 sensor fixing screw and re-check the sensor. Apply a small quantity of locking paint to the screw head.
- Perform the track 00 stopper adjustment.

### TRACK 00 STOPPER ADJUSTMENT

Run Test A TRACK SEEK and position the head to track 00. Adjust the track 00 stopper to give a clearance of 0.25 mm  $\pm$  0.15 mm (0.01 in.  $\pm$  0.006 in.) between the stopper and the head carriage (see Figure 5.10). Tighten the stopper fixing screw and apply a small quantity of locking paint to the screw head.

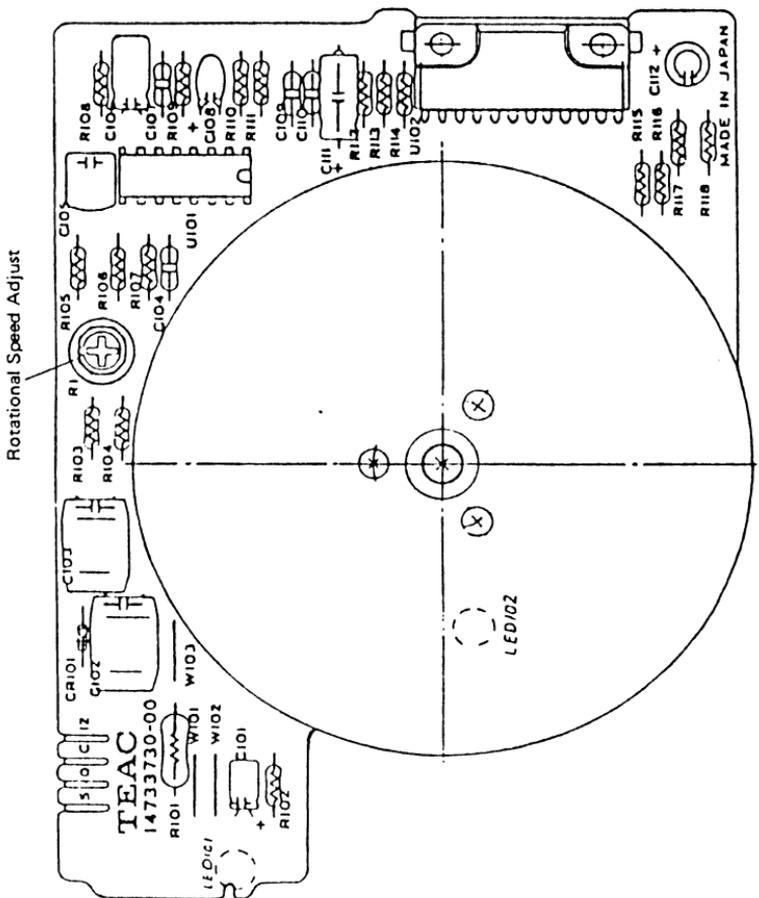


Figure 5.7 PCBA DC motor servo

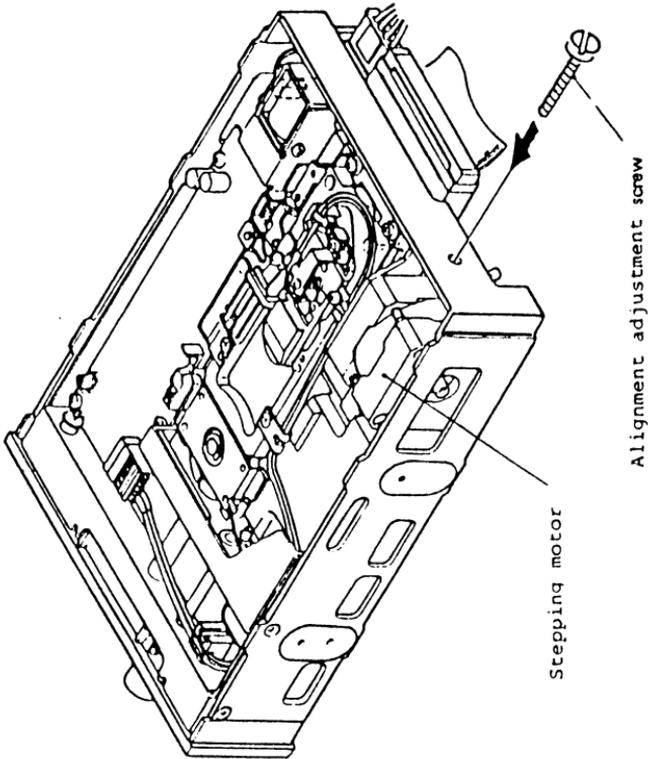


Figure 5.8 Track alignment adjustment



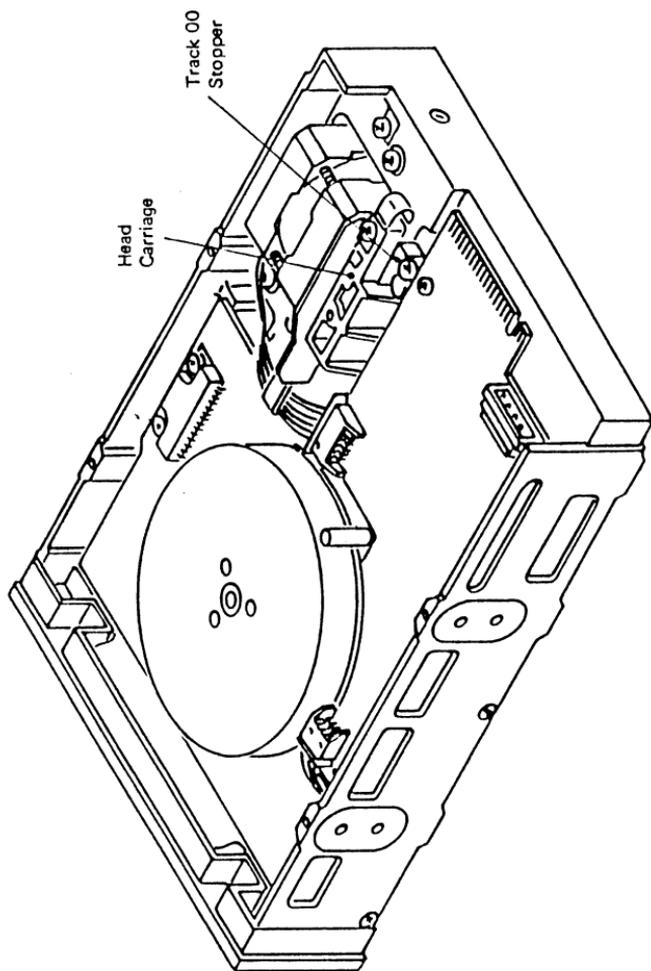


Figure 5.10 Track 00 sensor adjustment (stopper)

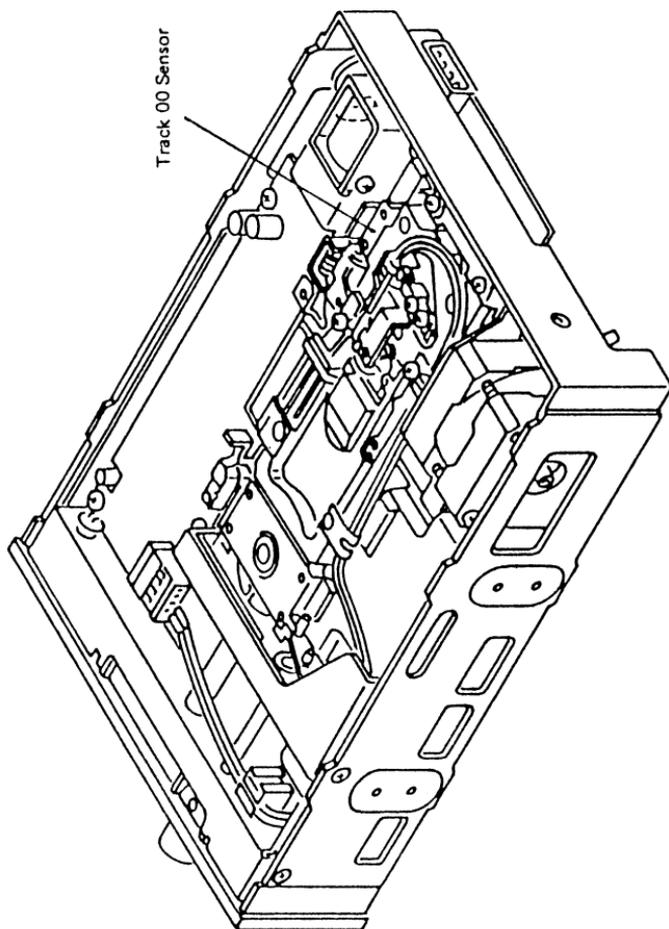


Figure 5.11 Track 00 sensor location

## PIN ASSIGNMENTS & STRAPPING

This section provides, in diagramatic form, information on pin assignments, strapping, cables, and component location.

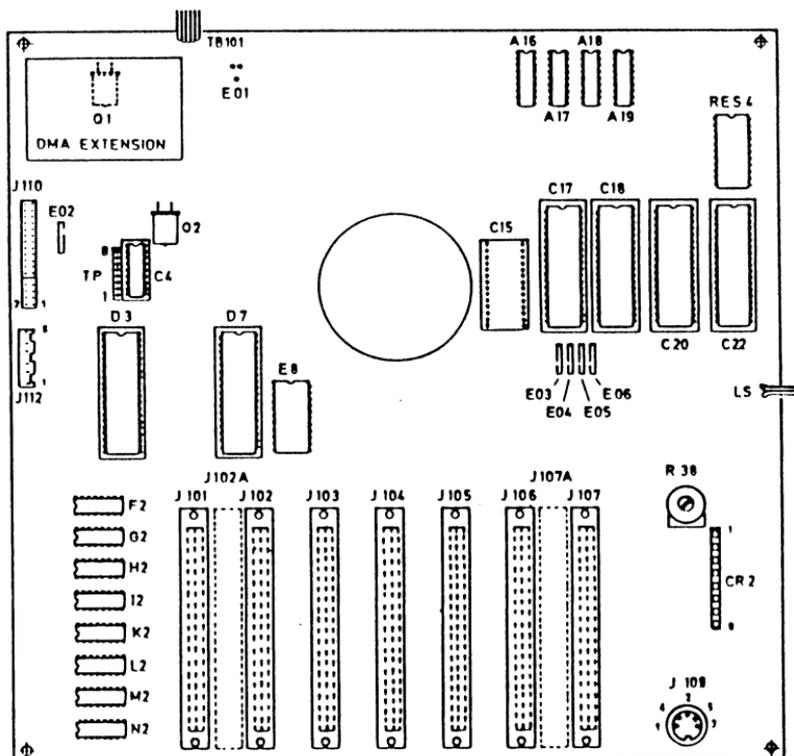
Information is included for the printed circuit boards that are in the NCR DECISION MATE V and for the various options that are available. Schematics are provided in the last part of this manual, Section 8.

## CONTROLLER BOARDS

| Board Number | Description                               | Remarks  |
|--------------|---|--|
| 017-0031575  | 8-bit, Flex disk, Monochrome              | Demonstration systems, up to tracer number 255   |
| 017-0031966  | 8-bit, Flex disk, Monochrome              | Production systems from tracer number 256  |
| 017-0032123  | 8-bit, Flex disk, Monochrome              | Replacement for: 017-0031966<br>Common service part for:<br>017-0032123, 017-0032124,<br>017-0032125 |
| 017-0032124  | 16-bit, Flex disk, Monochrome             |  |
| 017-0032125  | 8-bit, Fix disk, Monochrome               |  |
| 017-0032126  | 16-bit, Fix disk, Monochrome              | Replacement for: 017-0032123<br>Common service part for:<br>017-0032452, 017-0032453<br>017-0032454  |
| 017-0032452  | 8-bit, Flex disk, Monochrome              |  |
| 017-0032453  | 16-bit, Flex disk, Monochrome             | Replacement for: 017-0032124   |
| 017-0032454  | 8-bit, Fix disk, Monochrome               | Replacement for: 017-0032125   |
| 017-0032455  | 16-bit, Fix disk, Monochrome              | Replacement for: 017-0032126   |
| 017-0032456  | 8-bit, Fix disk, Monochrome               | Replacement for: 017-0032454   |
| 017-0032457  | 16-bit, Fix disk, Monochrome              | Replacement for: 017-0032455   |
| 017-0032730  | 8-bit, Fix disk, Monochrome               | Replacement for: 017-0032456   |
| 017-0032731  | 16-bit, Fix disk, Monochrome              | Replacement for: 017-0032457   |
| 017-0032721  | 8-bit, Flex disk, Monochrome, Multi-layer | Replacement for: 017-0032452   |
| 017-0032722  | 16-bit, Flex disk, Monochrome Multi-layer | Replacement for: 017-0032453   |
| 017-0032723  | 8-bit, Fix disk, Monochrome, Multi-layer  | Replacement for: 017-0032456   |
| 017-0032724  | 16-bit, Fix disk, Monochrome, Multi-layer | Replacement for: 017-0032457<br>Common service part for:<br>017-0032721, 017-0032722,<br>017-0032723 |
| 017-0032725  | 16-bit, Flex disk, Color, Multi-layer     | Common service part for:<br>017-0032725  |
| 017-0032726  | 16-bit, Fix disk, Color, Multi-layer      |  |

Controller board history

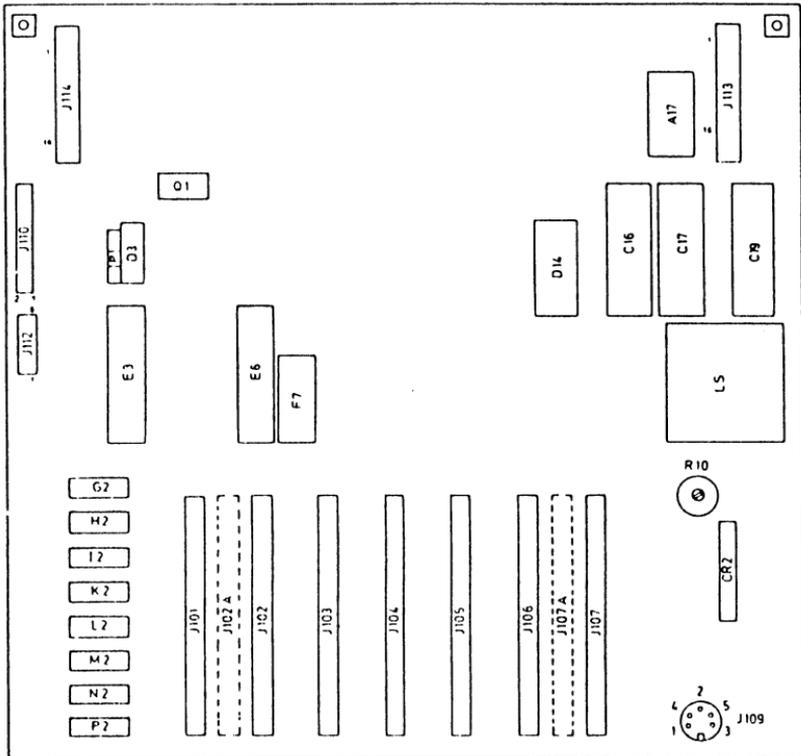
## Up To Tracer Number 255



|        |                           |          |                                |
|--------|---------------------------|----------|--------------------------------|
| A16-19 | Graphic Display RAM       | J102A    | Connector Custom Design Board  |
| C4     | Clock Generator           | J102-106 | Connectors Peripheral Adapters |
| C15    | ROM Firmware              | J107A    | Connector 16-Bit Processor     |
| C17    | Direct Memory Access      | J107     | Connector Diagnostic Module    |
| C18    | Processor Z80             | J109     | Connector Keyboard             |
| C20    | Controller, CRT           | J110     | Connector Flexible Disk Logic  |
| C22    | Controller, Keyboard      | J112     | Connector Flexible Disk Power  |
| CR2    | LEDs Level 0 Diagnostics  | K2       | Memory RAM (Bit 4)             |
| D3     | Controller, Memory        | L2       | Memory RAM (Bit 3)             |
| D7     | Controller, Flexible Disk | M2       | Memory RAM (Bit 2)             |
| E01-06 | Straps                    | N2       | Memory RAM (Bit 1)             |
| E8     | Chip Select               | Q1       | Quartz 20MHz                   |
| F2     | Memory RAM (Bit 8)        | Q2       | Quartz 24 MHz                  |
| G2     | Memory RAM (Bit 7)        | R38      | Potentiometer (Speaker)        |
| H2     | Memory RAM (Bit 6)        | RES 4    | Timer                          |
| I2     | Memory RAM (Bit 5)        | TB 101   | Terminal Board CRT             |
| J101   | Connector Memory Exp.     | TP1-8    | Test Points (Clock)            |

Component locations

## From Tracer Number 256



|     |                           |          |                                 |
|-----|---------------------------|----------|---------------------------------|
| A17 | Timer                     | N2       | Memory RAM (Bit 2)              |
| C16 | DMA                       | P2       | Memory RAM (Bit 1)              |
| C17 | Processor Z80             | J101     | Connector, Memory Exp.          |
| C19 | Controller, Keyboard      | J102A    | Connector, Custom Design Board  |
| CR2 | LEDs Level 0 Diagnostics  | J102-106 | Connectors, Peripheral Adapters |
| D3  | Clock Generator           | J107A    | Connector, 16-Bit Processor     |
| D14 | ROM (Firmware)            | J107     | Connector, Diagnostic Module    |
| E3  | Controller, RAM           | J109     | Connector, Keyboard             |
| E6  | Controller, Flexible Disk | J110     | Connector, Flexible Disk Logic  |
| F7  | Chip Select               | J112     | Connector, Flexible Disk Power  |
| G2  | Memory RAM (Bit 8)        | J113     | Connector, Graphic Display      |
| H2  | Memory RAM (Bit 7)        | J114     | Connector, Graphic Display      |
| I2  | Memory RAM (Bit 6)        | LS       | Loudspeaker                     |
| K2  | Memory RAM (Bit 5)        | Q1       | Quartz 24 MHz                   |
| L2  | Memory RAM (Bit 4)        | R10      | Potentiometer (Speaker)         |
| M2  | Memory RAM (Bit 3)        | TB1      | Test Points                     |

Major component locations

|    | a        | b           | c        |
|----|----------|-------------|----------|
| 1  | +5 V     | +5 V        | +5 V     |
| 2  | OPT 2    |             | +12 V    |
| 3  | RESET/   |             | RESETIN/ |
| 4  | IOW/     |             | IOR/     |
| 5  | MEMW/    |             | MEMR/    |
| 6  | D1       |             | D0       |
| 7  | D3       |             | D2       |
| 8  | D5       |             | D4       |
| 9  | D7       |             | D6       |
| 10 | READYDMA | READYP      | ABTRI/   |
| 11 | EOP/     | HOLD        |          |
| 12 | INTACK/  | SWITCH 16/  | IFSEL4/  |
| 13 | DBTRI/   | HLDA 16     | DIR/     |
| 14 | THOLD/   | 16 BITAV/   | HLDA     |
| 15 | PCLK/    | STDMARQ/    | CLK1     |
| 16 | LGRD     | LGRD        | TRAMD/   |
| 17 | BA19     | 16 BITSET / | BA18     |
| 18 | BA17     |             | BA16     |
| 19 | A15      |             | A14      |
| 20 | A13      | MEMRO/      | A12      |
| 21 | A11      |             | A10      |
| 22 | A9       |             | A8       |
| 23 | A7       |             | A6       |
| 24 | A5       |             | A4       |
| 25 | A3       |             | A2       |
| 26 | A1       |             | A0       |
| 27 | IFSEL3/  |             | IFSEL2/  |
| 28 | IFSEL1/  |             | IFSEL0/  |
| 29 | DRQ1     |             | DRQ0     |
| 30 | DACK1/   |             | DACK0/   |
| 31 | WAIT/    |             | INT/     |
| 32 | LGRD     | LGRD        | LGRD     |

Pin assignments J107/107A  
(diagnostics/16-bit processor)

|          |              |
|----------|--------------|
| J109 - 1 | Logic ground |
| J109 - 2 | Frame ground |
| J109 - 3 | +5 Volts     |
| J109 - 4 | SDPOLL       |
| J109 - 5 |              |

Pin assignments J109  
(keyboard)

|   |           |
|---|-----------|
| 6 | +12 Volts |
| 5 | +5 Volts  |
| 4 | +5 Volts  |
| 3 | LGRD      |
| 2 | LGRD      |
| 1 | LGRD      |

Pin assignments J112

|          |    |    |     |
|----------|----|----|-----|
| READY/   | 34 | 33 | GRD |
| SIDSEL/  | 32 | 31 | GRD |
| RDDATA/  | 30 | 29 | GRD |
| WRPROT/  | 28 | 27 | GRD |
| TRACK0/  | 26 | 25 | GRD |
| WREN/    | 24 | 23 | GRD |
| WRDATA/  | 22 | 21 | GRD |
| STEP/    | 20 | 19 | GRD |
| DIR/     | 18 | 17 | GRD |
| MOTORON/ | 16 | 15 | GRD |
|          | 14 | 13 | GRD |
| SEL1/    | 12 | 11 | GRD |
| SEL0/    | 10 | 9  | GRD |
| INDEX/   | 8  | 7  | GRD |
|          | 6  | 5  | GRD |
|          | 4  | 3  | GRD |
| HDLOAD/  | 2  | 1  | GRD |

Pin assignments J110

| a     |    | c     |
|-------|----|-------|
| +5V   | 1  | +5 V  |
|       | 2  |       |
| AOUT7 | 3  |       |
| AOUT6 | 4  | AOUT5 |
| AOUT4 | 5  | AOUT3 |
|       | 6  |       |
|       | 7  |       |
|       | 8  |       |
|       | 9  |       |
|       | 10 | AOUT2 |
|       | 11 | AOUT1 |
| OD0   | 12 | AOUT0 |
| OD1   | 13 | OD2   |
| OD3   | 14 |       |
|       | 15 |       |
| LGRD  | 16 | LGRD  |
|       | 17 |       |
|       | 18 |       |
| ID0   | 19 |       |
| ID1   | 20 |       |
| ID2   | 21 |       |
| ID3   | 22 |       |
| ID4   | 23 | CAS7/ |
| ID5   | 24 | CAS6/ |
| ID6   | 25 | CAS5/ |
| ID7   | 26 | CAS4/ |
| CAS2/ | 27 | CAS1/ |
| CAS3/ | 28 |       |
| OD4   | 29 | OD5   |
| RAS/  | 30 | WE/   |
| OD6   | 31 | OD7   |
| LGRD  | 32 | LGRD  |

Pin assignments J101  
(memory extension)

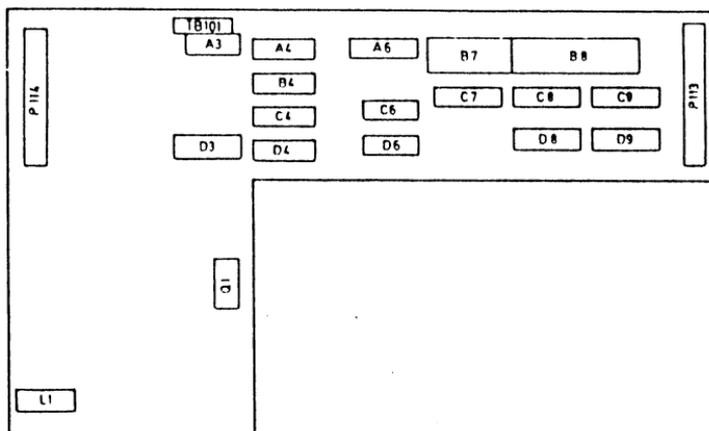
| a         |    | c         |
|-----------|----|-----------|
| +5 V      | 1  | +5 V      |
|           | 2  | +12 V     |
| RESET/    | 3  | RESET IN/ |
| IOW/      | 4  | IOR/      |
| MEMW/     | 5  | MEMR/     |
| BD1       | 6  | BD0       |
| BD3       | 7  | BD2       |
| BD5       | 8  | BD4       |
| BD7       | 9  | BD6       |
| READY DMA | 10 | ABTRI/    |
| EOP/      | 11 |           |
| INTACK/   | 12 | IFSEL 4/  |
| AUTO/     | 13 | DIR/      |
| THOLD/    | 14 | HLDA      |
| PCLK/     | 15 | CLK1      |
| LGRD      | 16 | TRAMD/    |
| BA19      | 17 | BA18      |
| BA17      | 18 | BA16      |
| BA15      | 19 | BA14      |
| BA13      | 20 | BA12      |
| BA11      | 21 | BA10      |
| BA9       | 22 | BA8       |
| BA7       | 23 | BA6       |
| BA5       | 24 | BA4       |
| BA3       | 25 | BA2       |
| BA1       | 26 | BA0       |
| IFSEL3/   | 27 | IFSEL2/   |
| IFSEL1/   | 28 | IFSEL0/   |
| DRQ1      | 29 | DRQ0      |
| DACK1/    | 30 | DACK0/    |
| WAIT/     | 31 | INT/      |
| LGRD      | 32 | LGRD      |

Pin assignments J102-106, J102A  
(peripheral adapters)

|     |               |
|-----|---------------|
| E01 | not connected |
| E02 | closed        |
| E03 | closed        |
| E04 | open          |
| E05 | closed        |
| E06 | open          |

Factory strapping  
(017 0031575 only)

## GRAPHICS BOARDS



|      |                            |       |                                 |
|------|----------------------------|-------|---------------------------------|
| A3   | Zoom                       | D3    | Attribute Register              |
| A4   | RAM                        | D4    | RAM                             |
| A6   | Shift Register             | D6    | Address Multiplexer             |
| B4   | RAM                        | D8    | Graphic Shift Register          |
| A/B7 | Character Generator        | D9    | Data Bus Transceiver            |
| A/B8 | Graphic Display Controller | L1    | Character Graphic Multiplexer   |
| C4   | RAM                        | P113  | Connector, Controller Board     |
| C7   | Graphic Shift Register     | O1    | Quartz 22.1184 MHz              |
| C8   | Data Bus Transceiver       | TB101 | Connector, CRT Deflection Board |
| C9   | Address Register           |       |                                 |

Major component locations

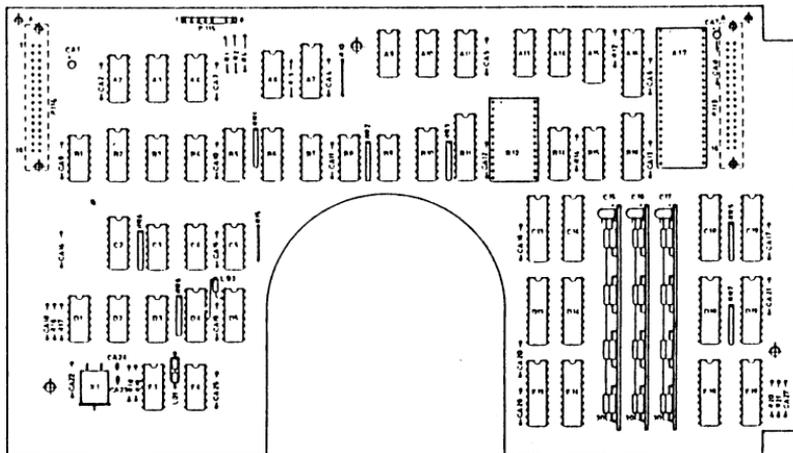
| a                 |    | c                |
|-------------------|----|------------------|
| +5V               | 1  | +5V              |
|                   | 2  |                  |
| D1                | 3  | D0               |
| D3                | 4  | D2               |
| D5                | 5  | D4               |
| D7                | 6  | D6               |
|                   | 7  |                  |
| HSYNCX            | 8  | HSYN             |
| VSYNCX            | 9  | LGRD             |
| BA1               | 10 | BA0              |
|                   | 11 |                  |
| GDCIOW/<br>DACK2/ | 12 | GDCIOR/<br>GDRQ2 |
|                   | 13 |                  |
|                   | 14 |                  |
|                   | 15 | WCLK             |
| LGRD              | 16 | LGRD             |

Pin assignments P113

| a     |    | c      |
|-------|----|--------|
| +5 V  | 1  | +5 V   |
| LGRD  | 2  | LGRD   |
| LPEN  | 3  | LPENSW |
| +12 V | 4  | +12 V  |
| +12 V | 5  |        |
|       | 6  |        |
|       | 7  |        |
|       | 8  |        |
|       | 9  |        |
|       | 10 |        |
|       | 11 |        |
|       | 12 |        |
|       | 13 |        |
|       | 14 |        |
|       | 15 | LGRD   |
| LGRD  | 16 | LGRD   |

Pin assignments P114

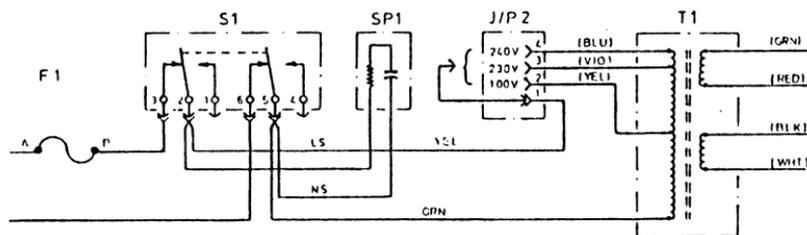
## COLOR CRT GRAPHICS BOARD



|               |                               |
|---------------|-------------------------------|
| A 7           | Character/Graphic Multiplexer |
| A 17          | Graphics Display Controller   |
| B 12          | Character Generator           |
| C 15/16/17    | Memory Hybrids (32 K each)    |
| C 13/14/18/19 | Pixel Data (Green)            |
| D 13/14/18/19 | Pixel Data (Red)              |
| E 13/14/18/19 | Pixel Data (Blue)             |
| P 113/114     | Connector, Controller Board   |
| P 115         | Connector, CRT                |
| X 1           | Quartz 20 MHz                 |

Major component locations

## POWER SUPPLY

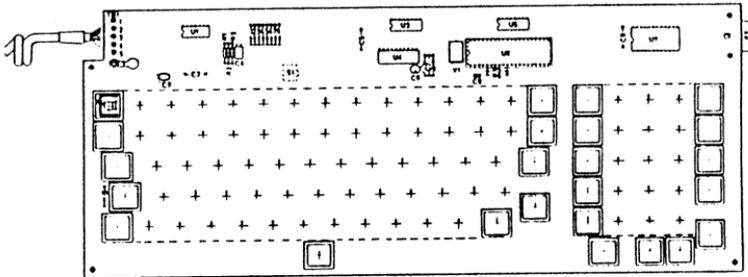


Transformer strapping (models 3273-XX XX-70/74/75)

| Voltage | System |      | Color |
|---------|--------|------|-------|
|         | Flex.  | Fix. |       |
| 100     | 3.0A   | 4.0A | 4.0A  |
| 120     | 3.0A   | 4.0A | 4.0A  |
| 220     | 1.5A   | 3.0A | 3.0A  |
| 230     | 1.5A   | 3.0A | 3.0A  |
| 240     | 1.5A   | 3.0A | 3.0A  |

Fuse ratings (F1)

KEYBOARD



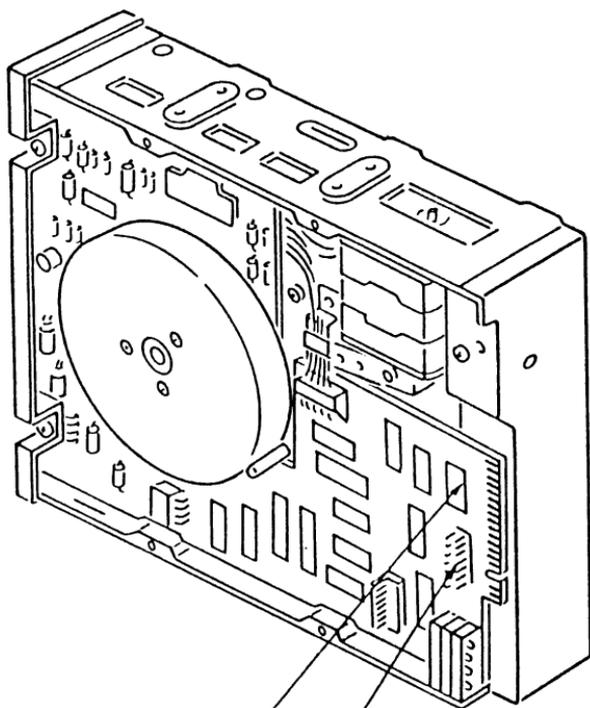
| JUMPER   | U6-8741/8041 |        | U6-8748/8048 |        |
|----------|--------------|--------|--------------|--------|
|          | open         | closed | open         | closed |
| J1       | X            |        | X            |        |
| J5       | X            |        | X            |        |
| J6       | X            |        |              | X      |
| J7       |              | X      | X            |        |
| J8       | X            |        | X            |        |
| J9       | X            |        | X            |        |
| J10      |              | X      |              | X      |
| J11      |              | X      | X            |        |
| J12      |              | X      | X            |        |
| J13      |              | X      | X            |        |
| J2 J3 J4 | RESERVED     |        |              |        |

Strapping

| SWITCH SETTING |      |      | LANGUAGE<br>CODE |
|----------------|------|------|------------------|
| S1/1           | S1/2 | S1/3 |                  |
| OFF            | OFF  | OFF  | US-English       |
| ON             | OFF  | OFF  | UK Int'l English |
| OFF            | ON   | OFF  | Danish           |
| ON             | ON   | OFF  | German           |
| OFF            | OFF  | ON   | Swedish/Finnish  |
| ON             | OFF  | ON   | Norwegian        |
| OFF            | ON   | ON   | Spanish          |
| ON             | ON   | ON   | Italian          |

| SWITCH SETTING |      |      | LANGUAGE<br>CODE     |
|----------------|------|------|----------------------|
| S1/1           | S1/2 | S1/3 |                      |
| OFF            | OFF  | OFF  | Swiss/German         |
| ON             | OFF  | OFF  | Swiss/French         |
| OFF            | ON   | OFF  | French               |
| ON             | ON   | OFF  | Canadian/Australian  |
| OFF            | OFF  | ON   | Canadian (Bilingual) |
| ON             | OFF  | ON   | South African        |
| OFF            | ON   | ON   | Portuguese           |
| ON             | ON   | ON   | Yugoslavian          |

## FLEXIBLE DISK DRIVE



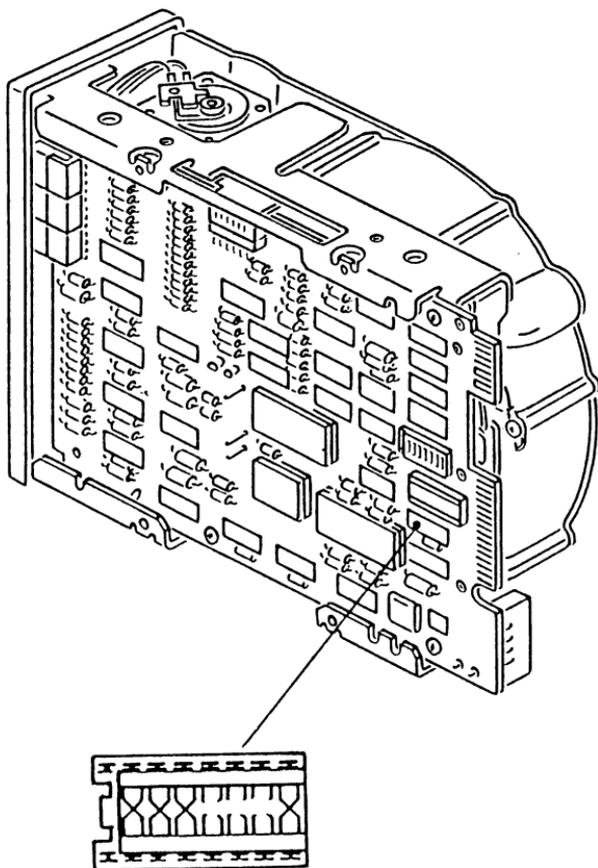
Terminator resistors

|   |     |
|---|-----|
| ○ | MX  |
| ○ | DS3 |
| ○ | DS2 |
| ○ | HM  |
| ○ | DS1 |
| ○ | DS0 |
| ○ | HS  |

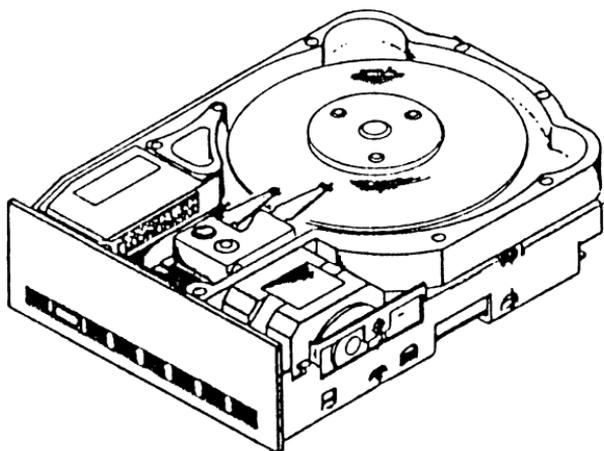
|                                     | Drive 0 | Drive 1 |
|-------------------------------------|---------|---------|
| MX                                  |         |         |
| DS3                                 |         |         |
| DS2                                 |         |         |
| HM                                  |         |         |
| DS1                                 | X       | X       |
| DS0                                 | X       |         |
| HS                                  |         |         |
| Terminator Resistor<br>Drive 1 only |         |         |

Strapping

All other straps are factory set and dependent on the board revision level. These straps should not be touched.

FIXED WINCHESTER DISK DRIVE  
(ST412)

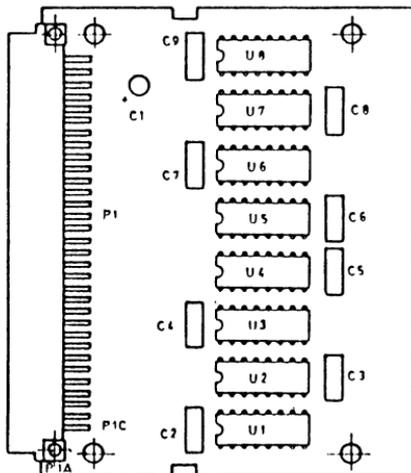
**FIXED DISK DRIVE  
(ST 212)**



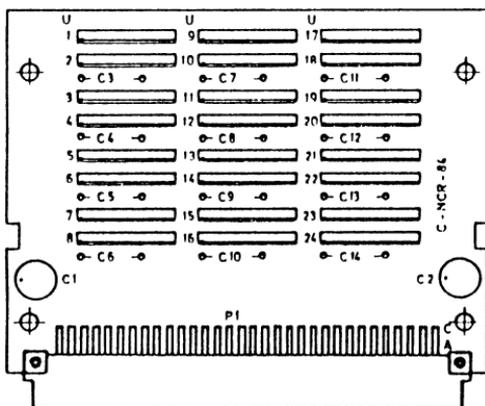
Strapping as for ST 412

### MEMORY EXPANSION

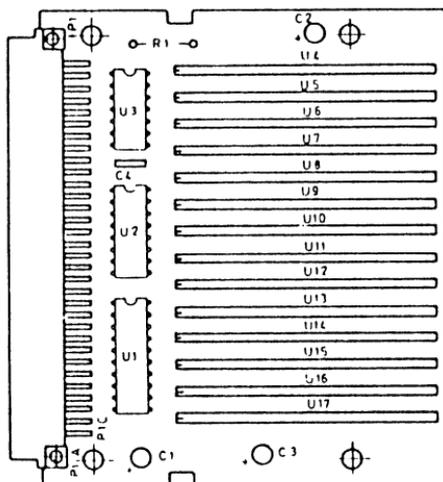
(K200, K202, K208)



64KB PCB



192KB PCB

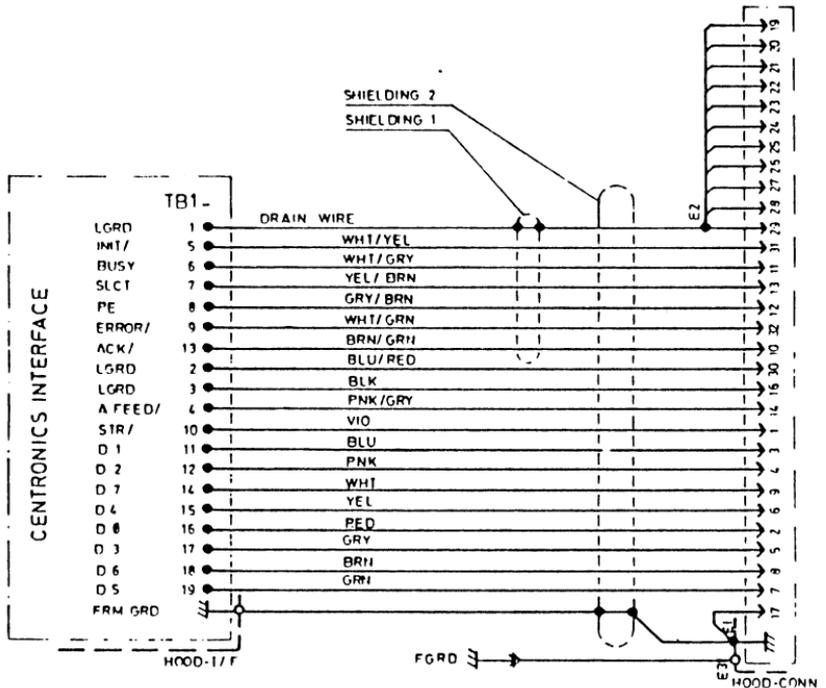
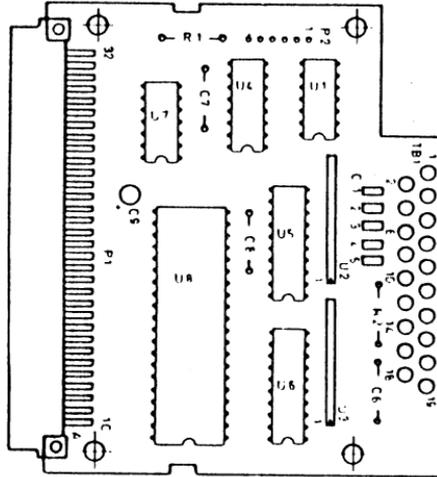


448KB PCB

| a      |    | c     |
|--------|----|-------|
| +5V    | 1  | +5 V  |
|        | 2  |       |
| AOUT 7 | 3  |       |
| AOUT6  | 4  | AOUT5 |
| AOUT4  | 5  | AOUT3 |
|        | 6  |       |
|        | 7  |       |
|        | 8  |       |
|        | 9  |       |
|        | 10 | AOUT2 |
|        | 11 | AOUT1 |
| OD0    | 12 | AOUT0 |
| OD1    | 13 | OD2   |
| OD3    | 14 |       |
|        | 15 |       |
| LGRD   | 16 | LGRD  |
|        | 17 |       |
|        | 18 |       |
| ID0    | 19 |       |
| ID1    | 20 |       |
| ID2    | 21 |       |
| ID3    | 22 |       |
| ID4    | 23 | CAS7/ |
| ID5    | 24 | CAS6/ |
| ID6    | 25 | CAS5/ |
| ID7    | 26 | CAS4/ |
| CAS2/  | 27 | CAS1/ |
| CAS3/  | 28 |       |
| OD4    | 29 | OD5   |
| RAS/   | 30 | WE/   |
| OD6    | 31 | OD7   |
| LGRD   | 32 | LGRD  |

Memory expansion pin assignment

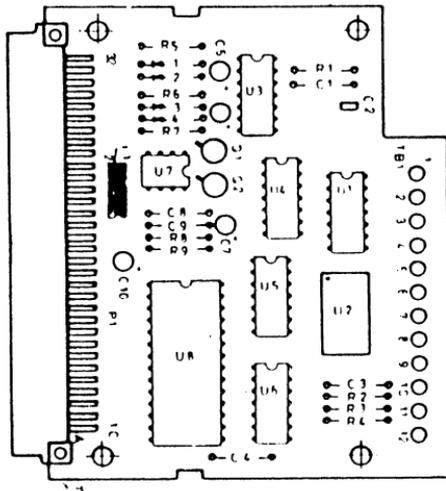
### CENTRONICS PERIPHERAL ADAPTER (K 210)



Cable connections

| a      |    | c       |
|--------|----|---------|
| +5 V   | 1  | +5 V    |
| IRQ    | 2  |         |
| RESET/ | 3  |         |
| IOW/   | 4  | IOR/    |
|        | 5  |         |
| BD1    | 6  | BD0     |
| BD3    | 7  | BD2     |
| BD5    | 8  | BD4     |
| BD7    | 9  | BD6     |
|        | 10 |         |
|        | 11 |         |
|        | 12 |         |
|        | 13 |         |
|        | 14 |         |
| LGRD   | 15 | CLK1    |
|        | 16 |         |
|        | 17 |         |
|        | 18 |         |
|        | 19 |         |
|        | 20 |         |
|        | 21 |         |
|        | 22 |         |
|        | 23 |         |
|        | 24 |         |
| BA1    | 25 |         |
|        | 26 | BA0     |
|        | 27 |         |
|        | 28 | IFSEL0/ |
|        | 29 |         |
|        | 30 |         |
|        | 31 |         |
| LGRD   | 32 | LGRD    |

Pin assignments P1  
(bus connector)

RS-PERIPHERAL ADAPTER  
(K211, K212, K213)

|   |  |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
|---|--|----|------|----|------|-----|------|-------|------|-----|------|-----|------|-----|------|------|-------|
| Number of bits per character  | 5, 6, 7, 8   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| Number of stop bits   | 1, 1 1/2, 2  |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| Parity  | Odd, Even, None  |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| Baud rate   | <table border="1"> <tbody> <tr> <td>50</td> <td>1800</td> </tr> <tr> <td>75</td> <td>2000</td> </tr> <tr> <td>110</td> <td>2400</td> </tr> <tr> <td>134.5</td> <td>3600</td> </tr> <tr> <td>150</td> <td>4800</td> </tr> <tr> <td>300</td> <td>7200</td> </tr> <tr> <td>600</td> <td>9600</td> </tr> <tr> <td>1200</td> <td>19200</td> </tr> </tbody> </table> | 50 | 1800 | 75 | 2000 | 110 | 2400 | 134.5 | 3600 | 150 | 4800 | 300 | 7200 | 600 | 9600 | 1200 | 19200 |
| 50  | 1800   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 75  | 2000   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 110   | 2400   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 134.5   | 3600   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 150   | 4800   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 300   | 7200   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 600   | 9600   |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| 1200  | 19200  |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |
| These features are software selectable using the Configure program (CONFIG) in the NCR CP/M operating system. |  |    |      |    |      |     |      |       |      |     |      |     |      |     |      |      |       |

## Software strapping

|    |        |                             |
|----|--------|-----------------------------|
| J2 | closed | for K 212 ( Printer Cable ) |
| J1 | closed | for K 211 ( Modem Cable )   |
| J2 | closed | for K 213 ( Plotter Cable ) |

## RS-232-C Hardware strapping

| a       |    | c       |
|---------|----|---------|
| +5 V    | 1  | +5 V    |
| IRQ     | 2  | +12 V   |
| RESET/  | 3  |         |
| IOW/    | 4  | IOR/    |
|         | 5  |         |
| BD1     | 6  | BD0     |
| BD3     | 7  | BD2     |
| BD5     | 8  | BD4     |
| BD7     | 9  | BD6     |
|         | 10 |         |
|         | 11 |         |
|         | 12 |         |
|         | 13 |         |
|         | 14 |         |
|         | 15 |         |
| LGRD    | 16 |         |
|         | 17 |         |
|         | 18 |         |
|         | 19 |         |
|         | 20 |         |
|         | 21 |         |
|         | 22 |         |
|         | 23 |         |
|         | 24 |         |
|         | 25 | BA2     |
| BA1     | 26 | BA0     |
|         | 27 |         |
| IFSEL1/ | 28 | IFSEL0/ |
|         | 29 |         |
|         | 30 |         |
|         | 31 |         |
| LGRD    | 32 | LGRD    |

RS-232C pin assignments

| Kit                                       | Port Address | Jumper | IFSEL Switch |
|---|--------------|--------|--------------|
| K211                                      | 70-7F (Hex)  | J1     | -            |
| K212/213                                  | 60-6F (Hex)  | J2     | -            |
| K801 with MODEM cable converter           | 70-77 (Hex)  | -      | 1 A          |
| K801 with PRINTER/PLOTTER cable converter | 60-67 (Hex)  | -      | 0 A          |

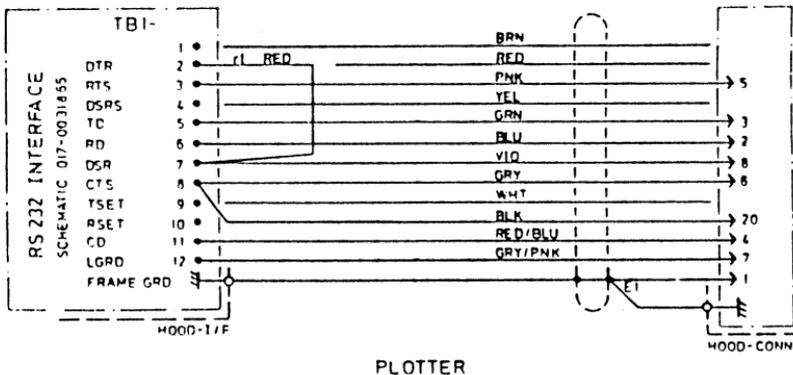
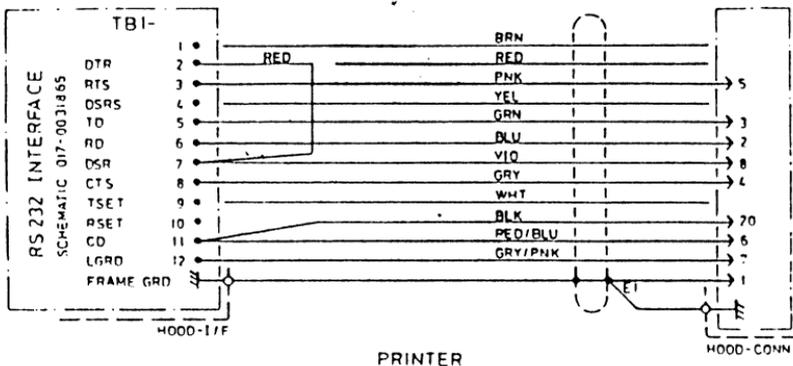
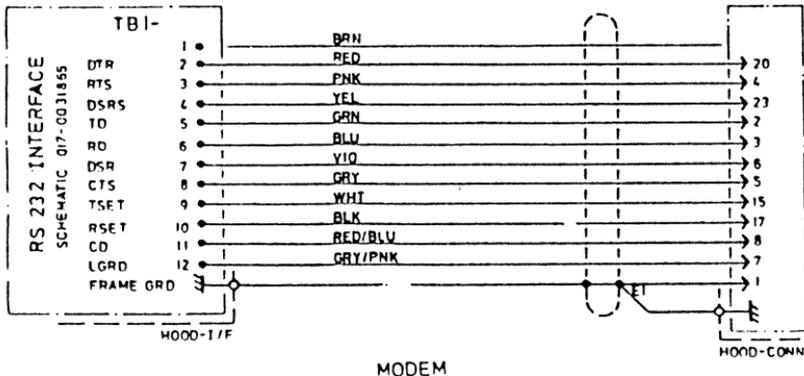
| DMV with Z80/8088  | SWITCH                |                                  |                                  |                       | CABLE CONV. |
|--------------------|-----------------------|----------------------------------|----------------------------------|-----------------------|-------------|
| CP/M MS DOS UCSD P | 4                     | 2                                | 1                                | B                     |             |
| PRINTER            | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            | <input type="radio"/> | 2           |
| COMMUNICATION      | <input type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input type="radio"/> | 1           |
| PLOTTER            | <input type="radio"/> | <input type="radio"/>            | <input type="radio"/>            | <input type="radio"/> | 3           |
| PLOT               | <input type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | 3           |
|                    | ○=OFF ●=ON            |                                  |                                  |                       |             |

4 2 1 B

ON ●  
 OFF ○

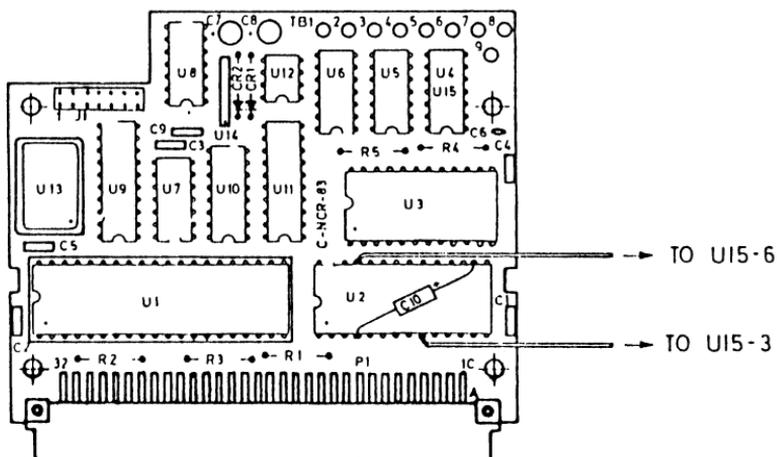
A

IF/ID-SELECTION



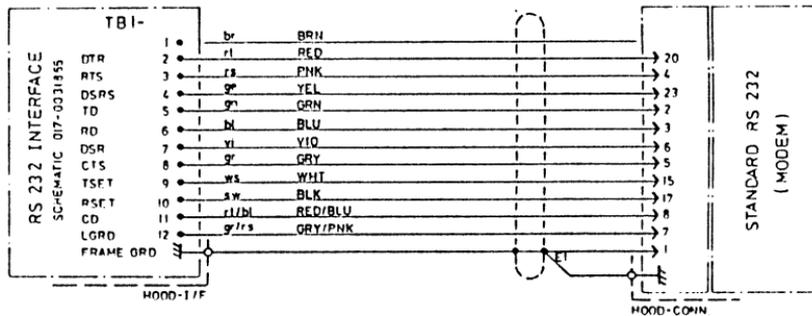
RS-232-C cables

## BUFFERED SYNC/ASYNCR ADAPTER (K 215)



| a      |    | c      |
|--------|----|--------|
| +5V    | 1  | +5V    |
| PERC/  | 2  | +12V   |
| RESET/ | 3  |        |
| IOW/   | 4  | IOR/   |
|        | 5  |        |
| BD1    | 6  | BD0    |
| BD3    | 7  | BD2    |
| BD5    | 8  | BD4    |
| BD7    | 9  | BD6    |
|        | 10 |        |
|        | 11 | IDSEL/ |
|        | 12 | IFSEL4 |
| AUTO/  | 13 |        |
|        | 14 |        |
| LGRD   | 15 |        |
|        | 16 |        |
|        | 17 |        |
|        | 18 |        |
|        | 19 |        |
|        | 20 |        |
|        | 21 |        |
|        | 22 |        |
|        | 23 |        |
|        | 24 |        |
| BA3    | 25 |        |
|        | 26 | BA0    |
| IFSEL3 | 27 | IFSEL2 |
| IFSEL1 | 28 | IFSEL0 |
|        | 29 |        |
|        | 30 |        |
|        | 31 |        |
| LGRD   | 32 | LGRD   |

Pin assignment P1

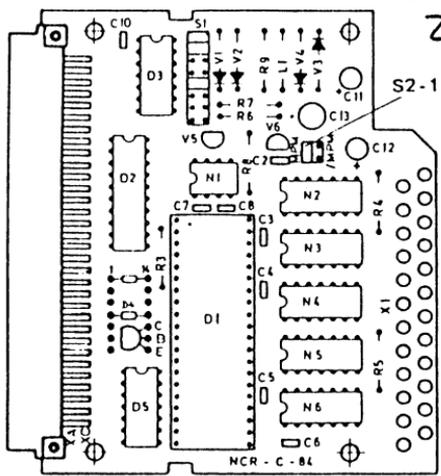


| IFSEL | J1             | Port Address |
|-------|----------------|--------------|
| 0A    | 11-12 and 9-10 | 60-67 hex    |
| 0B    | 13-14 and 9-10 | 68-6F hex    |
| 1A    | 11-12 and 7-8  | 70-77 hex    |
| 1B    | 13-14 and 7-8  | 78-7F hex    |
| 2A    | 11-12 and 5-6  | 30-37 hex    |
| 2B    | 13-14 and 5-6  | 38-3F hex    |
| 3A    | 11-12 and 3-4  | B0-B7 hex    |
| 3B    | 13-14 and 3-4  | B8-BF hex    |
| 4A    | 11-12 and 1-2  | C0-C7 hex    |
| 4B    | 13-14 and 1-2  | C8-CF hex    |

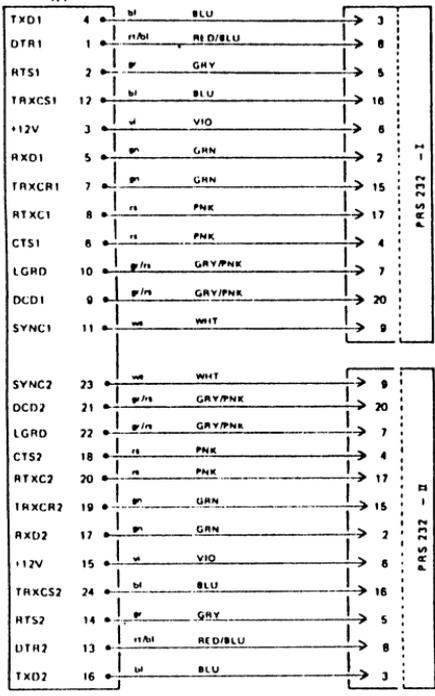
# SCC COMMUNICATION INTERFACE (K216)

S1-1

D1 =  
28530PS



X1



2 CHANNEL SERIAL CABLE

| K216 - V001        | MPM | MPM/ | S1-3 |
|--------------------|-----|------|------|
| MPM Operation      | ●   | ○    | ○    |
| Two Channel RS-232 | ○   | ●    | ●    |

| K216 - V002        | S2-1 | S2-2 | S2-3 |
|--------------------|------|------|------|
| MPM Operation      | ●    | ○    | ○    |
| Two Channel RS-232 | ○    | ●    | ●    |

Strapping SCC communication interface

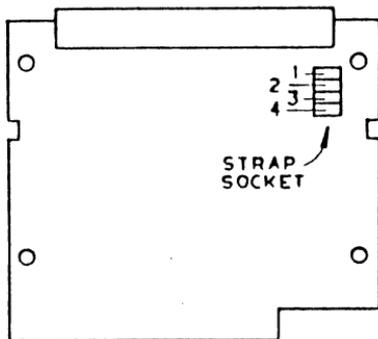
| IFSEL      |     | Switch S1 |   |   |   |   |   |   |          | Port Address |
|------------|-----|-----------|---|---|---|---|---|---|----------|--------------|
|            |     | 1         | 2 | 4 | 5 | 6 | 7 | 8 |          |              |
| IFSEL 0    | 0A1 | x         | x | x | o | o | o | o | o        | 60 - 63 Hex  |
|            | 0A2 | x         | o | x | o | o | o | o | o        | 64 - 67 Hex  |
|            | 0B1 | o         | x | x | o | o | o | o | o        | 68 - 6B Hex  |
|            | 0B2 | o         | o | x | o | o | o | o | o        | 6C - 6F Hex  |
| IFSEL 1    | 1A1 | x         | x | o | x | o | o | o | o        | 70 - 73 Hex  |
|            | 1A2 | x         | o | o | x | o | o | o | o        | 74 - 77 Hex  |
|            | 1B1 | o         | x | o | x | o | o | o | o        | 78 - 7B Hex  |
|            | 1B2 | o         | o | o | x | o | o | o | o        | 7C - 7F Hex  |
| IFSEL 2    | 2A1 | x         | x | o | o | x | o | o | o        | 30 - 33 Hex  |
|            | 2A2 | x         | o | o | o | x | o | o | o        | 34 - 37 Hex  |
|            | 2B1 | o         | x | o | o | x | o | o | o        | 38 - 3B Hex  |
|            | 2B2 | o         | o | o | o | x | o | o | o        | 3C - 3F Hex  |
| IFSEL 3    | 3A1 | x         | x | o | o | o | x | o | o        | B0 - B3 Hex  |
|            | 3A2 | x         | o | o | o | o | x | o | o        | B4 - B7 Hex  |
|            | 3B1 | o         | x | o | o | o | x | o | o        | B8 - BB Hex  |
|            | 3B2 | o         | o | o | o | o | x | o | o        | BC - BF Hex  |
| IFSEL 4    | 4A1 | x         | x | o | o | o | o | x | o        | C0 - C3 Hex  |
|            | 4A2 | x         | o | o | o | o | o | x | o        | C4 - C7 Hex  |
|            | 4B1 | o         | x | o | o | o | o | x | o        | C8 - CB Hex  |
|            | 4B2 | o         | o | o | o | o | o | x | o        | CC - CF Hex  |
| x = closed |     |           |   |   |   |   |   |   | o = open |              |

SCC Communication Cartridge

| a       |    | c       |
|---------|----|---------|
| +5V     | 1  | +5V     |
|         | 2  | +12V    |
| RESET/  | 3  |         |
| IRW/    | 4  | IRD/    |
|         | 5  |         |
| BD1     | 6  | BD0     |
| BD3     | 7  | BD2     |
| BD5     | 8  | BD4     |
| BD7     | 9  | BD6     |
|         | 10 |         |
|         | 11 |         |
| INTAK/  | 12 | IFSEL/4 |
|         | 13 |         |
|         | 14 |         |
| PCLK    | 15 |         |
| GRD     | 16 |         |
|         | 17 |         |
|         | 18 |         |
|         | 19 |         |
|         | 20 |         |
|         | 21 |         |
|         | 22 |         |
|         | 23 |         |
|         | 24 |         |
| BA3     | 25 | BA2     |
| BA1     | 26 | BA0     |
| IFSEL/3 | 27 | IFSEL/2 |
| IFSEL/1 | 28 | IFSEL/0 |
|         | 29 |         |
|         | 30 |         |
|         | 31 | INT/    |
| GRD     | 32 | GRD     |

Pin assignments P1  
(SCC communication cartridge)

## INTEGRATED MODEM (K 219)



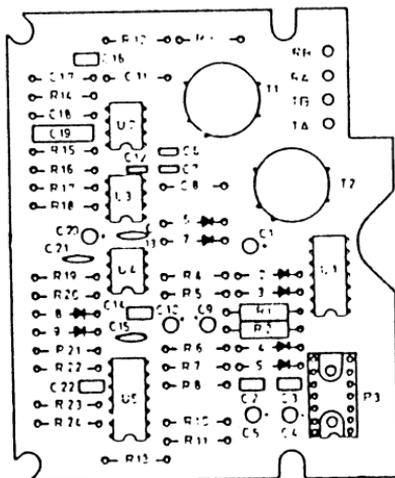
The strap socket is located next to the 64-pin bus connector

| STRAPS |    |           |             | FUNCTION   |
|--------|----|-----------|-------------|--|
| 1      | 2  | 3         | 4           |  |
| In     | In | In<br>Out | Not<br>used | Base address 70 Hex<br>Base address 78 Hex<br>NCR 3273<br>NCR 3276 |

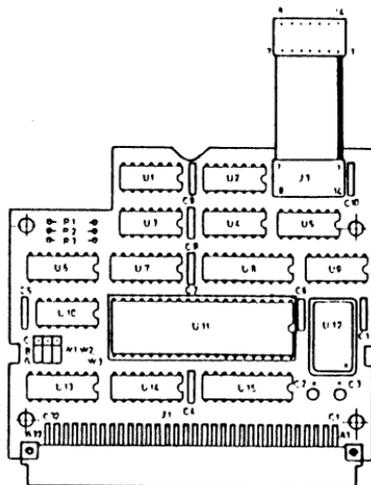
- Channel B control = BA + 0
- Channel B data = BA + 1
- Channel A control = BA + 2
- Channel A data = BA + 3
- Parallel control port = BA + 4

| a              |    | c      |
|----------------|----|--------|
| +5V            | 1  | +5V    |
| GND            | 2  |        |
| RESET/<br>IOW/ | 3  |        |
|                | 4  | IOR/   |
|                | 5  |        |
| BD1            | 6  | BD0    |
| BD3            | 7  | BD2    |
| BD5            | 8  | BD4    |
| BD7            | 9  | BD6    |
|                | 10 |        |
|                | 11 | IDSEL/ |
|                | 12 |        |
|                | 13 |        |
| CLK1           | 14 |        |
|                | 15 |        |
|                | 16 |        |
|                | 17 |        |
|                | 18 |        |
|                | 19 |        |
|                | 20 |        |
|                | 21 |        |
|                | 22 |        |
|                | 23 |        |
|                | 24 |        |
| BA3            | 25 | BA2    |
| BA1            | 26 | BA0    |
|                | 27 |        |
| IFSEL/         | 28 |        |
|                | 29 |        |
|                | 30 |        |
|                | 31 | INTR/  |
| GND .          | 32 | GND    |

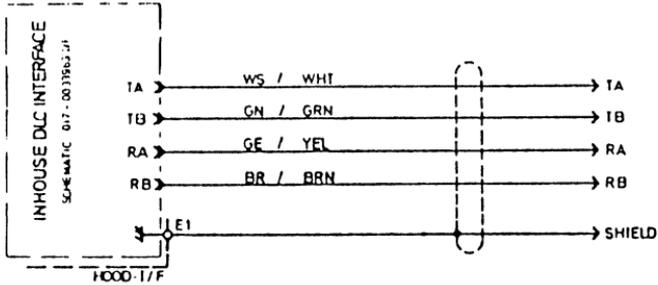
Pin assignments, integrated modem

DLC INHOUSE INTERFACE  
(K223)

DLC Inhouse I/F, board assy



DLC inhouse controller, board assy



| Header  | W1    | W2    | W3    | Port Address  |
|---------|-------|-------|-------|---------------|
| IFSEL 2 | A - B | A - B | A - B | 30 - 3F (Hex) |
| IFSEL 3 | A - B | A - B | B - C | B0 - BF (Hex) |

DLC inhouse controller

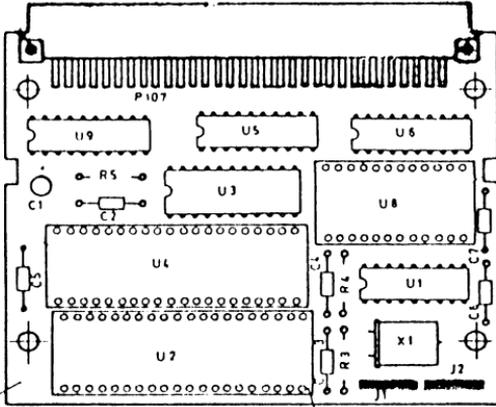
|    |          |
|----|----------|
| 1  | +5V      |
| 2  | TSTART/  |
| 3  | 4MSINT   |
| 4  | LED      |
| 5  | GND      |
| 6  | GND      |
| 7  | GND      |
| 8  | RDM      |
| 9  | 4MSSTOP/ |
| 10 | +12V     |
| 11 | +12V     |
| 12 | TDM/     |
| 13 | TDM      |
| 14 | +5V      |

Pin assignments J3  
(DLC-Inhouse Controller)

| a        |    | c       |
|----------|----|---------|
| +5V      | 1  |         |
| +5V      | 2  | +12V    |
| RESET/   | 3  | IFSEL/  |
| IOW/     | 4  | IOR/    |
|          | 5  |         |
| D1       | 6  | D0      |
| D3       | 7  | D2      |
| D5       | 8  | D4      |
| D7       | 9  | D6      |
| READYDMA | 10 |         |
| EOP/     | 11 |         |
|          | 12 |         |
|          | 13 | DIR     |
|          | 14 |         |
| PCLK     | 15 |         |
| GND      | 16 |         |
|          | 17 |         |
|          | 18 |         |
|          | 19 |         |
|          | 20 |         |
|          | 21 |         |
|          | 22 |         |
| A7       | 23 | A6      |
| A5       | 24 | A4      |
| A3       | 25 | A2      |
| A1       | 26 | A0      |
| IFSEL3/  | 27 | IFSEL2/ |
|          | 28 |         |
| DRQ1     | 29 | DRQ0    |
| DACK1/   | 30 | DACK0/  |
| WAIT     | 31 |         |
| GND      | 32 | GND     |

Pin assignments J1  
(DLC-Inhouse Controller)

# EXTERNAL 16-BIT PROCESSOR (K 231)

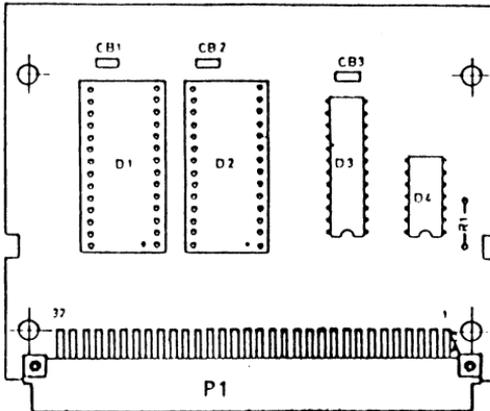


|    |        |
|----|--------|
| J1 | closed |
| J2 | closed |

|    | a        | b           | c        |
|----|----------|-------------|----------|
| 1  | +5 V     | +5 V        | +5 V     |
| 2  | OPT 2    |             | +12 V    |
| 3  | RESET/   |             | RESETIN/ |
| 4  | IOW/     |             | IOR/     |
| 5  | MEMW/    |             | MEMR/    |
| 6  | D1       |             | D0       |
| 7  | D3       |             | D2       |
| 8  | D5       |             | D4       |
| 9  | D7       |             | D6       |
| 10 | READYDMA | READYP      | ABTRI/   |
| 11 | EOP/     | HOLD        |          |
| 12 | INTACK/  | SWITCH 16/  | IFSEL4/  |
| 13 | DBTRI/   | HLDA 16     | DIR/     |
| 14 | THOLD/   | 16 BITAV/   | HLDA     |
| 15 | PCLK/    | STDMARQ/    | CLK1     |
| 16 | LGRD     | LGRD        | TRAMD/   |
| 17 | BA19     | 16 BITSET / | BA18     |
| 18 | BA17     |             | BA16     |
| 19 | A15      |             | A14      |
| 20 | A13      | MEMRQ/      | A12      |
| 21 | A11      |             | A10      |
| 22 | A9       |             | A8       |
| 23 | A7       |             | A6       |
| 24 | A5       |             | A4       |
| 25 | A3       |             | A2       |
| 26 | A1       |             | A0       |
| 27 | IFSEL3/  |             | IFSEL2/  |
| 28 | IFSEL1/  |             | IFSEL0/  |
| 29 | DRQ1     |             | DRQ0     |
| 30 | DACK1/   |             | DACK0/   |
| 31 | WAIT/    |             | INT/     |
| 32 | LGRD     | LGRD        | LGRD     |

Pin assignments J107/107A  
(diagnostics/16-bit processor)

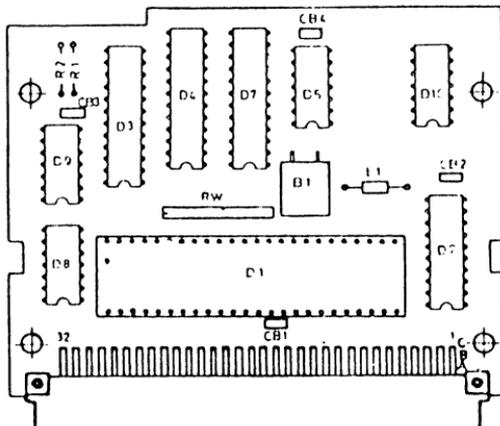
SHARED RAM  
(K 233)



| a        |    | c        |
|----------|----|----------|
| +5V      | 1  | +5V      |
|          | 2  | +12V     |
| RESET/   | 3  |          |
| IWR/     | 4  | IRD/     |
| MWR/     | 5  | MRD/     |
| BD1      | 6  | BD0      |
| BD3      | 7  | BD2      |
| BD5      | 8  | BD4      |
| BD7      | 9  | BD6      |
|          | 10 |          |
|          | 11 |          |
| INTAK/   | 12 | IFSEL4 / |
|          | 13 | DIR/     |
|          | 14 |          |
| PCLK     | 15 |          |
| GRD      | 16 | TRAMD/   |
| BA19     | 17 | BA18     |
| BA17     | 18 | BA16     |
| BA15     | 19 | BA14     |
| BA13     | 20 | BA12     |
| BA11     | 21 | BA10     |
| BA9      | 22 | BA8      |
| BA7      | 23 | BA6      |
| BA5      | 24 | BA4      |
| BA3      | 25 | BA2      |
| BA1      | 26 | BA0      |
| IFSEL3/  | 27 | IFSEL2/  |
| IFSEL 1/ | 28 | IFSEL0/  |
|          | 29 |          |
|          | 30 |          |
|          | 31 | INT/     |
| GRD      | 32 | GRD      |

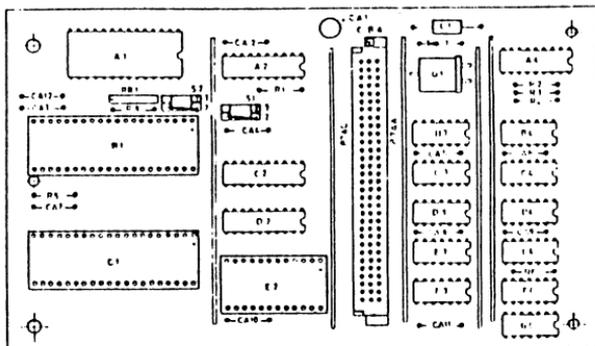
Pin assignments P1  
(shared RAM)

# 68008 PROCESSOR BOARD (K234)



|    | a      | b          | c     |
|----|--------|------------|-------|
| 1  | +5V    |            | +5V   |
| 2  |        |            |       |
| 3  | RESET/ |            |       |
| 4  | IOW/   |            | IOR/  |
| 5  | MEMW/  |            | MEMR/ |
| 6  | D1     |            | D0    |
| 7  | D3     |            | D2    |
| 8  | D5     | TIMINT     | D4    |
| 9  | D7     |            | D6    |
| 10 |        | WAITP/     |       |
| 11 |        | HOLDDMA/   |       |
| 12 | INTAC/ | PROCCH/    |       |
| 13 |        | HOLDA16    |       |
| 14 | THOLD/ |            | HOLDA |
| 15 |        |            |       |
| 16 | GRD    |            |       |
| 17 | BA19   | 16 BIT SET | BA18  |
| 18 | BA17   |            | BA16  |
| 19 | A15    |            | A14   |
| 20 | A13    | MEMRQ/     | A12   |
| 21 | A11    |            | A10   |
| 22 | A9     |            | A8    |
| 23 | A7     |            | A6    |
| 24 | A5     |            | A4    |
| 25 | A3     |            | A2    |
| 26 | A1     |            | A0    |
| 27 |        |            |       |
| 28 |        |            |       |
| 29 |        |            |       |
| 30 |        |            |       |
| 31 |        |            | INT/  |
| 32 | GRD    |            | GRD   |

Pin assignments  
Processor 68008

16-BIT PROCESSOR WITH PIC  
(K235)

|                  |       |
|------------------|-------|
| S1 - 1 to S1 - 2 | IRQ5  |
| S1 - 1 to S1 - 3 | IRQ6  |
| S2 - 1 to S2 - 2 | IRQ2A |
| S2 - 1 to S2 - 3 | IRQ2  |

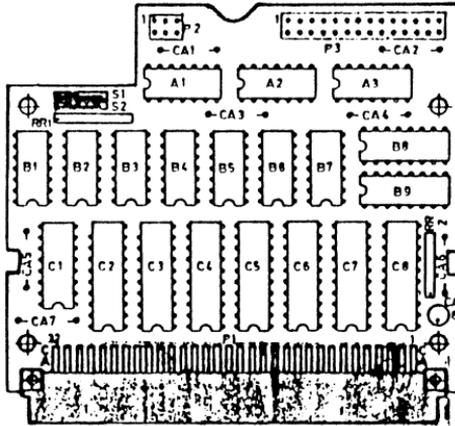
Switches, 16-bit processor with interrupt controller

Install wire jumper in location R5 only when IC (8087) is not mounted in location B1.

|    | a        | b            | c        |
|----|----------|--------------|----------|
| 1  | +5V      | +5V          | +5V      |
| 2  | OPT2     | IRQ2         | +12V     |
| 3  | RESET/   | IRQ3         | RESETIN/ |
| 4  | IOW/     | IRQ4         | IOR/     |
| 5  | MEMW/    | IRQ5         | MEMR/    |
| 6  | D1       | FLEXINT      | D0       |
| 7  | D3       | KEYINT       | D2       |
| 8  | D5       | TIMINT       | D4       |
| 9  | D7       | IRQ6         | D6       |
| 10 | READYDMA | READYP       | ABTRI/   |
| 11 | EOP/     | HOLD         |          |
| 12 | INTACK/  | SWITCH16/    | IFSEL4/  |
| 13 | DBTRI/   | HOLDA16      | DIR      |
| 14 | THOLD/   | 16 BITAV/    | HLDA     |
| 15 | PCLK/    | STDMARQ/     | CLK1     |
| 16 | LGRD     | LGRD         | TRAMD/   |
| 17 | BA19     | 16 BIT SET / | BA18     |
| 18 | BA17     | INTCSL /     | BA16     |
| 19 | A15      |              | A14      |
| 20 | A13      | MEMRQ/       | A12      |
| 21 | A11      |              | A10      |
| 22 | A9       |              | A8       |
| 23 | A7       |              | A6       |
| 24 | A5       |              | A4       |
| 25 | A3       |              | A2       |
| 26 | A1       |              | A0       |
| 27 | IFSEL3/  |              | IFSEL2/  |
| 28 | IFSEL1/  |              | IFSEL0/  |
| 29 | DRQ1     |              | DRQ0/    |
| 30 | DACK1/   |              | DACK0/   |
| 31 | WAIT/    | IRQ2A        | INT/     |
| 32 | LGRD     | LGRD         | LGRD     |

Pin assignments P7AA to P7AC  
(16-bit processor 8088, interrupt controller 8259A)

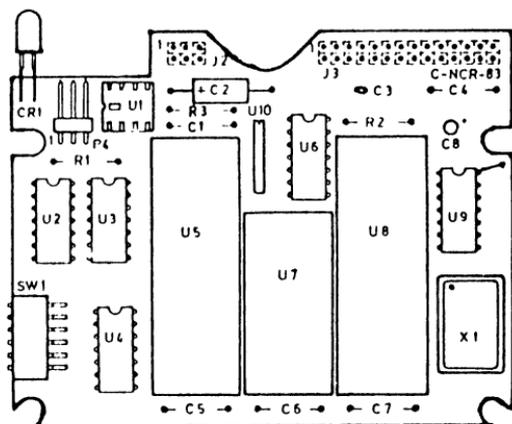
OMNINET ADAPTER  
(K 600)



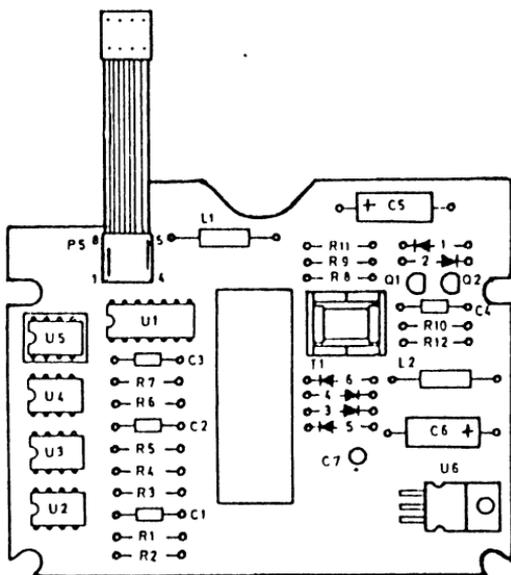
Interface PCB

| a        |    | c       |
|----------|----|---------|
| +5V      | 1  | +5V     |
| PERC/    | 2  |         |
| RESET/   | 3  |         |
| IOW/     | 4  | IOR/    |
| MEMW/    | 5  | MEMR/   |
| BD1      | 6  | BD0     |
| BD3      | 7  | BD2     |
| BD5      | 8  | BD4     |
| BD7      | 9  | BD6     |
| READYDMA | 10 | ABTRI/  |
|          | 11 | IDSEL/  |
|          | 12 |         |
| AUTO/    | 13 | DIR/    |
| THOLD/   | 14 | HLDA/   |
|          | 15 |         |
|          | 16 |         |
| BA19     | 17 | BA18    |
| BA17     | 18 | BA16    |
| BA15     | 19 | BA14    |
| BA13     | 20 | BA12    |
| BA11     | 21 | BA10    |
| BA9      | 22 | BA8     |
| BA7      | 23 | BA6     |
| BA5      | 24 | BA4     |
| BA3      | 25 | BA2     |
| BA1      | 26 | BA0     |
| IFSEL3/  | 27 | IFSEL2/ |
|          | 28 |         |
| DRQ1     | 29 |         |
| DACK1/   | 30 |         |
|          | 31 | INT/    |
| LGRD     | 32 | LGRD    |

Pin assignments P1



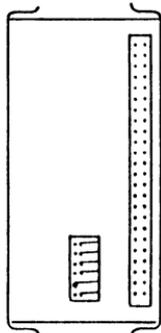
Controller PCB



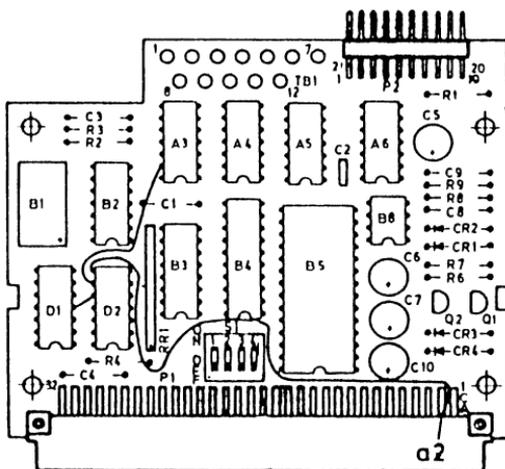
Isolator PCB

| REQUESTER ID |     | SWITCH SETTING | REQUESTER ID |     | SWITCH SETTING |
|--------------|-----|----------------|--------------|-----|----------------|
| HEX          | DEC | 1 2 3 4 5 6    | HEX          | DEC | 1 2 3 4 5 6    |
| 0            | 0   | 000000         | 20           | 32  | 000001         |
| 1            | 1   | 100000         | 21           | 33  | 100001         |
| 2            | 2   | 010000         | 22           | 34  | 010001         |
| 3            | 3   | 110000         | 23           | 35  | 110001         |
| 4            | 4   | 001000         | 24           | 36  | 001001         |
| 5            | 5   | 101000         | 25           | 37  | 101001         |
| 6            | 6   | 011000         | 26           | 38  | 011001         |
| 7            | 7   | 111000         | 27           | 39  | 111001         |
| 8            | 8   | 000100         | 28           | 40  | 000101         |
| 9            | 9   | 100100         | 29           | 41  | 100101         |
| A            | 10  | 010100         | 2A           | 42  | 010101         |
| B            | 11  | 110100         | 2B           | 43  | 110101         |
| C            | 12  | 001100         | 2C           | 44  | 001101         |
| D            | 13  | 101100         | 2D           | 45  | 101101         |
| E            | 14  | 011100         | 2E           | 46  | 011101         |
| F            | 15  | 111100         | 2F           | 47  | 111101         |
| 10           | 16  | 000010         | 30           | 48  | 000011         |
| 11           | 17  | 100010         | 31           | 49  | 100011         |
| 12           | 18  | 010010         | 32           | 50  | 010011         |
| 13           | 19  | 110010         | 33           | 51  | 110011         |
| 14           | 20  | 001010         | 34           | 52  | 001011         |
| 15           | 21  | 101010         | 35           | 53  | 101011         |
| 16           | 22  | 011010         | 36           | 54  | 011011         |
| 17           | 23  | 111010         | 37           | 55  | 111011         |
| 18           | 24  | 000110         | 38           | 56  | 000111         |
| 19           | 25  | 100110         | 39           | 57  | 100111         |
| 1A           | 26  | 010110         | 3A           | 58  | 010111         |
| 1B           | 27  | 110110         | 3B           | 59  | 110111         |
| 1C           | 28  | 001110         | 3C           | 60  | 001111         |
| 1D           | 29  | 101110         | 3D           | 61  | 101111         |
| 1E           | 30  | 011110         | 3E           | 62  | 011111         |
| 1F           | 31  | 111110         | 3F           | 63  | 111111         |

Requester switch settings

Transporter Switches  
(Unit Identification Switches)

# SWITCHABLE RS-232 ADAPTER (K801)



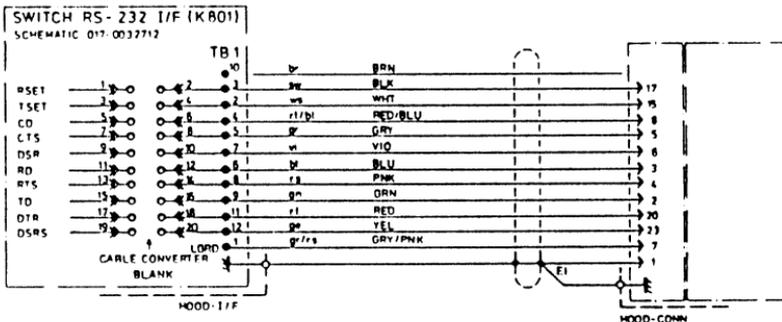
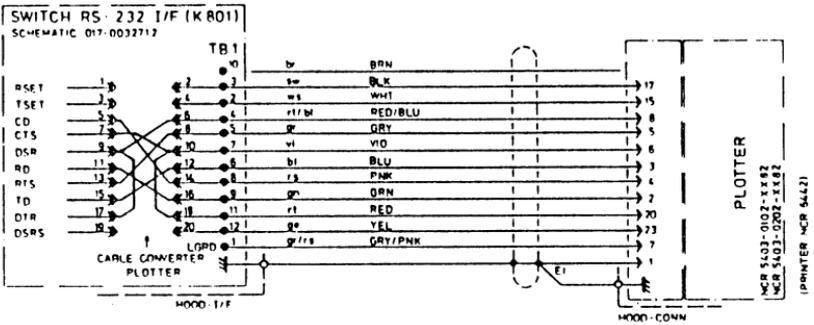
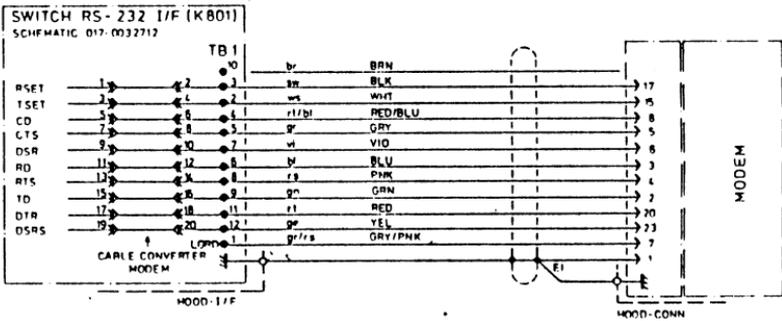
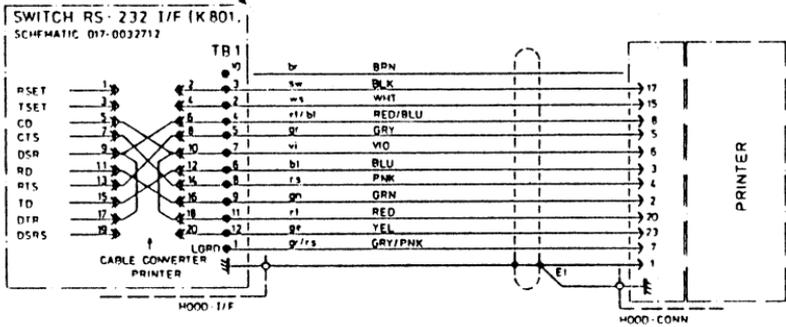
| IFSEL | SWITCH |   |   |   | PORT-ADDR. |
|-------|--------|---|---|---|------------|
|       | 4      | 2 | 1 | B |            |
| 0 A   | ○      | ○ | ○ | ○ | 60H - 67H  |
| 0 B   | ○      | ○ | ○ | ● | 68H - 6FH  |
| 1 A   | ○      | ○ | ● | ○ | 70H - 77H  |
| 1 B   | ○      | ○ | ○ | ● | 78H - 7FH  |
| 2 A   | ○      | ● | ○ | ○ | 30H - 37H  |
| 2 B   | ○      | ● | ○ | ● | 38H - 3FH  |
| 3 A   | ○      | ● | ● | ○ | 80H - 87H  |
| 3 B   | ○      | ● | ● | ● | 88H - 8FH  |
| 4 A   | ●      | ○ | ○ | ○ | C0H - C7H  |
| 4 B   | ●      | ○ | ○ | ● | C8H - CFH  |

| DMV with Z80/8088<br>CP/M MS DOS UCSD ● | SWITCH |      |   |   | CABLE<br>CONV |
|---|--------|------|---|---|---------------|
|   | 4      | 2    | 1 | B |               |
| PRINTER                                 | ○      | ○    | ○ | ○ | 2             |
| COMMUNICATION                           | ○      | ○    | ● | ○ | 1             |
| PLOTTER                                 | ○      | ○    | ○ | ○ | 3             |
| PLOT                                    | ○      | ●    | ● | ○ | 3             |
|   | ○ OFF  | ● ON |   |   |               |

4 2 1 B

ON ●  
 OFF ○  
 A

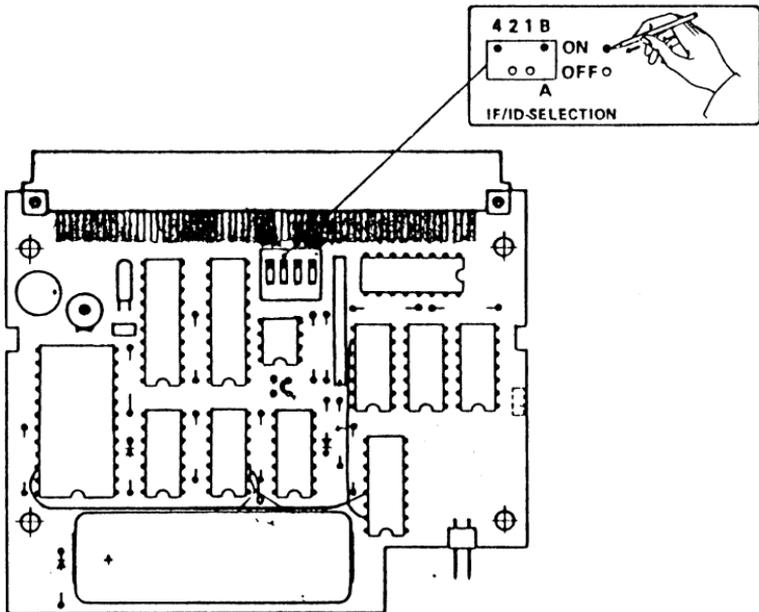
IF/ID SELECTION



| a      |    | c      |
|--------|----|--------|
| +5V    | 1  | +5V    |
| IRQ    | 2  | +12V   |
| RESET/ | 3  |        |
| IOW/   | 4  | IOR/   |
|        | 5  |        |
| BD1    | 6  | BD0    |
| BD3    | 7  | BD2    |
| BD5    | 8  | BD4    |
| BD7    | 9  | BD6    |
|        | 10 |        |
|        | 11 |        |
|        | 12 | ISEL4/ |
|        | 13 |        |
|        | 14 |        |
|        | 15 |        |
| LGRD   | 16 |        |
|        | 17 |        |
|        | 18 |        |
|        | 19 |        |
|        | 20 |        |
|        | 21 |        |
|        | 22 |        |
|        | 23 |        |
|        | 24 |        |
| BA3    | 25 | BA2    |
| BA1    | 26 | BA0    |
| ISEL3/ | 27 | ISEL2/ |
| ISEL1/ | 28 | ISEL0/ |
|        | 29 |        |
|        | 30 |        |
|        | 31 | INT/   |
| LGRD   | 32 | LGRD   |

Pin assignments P1  
(switchable RS-232C adapter)

REAL-TIME-CLOCK  
(K 803)



IFSEL switches

| IFSEL | SWITCH<br>4 2 1 B | PORT   |         |
|-------|-------------------|--------|---------|
|       |                   | HEX    | DEC     |
| 0A    | ○ ○ ○ ○           | 60-67H | 96-103  |
| 0B    | ○ ○ ○ ●           | 68-6FH | 104-111 |
| 1A    | ○ ○ ● ○           | 70-77H | 112-119 |
| 1B    | ○ ○ ● ●           | 78-7FH | 120-127 |
| 2A    | ○ ● ○ ○           | 30-37H | 48- 55  |
| 2B    | ○ ● ○ ●           | 38-3FH | 56- 63  |
| 3A    | ○ ● ● ○           | 80-87H | 176-183 |
| 3B    | ○ ● ● ●           | 88-8FH | 184-191 |
| 4A    | ● ○ ○ ○           | C0-C7H | 192-199 |
| 4B    | ● ○ ○ ●           | C8-CFH | 200-207 |

IFSEL switch settings

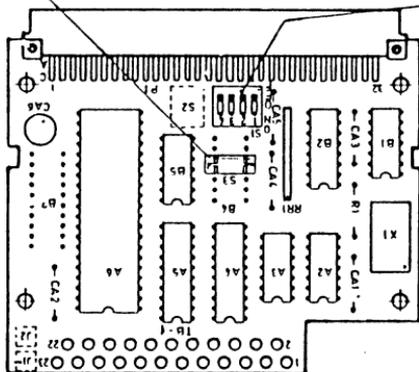
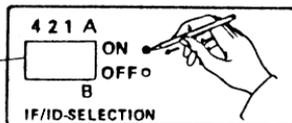
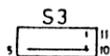
| a      |    | c       |
|--------|----|---------|
| +5V    | 1  | +5V     |
| IRQ    | 2  | +12V    |
| RESET/ | 3  |         |
| IOW/   | 4  | IOR/    |
|        | 5  |         |
| BD1    | 6  | BD0     |
| BD3    | 7  | BD2     |
| BD5    | 8  | BD4     |
| BD7    | 9  | BD6     |
|        | 10 |         |
|        | 11 | IDSEL/  |
|        | 12 | IFSEL 4 |
| AUTO/  | 13 |         |
|        | 14 |         |
|        | 15 |         |
| LGRD   | 16 | .       |
|        | 17 |         |
|        | 18 |         |
|        | 19 |         |
|        | 20 |         |
|        | 21 |         |
|        | 22 |         |
|        | 23 |         |
|        | 24 |         |
| BA3    | 25 | BA2     |
| BA1    | 26 | BA0     |
| IFSEL3 | 27 | IFSEL2  |
| IFSEL1 | 28 | IFSEL0  |
|        | 29 |         |
|        | 30 |         |
| WAIT/  | 31 | INT/    |
| LGRD   | 32 | LGRD    |

Pin assignments P1

|      |           |
|------|-----------|
| P2-1 | STBY-INT/ |
| -2   | LGRD      |

Standby interrupt connector

IEEE-488 ADAPTER  
(K 804)



| b              |    | c      |
|----------------|----|--------|
| +5V            | 1  | +5V    |
| IRQ            | 2  |        |
| Reset/<br>IOW/ | 3  |        |
|                | 4  | IOR/   |
|                | 5  |        |
| BD1            | 6  | BD0    |
| BD3            | 7  | BD2    |
| BD5            | 8  | BD4    |
| BD7            | 9  | BD6    |
|                | 10 |        |
| EOP/           | 11 |        |
|                | 12 | ISEL4/ |
|                | 13 | DIR/   |
|                | 14 |        |
| LGRD           | 15 |        |
|                | 16 |        |
|                | 17 |        |
|                | 18 |        |
|                | 19 |        |
|                | 20 |        |
|                | 21 |        |
|                | 22 |        |
|                | 23 |        |
|                | 24 |        |
| BA3            | 25 | BA2    |
| BA1            | 26 | BA0    |
| ISEL3/         | 27 | ISEL2/ |
| ISEL1/         | 28 | ISEL0/ |
| DRO1           | 29 | DRO0   |
| DACK1/         | 30 | DACK0/ |
|                | 31 | INT/   |
| LGRD           | 32 | LGRD   |

Pin assignments P1





|    |        |
|----|--------|
| P1 | +5V    |
| 2  | XA/Y1  |
| 3  | XB/Y2  |
| 4  | YA/X2  |
| 5  | YB/X1  |
| 6  | S1/BND |
| 7  | S3     |
| 8  | S2     |
| 9  | GND/S1 |

Mouse connector  
pin assignments

|           | Jumpers Closed |
|-----------|----------------|
| IFSEL 0a/ | J1, J6         |
| IFSEL 0b/ | J1, J7         |
| IFSEL 1a/ | J2, J6         |
| IFSEL 1b/ | J2, J7         |
| IFSEL 2a/ | J3, J6         |
| IFSEL 2b/ | J3, J7         |
| IFSEL 3a/ | J4, J6         |
| IFSEL 3b/ | J4, J7         |
| IFSEL 4a/ | J5, J6         |
| IFSEL 4b/ | J5, J7         |

IFSEL Jumpers

|  |                                   |
|--|-----------------------------------|
| Alps Mouse, Hawkey Mouse<br>Depraz Mouse | J8, J9, J10 Off<br>J8, J9, J10 On |
|--|-----------------------------------|

Mouse selection jumpers

## NCR 3282 WINCHESTER DISK UNITS

### GENERAL DESCRIPTION

These units are freestanding Winchester disk drives designed for connection to the NCR DECISION MATE V. They are intended for connection to systems with either one or two flexible disk drives. Each unit has a formatted capacity of 10 Mbytes, and up to three units may be connected together in a daisy-chain configuration.

The sub-models of the NCR 3282 are:

A single unit, this unit includes a disk controller, an interface to allow direct connection to the bus of the NCR DECISION MATE V. It is not possible to connect additional units to this model.

A master unit, this unit is similar to a single unit but includes additional hardware to allow the connection of either one or two secondary units in a daisy-chain configuration.

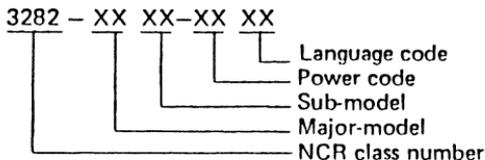
A secondary unit, this unit does not have a disk controller or interface. It is designed to connect to a master unit. A maximum of two secondary units may be connected to the daisy-chain.

All models are supplied with a cabinet that contains the drive, power supply, fan, power cables, and interconnection cables that provide for easy assembly of the units in the daisy-chain configuration.

No preparation is required before installation, simply connect the units, ensure the terminator resistor plug is installed in the last unit, (not required on the single unit), connect to a suitable power source and the units are ready to use.

### MODEL NUMBER DESCRIPTION

The configuration of these units is defined by the model number. The standard arrangement of the model number is shown below:



A full description of the model number for the NCR 3282 is shown in Figure 7.1.

| Description   |      |  |
|---------------|------|--|
| Class         | 3282 | NCR class number   |
| Major-model   | 01   | Fixed disk drive, 10 Mbyte (formatted)                                 |
| Sub-model     | 01   | Single drive with controller and interface                             |
|               | 02   | Master drive with controller, interface and connector for sub-model 03 |
|               | 03   | Secondary drive with connector for sub-model 02                        |
| Power code    | 60   | 120 volts 50/60 Hz   |
|               | 65   | 220 volts 50/60 Hz   |
|               | 70   | 100 volts 50/60 Hz   |
|               | 74   | 230 volts 50/60 Hz   |
|               | 75   | 240 volts 50/60 Hz   |
| Language code | 90   | No language characteristics  |

Figure 7.1 Model number description

## INSTALLATION

The basic data that may be required for installation is given in Figure 7.2.

|   |                       |
|---|-----------------------|
| Height  | 183mm (7.2in.)        |
| Width   | 260mm (10.2in.)       |
| Depth   | 380mm (14.9in.)       |
| Weight  | 11kg (24.2lb.)        |
| Power requirements<br>(Master or Single)        | 65 Watts              |
| Power requirements (Secondary)                  | 55 Watts              |
| Interconnection cable<br>(Master or Single)     | 2 metres (6.6 feet)   |
| Interconnection cable<br>(NCR 3283 to NCR 3282) | 0.5 metres (1.6 feet) |

Figure 7.2 Installation data

## SINGLE DRIVE

Use the following procedure to connect the single drive model:

1. Ensure the NCR DECISION MATE V is switched off
2. Connect the interface plug into one of the bus connectors (2 to 6) at the rear of the NCR DECISION MATE V.
3. Connect the power cable to the NCR 3282 and to a suitable power source
4. Switch on the NCR 3282 and the NCR DECISION MATE V

## MASTER AND SECONDARY DRIVES

If a master unit is being installed alone (without secondary units) use the same procedure as for a single unit.

If being installed with secondary units, use the following procedure:

1. Ensure the NCR DECISION MATE V is switched off
2. Connect the interface plug on the master unit to one of the bus connectors (2 to 6) at the rear of the NCR DECISION MATE V
3. Remove the terminator resistor plug from the rear of the master unit
4. Connect the interconnection cable from secondary unit into the connector at the rear of the master unit (previously occupied by the terminator resistor plug)
5. If a second secondary unit is being installed connect the interconnection cable from the second secondary unit to the connector at the rear of the first secondary unit
6. Install the terminator resistor plug into the connector at the rear of the last secondary unit
7. Connect the power cable(s) to the NCR 3282(s) and to a suitable power source
8. Switch on the NCR 3282(2) and the NCR DECISION MATE V.

**NOTE:** For correct operation all units in the daisy-chain must be switched on, and must remain switched on until operation is finished.

## HARDWARE DESCRIPTION

The hardware of the single, master, and secondary units is similar. Figure 7.3 shows the hardware elements that are used in each of the units.

|                                | Single | Master | Secondary |
|--------------------------------|--------|--------|-----------|
| Disk controller                | Yes    | Yes    | No        |
| Interface and cable            | Yes    | Yes    | No        |
| Connector board                | No     | Yes    | Yes       |
| Cable (NCR3282 to NCR 3282)    | No     | No     | Yes       |
| Integrated terminator resistor | Yes    | No     | No        |
| Terminator resistor plug       | No     | Yes    | No        |

Figure 7.3 Hardware elements

Block diagrams of a single and a typical master and secondary set-up are shown in Figures 7.4 and 7.5.

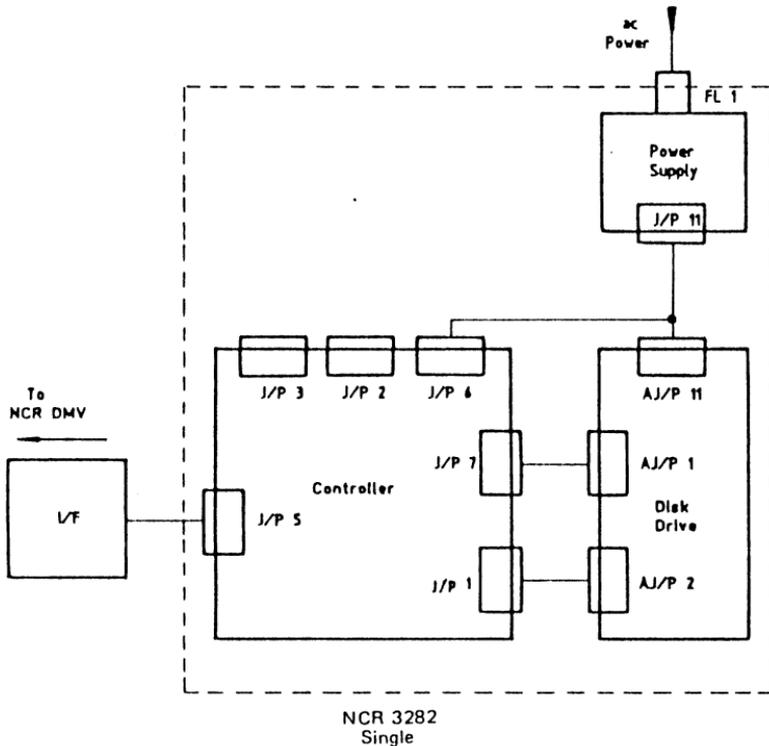


Figure 7.4 Single unit configuration

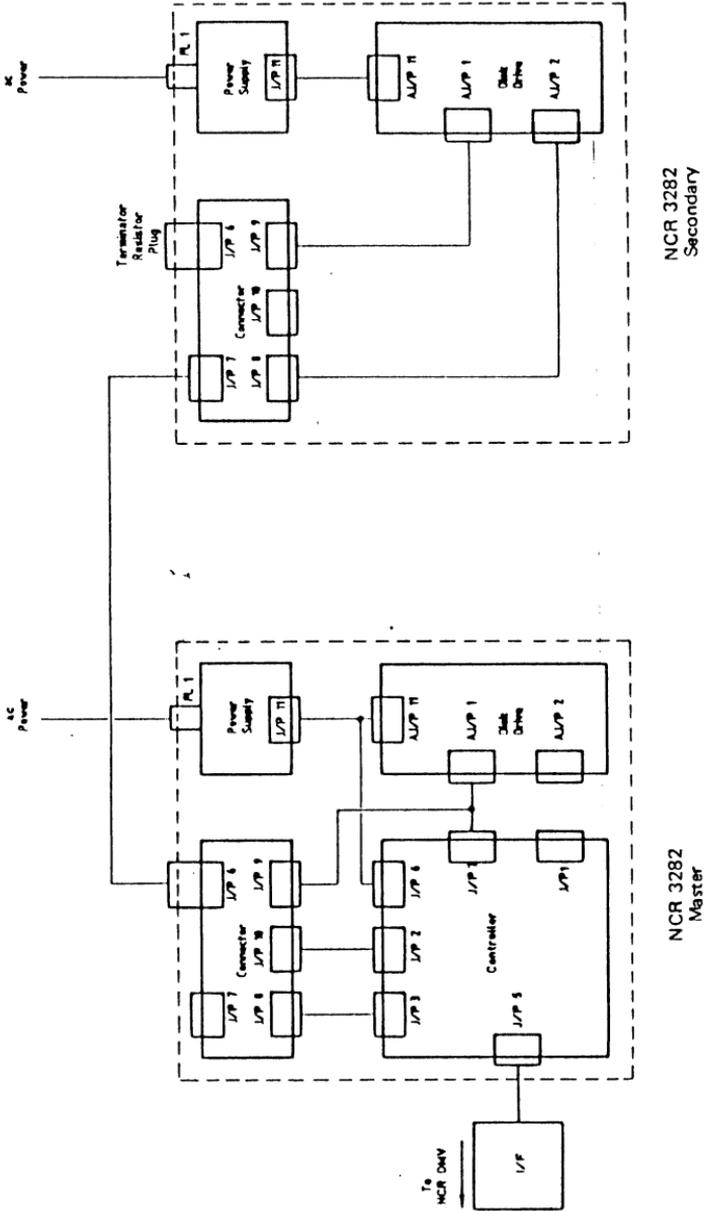


Figure 7.5 Typical Master/Secondary configuration

## DISK DRIVE (H6801-STD1-06-46)

The drive used in the NCR 3282 is a sealed module and most repairs can only be made in a workshop. In the event of problems replace the complete drive, and contact your local NCR office regarding the repair of the faulty drive. Do not attempt to open the drive module.

### Strapping

The strapping and termination of the drive are set by the factory. When replacing drive modules ensure that strapping and termination is set correctly as shown in Figures 7.6 and 7.7.

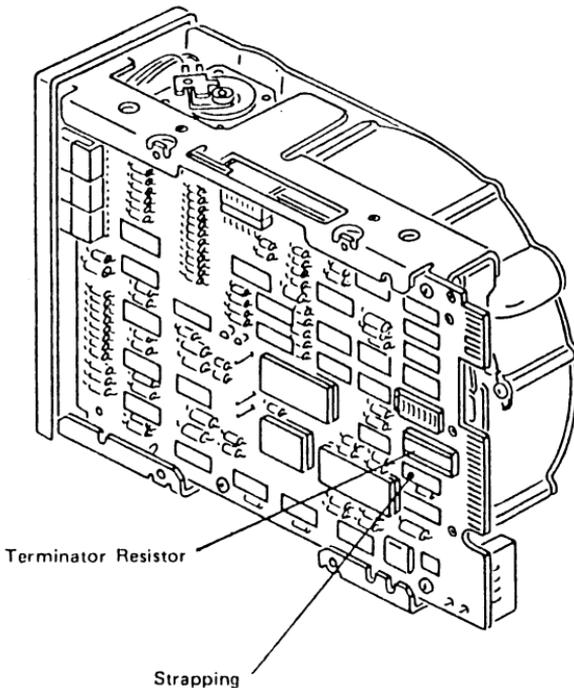


Figure 7.6 Strapping locations

| Strapping Header Pins  | Single Unit | Master Unit | Secondary Unit |
|--|-------------|-------------|----------------|
| 2 to 15  | Closed      | Closed      | Closed         |
| 3 to 14  | Closed      | Closed      | Closed         |
| 4 to 13  | Closed      | Closed      | Closed         |
| 5 to 12  | Open        | Open        | Open           |
| 6 to 11  | Open        | Open        | Closed         |
| 7 to 10  | Open        | Open        | Open           |
| 8 to 9   | Closed      | Closed      | Open           |
| Terminator resistor  | Installed   | Removed     | Removed        |
| Normally a 14 pin strapping header is fitted into a 16 pin socket leaving pins 1 and 16 open |             |             |                |

Figure 7.7 Strapping settings

## DISK CONTROLLER

The disk controller is installed in single and master units only, not in secondary units. The one controller provides complete control over all drives in the system, and has the following features:

- All necessary buffers and receivers/drivers
- Built-in data separator
- Built-in write pre-compensation logic
- Cyclic redundancy check for ID fields
- Automatic retries for all errors
- MFM encoding
- Soft sectoring

When problems are suspected with the controller, replace the complete controller and return the faulty controller for workshop repair.

## POWER SUPPLY

The power supply comprises the following modules:

- Power connector
- Primary fuse
- Transformer
- Rectifier
- Switcher (+5 V, +12 V)
- Secondary fuse for unregulated output

The power supply is capable of operating with the following ac power sources:

| Frequency   | Nominal Voltage | Range   |
|-------------|-----------------|---------|
| 49 to 61 Hz | 100             | 90-107  |
| " "         | 120             | 104-127 |
| " "         | 220             | 198-235 |
| " "         | 230             | 207-246 |
| " "         | 240             | 216-257 |

Current limiting and overvoltage protection are provided. The following power line transients should not affect the specified performance:

| Input Voltage  | Duration  | Frequency of Occurrence |
|----------------|-----------|-------------------------|
| 50% of nominal | 1/2 cycle | Once in 10 seconds      |

The power supply is available in three models:

- For a power source with a nominal voltage of 120 Vac
- For a power source with a nominal voltage of 220 Vac
- A model that can be strapped to suit power sources with nominal voltages of 100, 230, and 240 Vac.

The different models of the power supply can be identified by the "Power Code" which is a part of the model number.

| Power Code                           | Nominal Voltage |
|--------------------------------------|-----------------|
| 60                                   | 120 Vac         |
| 65                                   | 220 Vac         |
| 70*                                  | 100 Vac         |
| 74*                                  | 230 Vac         |
| 75*                                  | 240 Vac         |
| *Selectable by transformer strapping |                 |

The strapping of the transformer for the power supplies with power codes 70, 74, and 75 is shown in Figure 7.8.

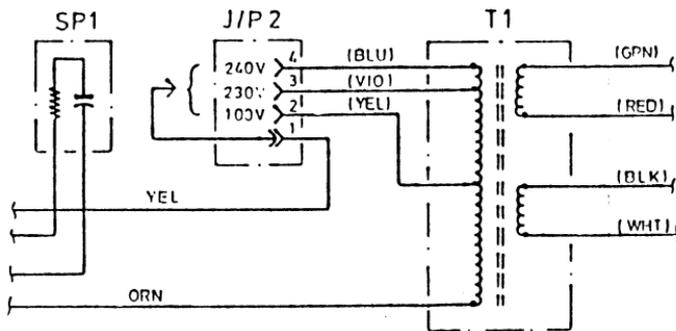


Figure 7.8 Power supply strapping

### Fault Finding

The power supply schematic and component locations are shown in Figures 7.9 and 7.10: The fault finding flow-chart, Figure 7.11 may be used to locate problems in the power supply.

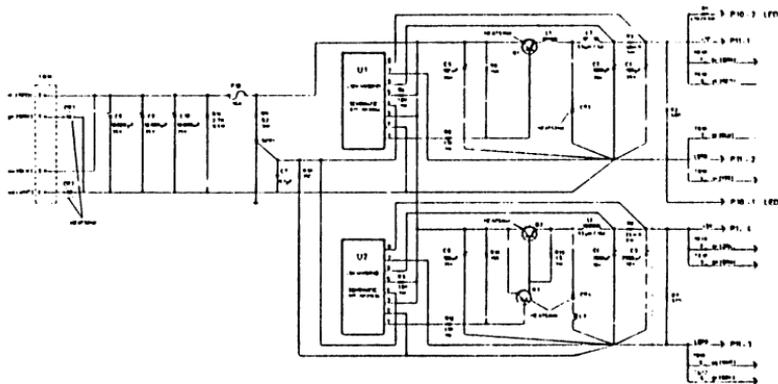


Figure 7.9 Power supply schematic

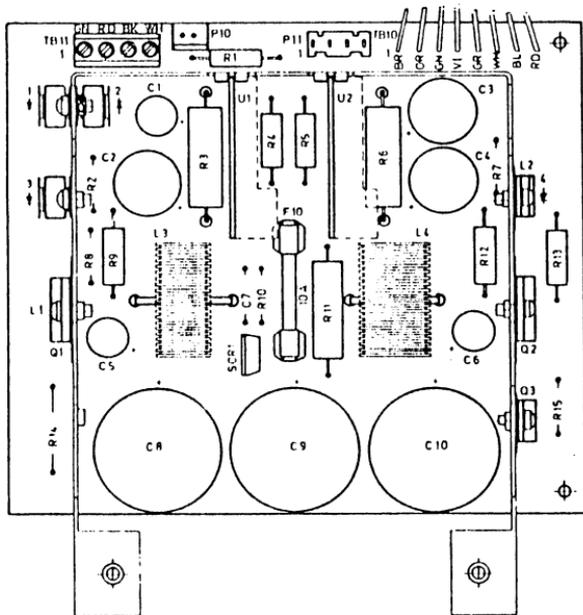


Figure 7.10 Component locations

Start

Connect meter between transformer secondary terminals – Green lead and Red lead, or Black lead and White lead

Is voltage approximately 24 Vac?

Yes

No

Possible causes:

- Primary fuse F1 blown
- On/Off switch S1 faulty
- Transformer T1 faulty
- Input wiring faulty

Connect meter between P10 on regulator board and ground

Is voltage approximately 24 Vdc?

Yes

No

Possible causes:

- CR1/CR2 faulty
- C1,C2,C3 or R1 faulty

Disconnect J11 from regulator board, disconnect J112 from controller board

Connect negative lead of meter to P11-2/3 (Gnd)

Are voltages at P11-1 (+12V) and P11-4 (+5V) correct?

Yes

No

Possible causes:

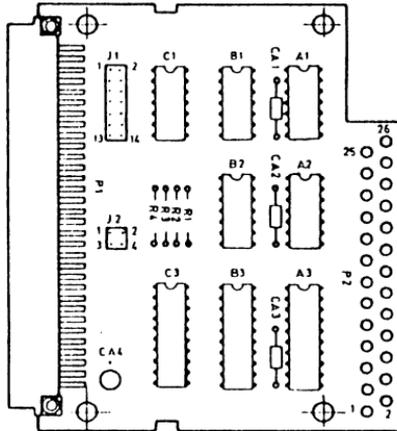
- Regulator board fuse F10 blown
- Faulty regulator board

Figure 7.11 Fault finding flow-chart

## INTERFACE BOARD

This board provides the interface between the bus of the NCR DECISION MATE V and the disk controller. It is contained in the plug housing that connects into the bus of the NCR DECISION MATE V.

To provide for future compatibility strapping is included on this board. Figure 7.12 shows the board layout and the strapping.



| J1    |        | J2  |      |
|-------|--------|-----|------|
| Pin   |        | Pin |      |
| 1-2   | Open   | 1-2 | Open |
| 3-4   | Open   | 3-4 | Open |
| 5-6   | Open   |     |      |
| 7-8   | Open   |     |      |
| 9-10  | Closed |     |      |
| 11-12 | Closed |     |      |
| 13-14 | Open   |     |      |

Figure 7.12 Interface board strapping

## LEVEL 1 DIAGNOSTICS

The level 1 diagnostics contained in the NCR DECISION MATE V Diagnostic Module can be used to check the NCR 3282 disk drive units:

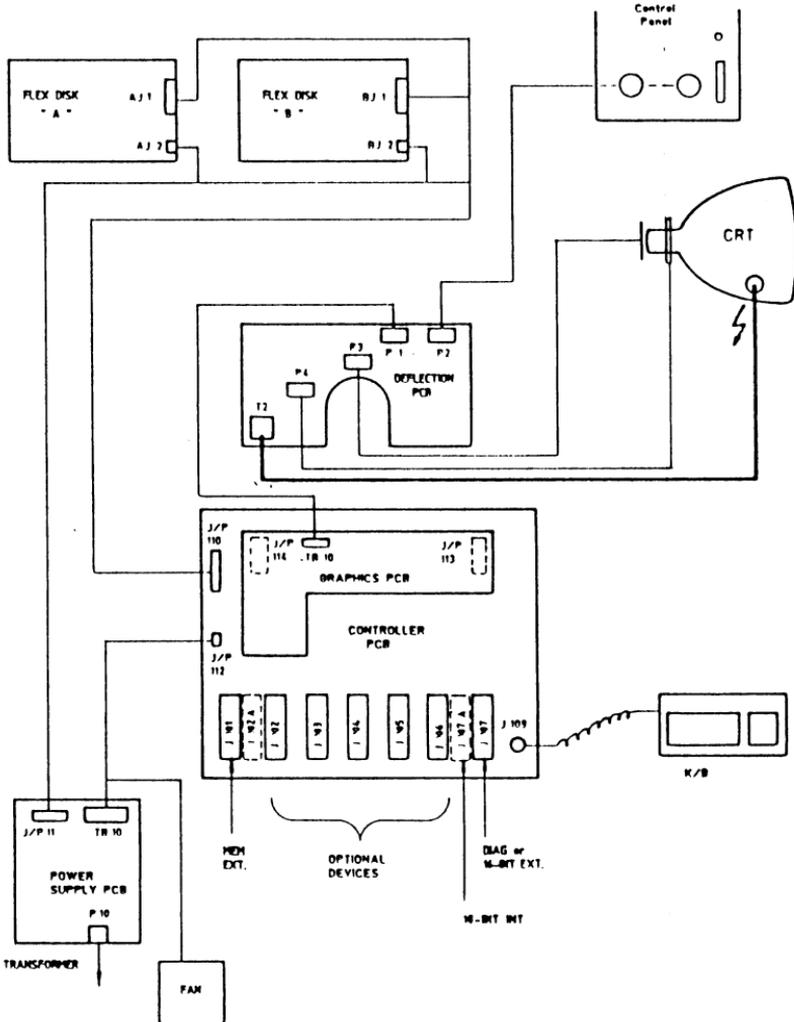
The first unit (Single or Master) contains platters C and D

The second unit (first Secondary) contains platters E and F

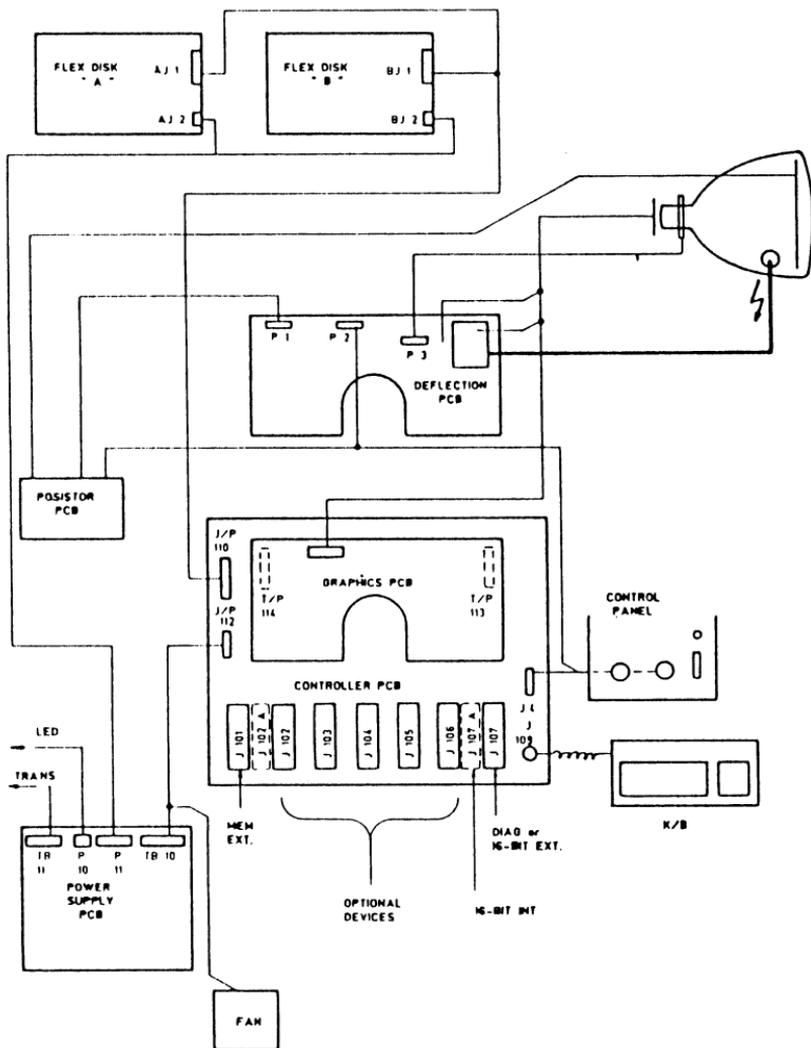
The third unit (second Secondary) contains platters G and H

For a full description of how to use these diagnostics refer to LEVEL 1 DIAGNOSTICS in this manual.

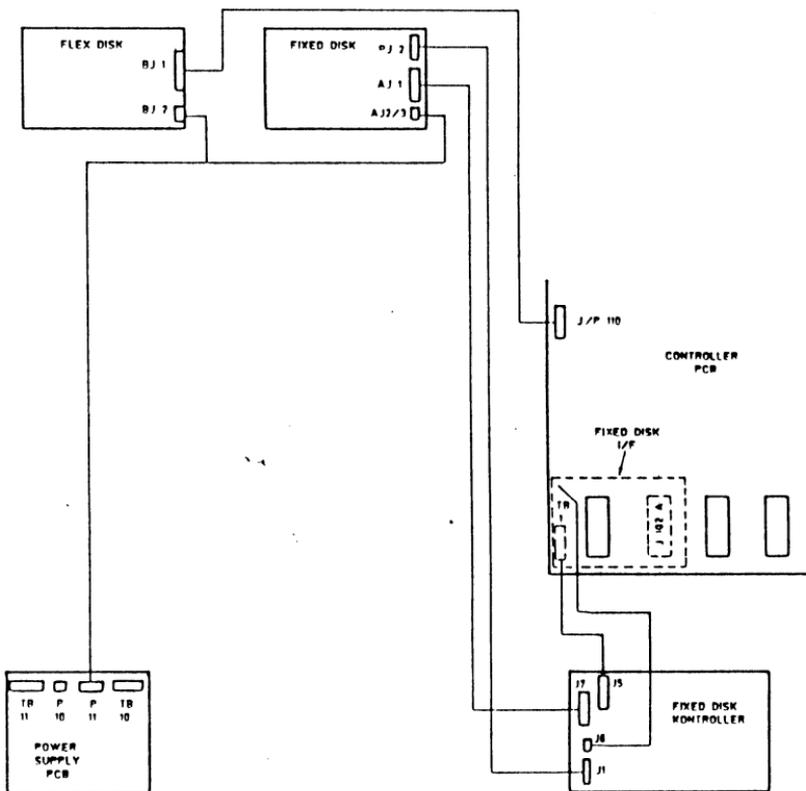
### WIRING BLOCK DIAGRAM MONOCHROME DUAL FLEXIBLE DISK SYSTEM



# WIRING BLOCK DIAGRAM COLOR DUAL FLEXIBLE DISK SYSTEM



WIRING BLOCK DIAGRAM  
FLEXIBLE/FIXED DISKS



## PCB AND SCHEMATIC COMPATIBILITY

| Type               | Number        | Schematic     |
|--------------------|---------------|---------------|
| Controller (Mono)  | 017-0031966 A | 017-0032012 A |
|                    | 017-0032123 A | 017-0032012 B |
|                    | 017-0032124 A | 017-0032012 B |
|                    | 017-0032125 A | 017-0032012 B |
|                    | 017-0032126 A | 017-0032012 B |
|                    | 017-0032730 A | 017-0032012 D |
|                    | 017-0032731 A | 017-0032012 D |
|                    | 017-0032721 A | 017-0032012 F |
|                    | 017-0032721 B | 017-0032012 G |
|                    | 017-0032722 A | 018-0032012 F |
|                    | 017-0032722 B | 017-0032012 G |
|                    | 017-0032723 A | 018-0032012 F |
|                    | 017-0032723 B | 017-0032012 G |
|                    | 017-0032724 A | 017-0032012 F |
|                    | 017-0032724 B | 017-0032012 G |
|                    | 017-0033399 A | 017-0032012 H |
|                    | 017-0033399 B | 018-0032012 H |
|                    | 017-0033400 A | 017-0032012 H |
|                    | 017-0033401 A | 017-0032012 H |
|                    | 017-0033402 A | 017-0032012 H |
| Controller (Color) | 017-0032853 A | 017-0032012 E |
|                    | 017-0032854 A | 018-0032012 E |
|                    | 017-0032855 A | 017-0032012 G |
|                    | 017-0032856 A | 018-0032012 G |
|                    | 017-0033403 A | 017-0032012 H |
|                    | 017-0033404 A | 017-0032012 H |
| Graphics (Mono)    | 017-0032002 A | 017-0032010 A |
|                    | 017-0032139 A | 017-0032010 B |
|                    | 017-0031151 A | 017-0032010 C |
|                    | 017-0032456 A | 017-0032010 D |
|                    | 017-0032140 A | 017-0032010 E |
|                    | 017-0033416 A | 017-0032010 H |
|                    | 017-0032850 A | 017-0032010 G |
|                    | 017-0033417 A | 017-0032010 H |

| Type               | Number        | Schematic     |
|--------------------|---------------|---------------|
| Graphics (Color)   | 017-0032479 A | 017-0032489 A |
|                    | 017-0032851 A | 017-0032489 A |
|                    | 017-0032851 B | 017-0032489 B |
|                    | 017-0032903 A | 017-0032489 C |
|                    | 017-0033418 A | 017-0032489 D |
|                    | 017-0033470 A | 017-0032489 D |
|                    | 017-0033419 A | 017-0032489 D |
|                    | 017-0033471 A | 017-0032489 D |
| Deflection (Mono)  | 998-0612283 A | 017-0031978 B |
|                    | 998-0612284 A | 017-0031978 B |
|                    | 998-0612285 A | 017-0031978 B |
|                    | 998-0612286 A | 017-0031979 C |
|                    | 998-0612287 A | 017-0031979 C |
|                    | 998-6012288 A | 017-0031979 B |
|                    | 998-0612289 A | 017-0031979 B |
|                    | 998-0612293 A | 017-0031979 C |
|                    | 998-0612294 A | 017-0031979 C |
|                    | 998-0612295 A | 017-0031979 D |
| Deflection (Color) | 017-0032152 A | 017-0032158 A |
|                    | 017-0032836 A | 017-0032158 B |
|                    | 017-0032925 A | 017-0032158 B |
|                    | 017-0032925 B | 017-0032158 B |
|                    | 017-0033552 A | 017-0032158 D |
|                    | 017-0033445 A | 017-0032158 D |
|                    | 017-0033496 A | 017-0032158 E |
|                    | 017-0033624 A | 017-0032158 F |
|                    | 017-0033627 A | 017-0033627 F |
| HV Oscillator      | 017-0032437 A | 017-0032158 A |
|                    | 017-0032437 B | 017-0032158 A |
|                    | 017-0032859 A | 017-0032158 B |
|                    | 017-0032926 A | 017-0032158 C |
|                    | 017-0032926 A | 017-0032158 D |
| Video Amp.         | 017-0032468 A | 017-0032158 A |
|                    | 017-0032849 A | 017-0032158 B |
|                    | 017-0032900 A | 017-0032158 B |
|                    | 017-0032900 A | 017-0032158 C |
|                    | 017-0033464 A | 017-0032158 D |
|                    | 017-0033464 A | 017-0032158 E |
|                    | 017-0033494 A | 017-0032158 F |

|                  |                   |             |             |             |   |
|------------------|-------------------|-------------|-------------|-------------|---|
| Video Pre-amp.   | 017-0032496       | A           | 017-0032158 | A           |   |
|                  | 017-0032871       | A           | 017-0032158 | B           |   |
|                  | 017-0032871       | A           | 017-0032158 | C           |   |
|                  | 017-0032871       | A           | 017-0032158 | D           |   |
|                  | 017-0033498       | A           | 017-0032158 | E           |   |
|                  | 017-0033624       | A           | 017-0032158 | F           |   |
| Posistor (120 V) | 017-0032526       | A           | 017-0031570 | B           |   |
|                  | (120 V)           | 017-0033361 | A           | 017-0031570 | B |
|                  | (220 V)           | 017-0032527 | A           | 017-0031570 | B |
| Hybrid 32KB      | 017-0032503       | A           | 017-0032511 | A           |   |
|                  | 017-0033469       | A           | 017-0032511 | B           |   |
|                  | 017-0033469       | B           | 017-0032511 | B           |   |
| Power Supply     | 017-0031939       | A           | 017-0031601 | B           |   |
|                  | 017-0031939       | B           | 017-0031601 | B           |   |
|                  | 017-0031939       | C           | 017-0031601 | B           |   |
|                  | 017-0031939       | C           | 017-0031601 | C           |   |
|                  | 017-0031939       | D           | 017-0031601 | C           |   |
|                  | 017-0032514       | A           | 017-0031601 | E           |   |
|                  | 017-0032432       | A           | 017-0031601 | F           |   |
|                  | 017-0032432       | B           | 017-0031601 | F           |   |
|                  | 017-0032432       | C           | 017-0031601 | F           |   |
|                  | 017-0032432       | D           | 017-0031601 | F           |   |
|                  | P.S. (fixed disk) | 017-0032099 | A           | 017-0032115 | A |
| 017-0032099      |                   | B           | 017-0032115 | A           |   |
| 017-0032432      |                   | A           | 017-0031601 | A           |   |
| P.S. Hybrid 12V  | 017-0031924       | A           | 017-0031944 | A           |   |
|                  | 017-0032513       | A           | 017-0031944 | B           |   |
|                  | 017-0032460       | A           | 017-0031944 | C           |   |
|                  | 017-0032460       | B           | 017-0031944 | D           |   |
|                  | 017-0032460       | C           | 017-0031944 | D           |   |
| P.S. Hybrid 5V   | 017-0031616       | A           | 017-0031624 | A           |   |
|                  | 017-0032512       | A           | 017-0031624 | B           |   |
|                  | 017-0032459       | A           | 017-0031624 | C           |   |
|                  | 017-0032459       | B           | 017-0031624 | D           |   |
| Rectifier        | 017-0031925       | A           | 017-0031601 | B           |   |
|                  | 017-0032114       | A           | 017-0031601 | C           |   |
|                  | 017-0032120       | A           | 017-0031601 | D           |   |

|                             |             |   |               |
|-----------------------------|-------------|---|---------------|
| Fixed Disk Controller       | 008-0072621 | A | not           |
|                             | 008-0072623 | A | released      |
| Fixed Disk Interface (3282) | 017-0027021 | A | 017-0027022 A |
|                             | 017-0027064 | A | 017-0027022 C |
|                             | 017-0027102 | A | 017-0027022 D |
|                             | 017-0027102 | B | 017-0027022 D |
| Fixed Disk Interface (3273) | 017-0032087 | A | 017-0032095 A |
|                             | 017-0032658 | A | 017-0032095 B |
| Memory Ext. 64 KB           | 017-0032550 | A | 017-0032558 A |
| Memory Ext. 192KB           | 017-0032130 | A | 017-0032138 A |
|                             | 017-0032130 | B | 017-0032138 B |
|                             | 017-0032130 | C | 017-0032138 C |
|                             | 017-0032130 | D | 017-0032138 C |
|                             | 017-0032130 | E | 017-0032138 D |
|                             | 017-0032130 | F | 017-0032138 D |
|                             | 017-0032130 | G | 017-0032138 D |
| Memory Ext.448KB            | 017-0032516 | A | 017-0032524 A |
|                             | 017-0033449 | A | 017-0032524 B |
|                             | 017-0033449 | B | 017-0032524 B |
|                             | 017-0033449 | C | 017-0032524 B |
| Centronics                  | 017-0031546 | A | 017-0031554 A |
|                             | 017-0031546 | B | 017-0031554 A |
|                             | 017-0031546 | C | 017-0031554 B |
| RS-232-C                    | 017-0031857 | A | 017-0031865 A |
|                             | 017-0031857 | B | 017-0031865 B |
|                             | 017-0031857 | C | 017-0031865 B |
|                             | 017-0031857 | C | 017-0031865 C |
| RS-232-C (K213)             | 017-0033415 | A | 017-0031865 C |
| RS-232-C (Buffered)         | 017-0032782 | A | 017-0032792 A |
|                             | 017-0032782 | B | 017-0032792 A |
|                             | 017-0032782 | C | 017-0032792 A |
|                             | 017-0032782 | D | 017-0032792 B |
|                             | 017-0032782 | E | 017-0032792 C |
|                             | 017-0032782 | F | 017-0032792 C |

|                           |                 |               |               |
|---------------------------|-----------------|---------------|---------------|
| SCC Comm. Cartridge       | 017-0033563 B   | 017-0033564 B |               |
| Diagnostic Module         | 017-0031866 A   | 017-0031874 A |               |
|                           | 017-0031866 B   | 017-0031874 B |               |
|                           | 017-0031866 C   | 017-0031874 B |               |
| DLC Inhouse Interface     | 017-0033962 A   | 017-0033972 C |               |
| 16-Bit (External)         | 017-0032540 A   | 017-0032548 A |               |
| 16-Bit (Internal)         | 017-0031993 A   | 017-0032001 A |               |
|                           | 017-0031993 B   | 017-0032001 A |               |
|                           | 017-0032649 A   | 017-0032001 B |               |
|                           | 017-0032742 A   | 017-0032001 C |               |
|                           | 017-0032742 B   | 017-0032001 D |               |
| Shared RAM Cartridge      | 017-0033581 A   | 017-0033582 A |               |
|                           | 017-0033581 B   | 017-0033582 A |               |
| 68008 Processor Board     | 017-0033572 A   | 017-0033573 A |               |
|                           | 017-0033572 B   | 017-0033573 A |               |
| 16-Bit Processor with PIC | 017-0033501 A   | 017-0033502 A |               |
| Omni Net Controller       | 017-0032206 A   | 017-0032434 A |               |
|                           | 017-0032206 B   | 017-0032434 B |               |
| Omni Net Interface        | 017-0032197 A   | 017-0032433 A |               |
|                           | 017-0033441 A   | 017-0032433 B |               |
|                           | 017-0033619 A   | 017-0032433 C |               |
| Omni Net Isolator         | 017-0032214 A   | 017-0032222 A |               |
| RS-232-C (Switchable)     | 017-0032711 A   | 017-0032712 A |               |
|                           | 017-0032711 B   | 017-0032712 B |               |
|                           | (Conv. Mod/Ptr) | 017-0033008 A | 017-0033007 A |
|                           | (Conv. Plt/Blk) | 018-0033312 A | 017-0033319 A |
| Real-Time-Clock           | 018-0032702 A   | 017-0032703 A |               |
|                           | 017-0032702 B   | 017-0032703 B |               |
| IEEE-488                  | 017-0032640 A   | 017-0032641 A |               |
|                           | 017-0032640 B   | 017-0032641 B |               |

|                  |               |               |
|------------------|---------------|---------------|
| Mouse            | 017-0032816 A | 017-0032824 A |
|                  | 017-0032816 B | 017-0032824 B |
| Ky'bd DIN        | 017-0031555 A | 017-0031563 A |
| DIN              | 017-0032077 A | 017-0031563 B |
| DIN              | 017-0032168 A | 017-0031563 C |
| DIN              | 017-0032531 A | 017-0031563 D |
| DIN              | 017-0032531 B | 017-0031563 E |
| DIN              | 017-0032531 B | 017-0031563 F |
| DIN              | 017-0032531 C | 017-0031563 G |
| Lat Am I CAP     | 017-0032537 A | 017-0031563 E |
| Lat BAS II CAP   | 017-0032538 A | 017-0031563 E |
| Lat Bas II DIN   | 017-0032536 A | 017-0031563 E |
| Lat Bas II DIN   | 017-0032536 A | 017-0031563 F |
| Lat Bas II DIN   | 017-0032536 B | 017-0021563 G |
| Non Lat BAS III  | 018-0033379 A | 017-0031563 F |
| Non Lat Bas III  | 017-0033379 B | 017-0031563 G |
| US Lang CAP      | 017-0032535 A | 017-0031563 D |
| US Lang CAP      | 017-0032535 B | 017-0031563 E |
| US Lang CAP      | 017-0032902 A | 017-0031563 E |
| US Lang CAP      | 017-0032902 A | 017-0031563 F |
| US Lang CAP      | 017-0032902 B | 018-0031563 G |
| Lat Lang I typw  | 017-0033591 A | 018-0031563 H |
| Lat Lang II typw | 017-0033592 A | 018-0031563 H |
| US Lang I typw   | 017-0033593 A | 018-0031563 H |

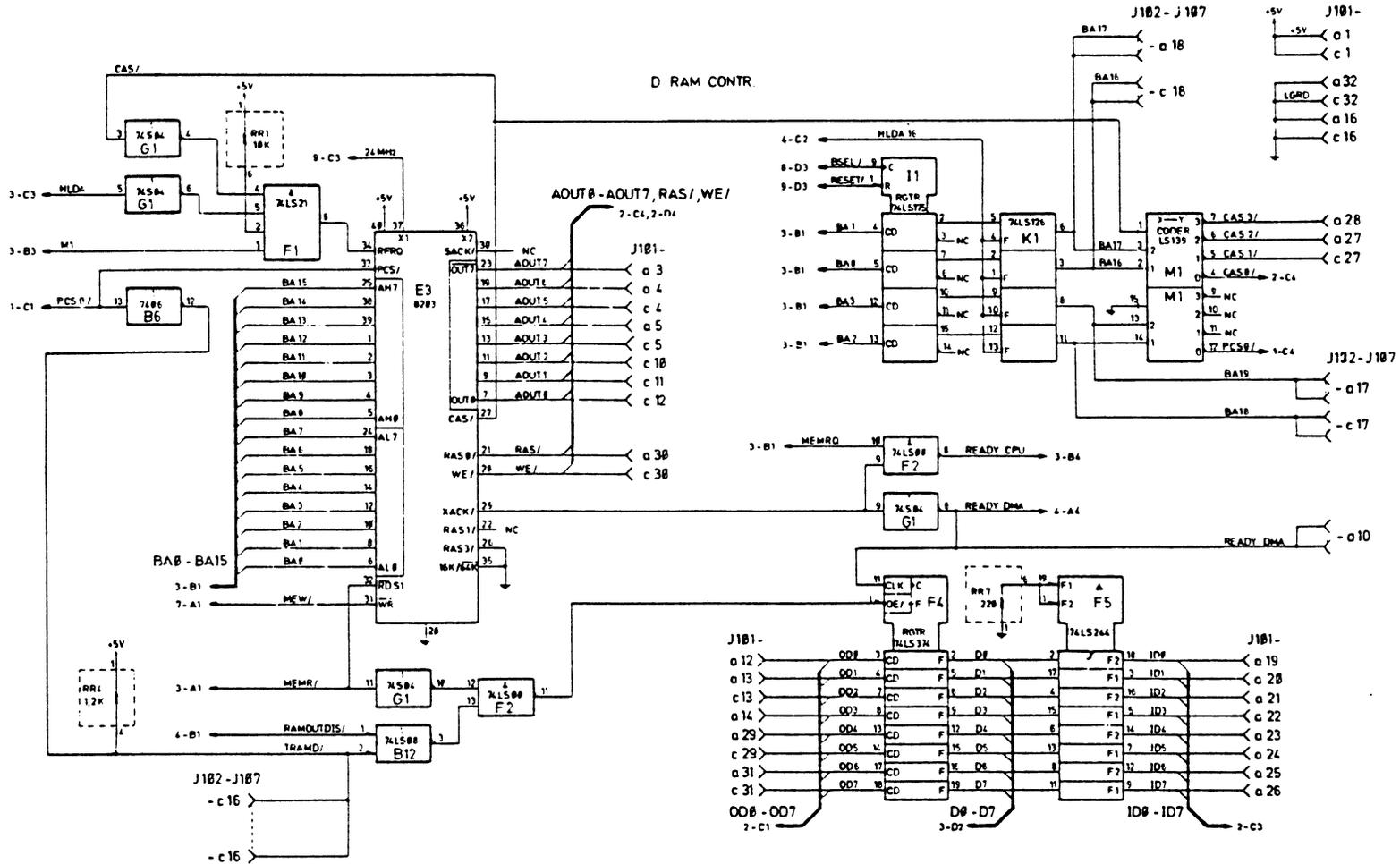
The following schematics have been chosen for inclusion in this manual to provide the broadest coverage for the various PCBs that are in the field.

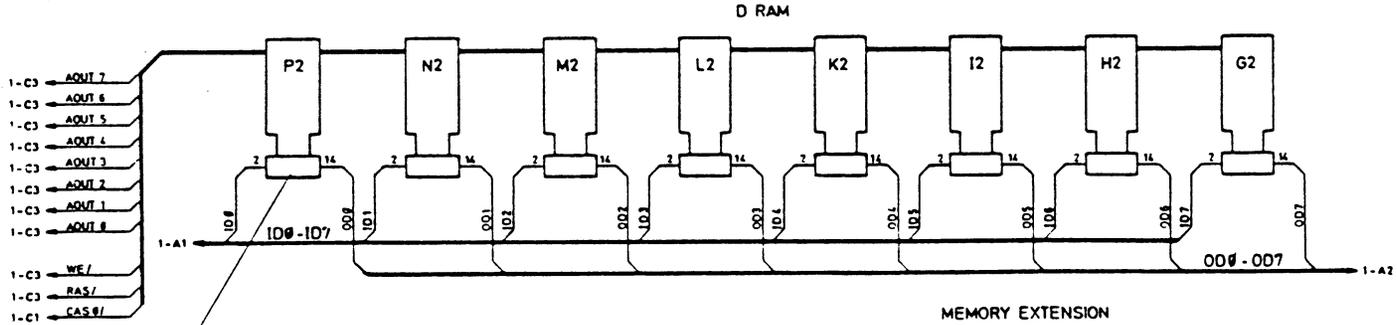
In many instances schematics are revised to show minor changes to components or their values: such information may be found in the Parts Identification Manual.

If a schematic with the correct revision level is not available, then use the schematic with the next higher revision level.

|  |                    |
|--|--------------------|
| PCB Controller                         | 017-0032012 Rev. C |
|  | 017-0032012 Rev. H |
| PCB Monochrome Graphics                | 017-0032010 Rev. D |
|  | 017-0032010 Rev. H |
| PCB Color Graphics                     | 017-0032489 Rev. D |
| Deflection Monochrome                  | 017-0031979 Rev. D |
| Video Deflection Color                 | 017-0032158 Rev. F |
| Memory Hybrid 32K                      | 017-0032511 Rev. B |
| +5V Hybrid                             | 017-0031624 Rev. D |
| +12V Hybrid                            | 017-0031944 Rev. D |
| Wiring                                 | 017-0031570 Rev. B |
| Power Supply                           | 017-0031601 Rev. F |
| Integrated Fixed Disk Interface        | 017-0032095 Rev. B |
| Internal 16-Bit Processor              | 017-0032001 Rev. D |
| Keyboard                               | 017-0031563 Rev. G |
| Memory Extension 64K (K200)            | 017-0032558 Rev. A |
| Memory Extension 192K (K202)           | 017-0032138 Rev. D |
| Memory Extension 448K (K208)           | 017-0032524 Rev. B |
| Centronics Interface (K210)            | 017-0031554 Rev. B |
| RS-232C Interface (K211/212/213)       | 017-0031865 Rev. C |
| Buffered Async/Bisync Interface (K215) | 017-0032792 Rev. C |
| SCC Communication Interface (K216)     | 017-0033564 Rev. B |
| Diagnostic Module (K220)               | 017-0031874 Rev. B |
| DLC Inhouse Interface (K223)           | 017-0033972 Rev. C |
| External 16-Bit Processor (K231)       | 017-0032548 Rev. A |
| Shared RAM (K233)                      | 017-0033582 Rev. A |
| 68008 Processor Board (K234)           | 017-0033573 Rev. A |
| 16-Bit Processor with PIC (K235)       | 017-0033502 Rev. A |
| Omninet Interface (K600)               | 017-0032433 Rev. C |
| Omninet Isolator (K600)                | 017-0032222 Rev. A |
| Omninet Controller (K600)              | 017-0032434 Rev. B |
| RS-232C Switchable Interface (K801)    | 017-0032712 Rev. B |
| Real Time Clock (K803)                 | 017-0032703 Rev. B |
| IEEE-488 Interface (K804)              | 017-0032641 Rev. B |
| Mouse Interface (K806)                 | 017-0032824 Rev. B |
| NCR 3282 Fixed Disk Interface          | 017-0027022 Rev. D |

(This page deliberately left blank)



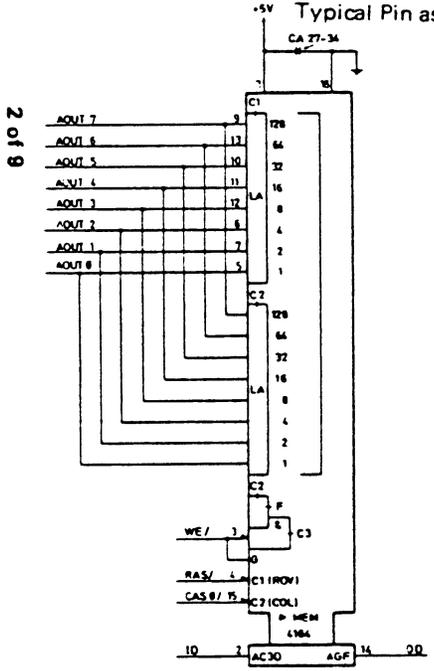


MEMORY EXTENSION

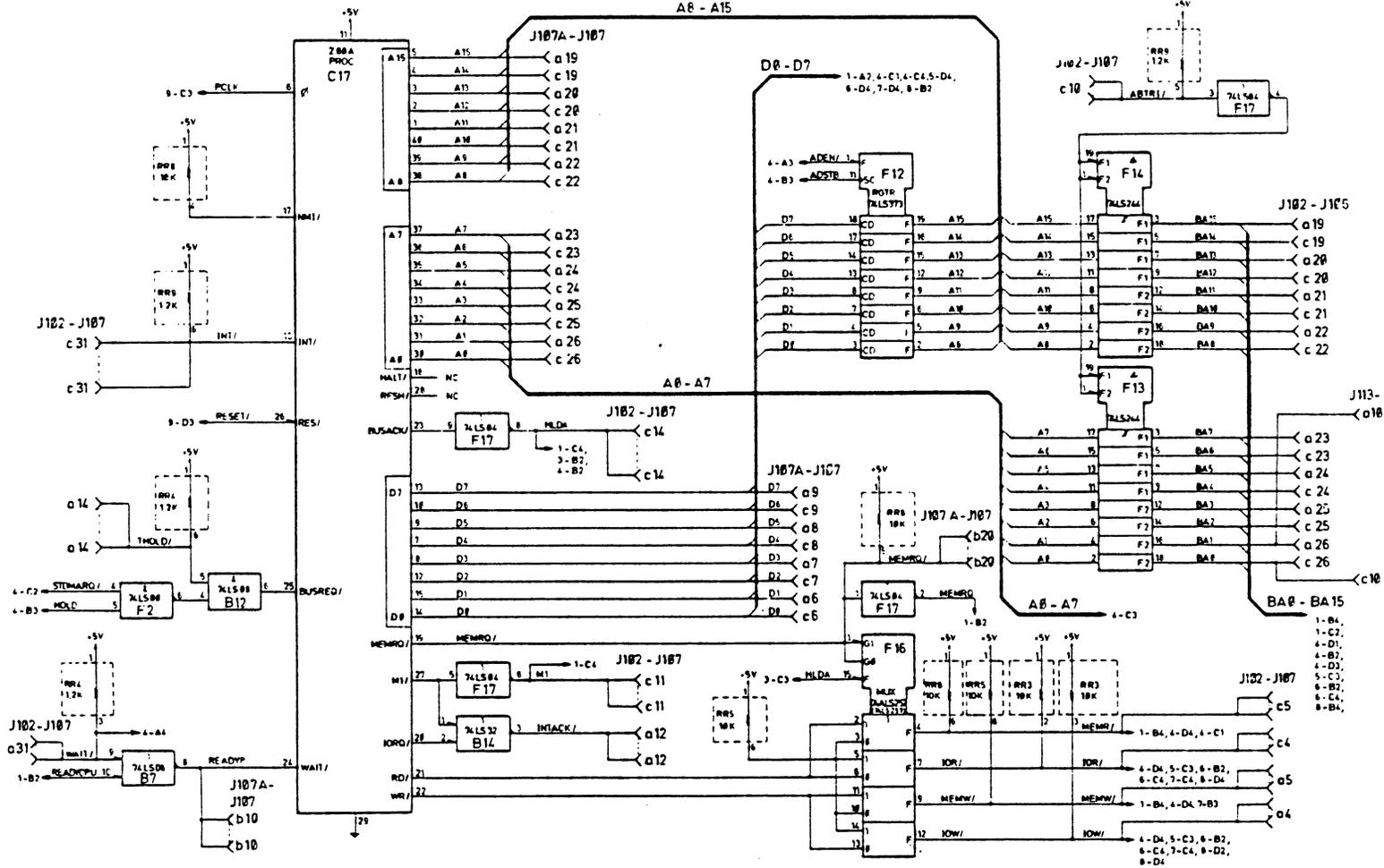
J101

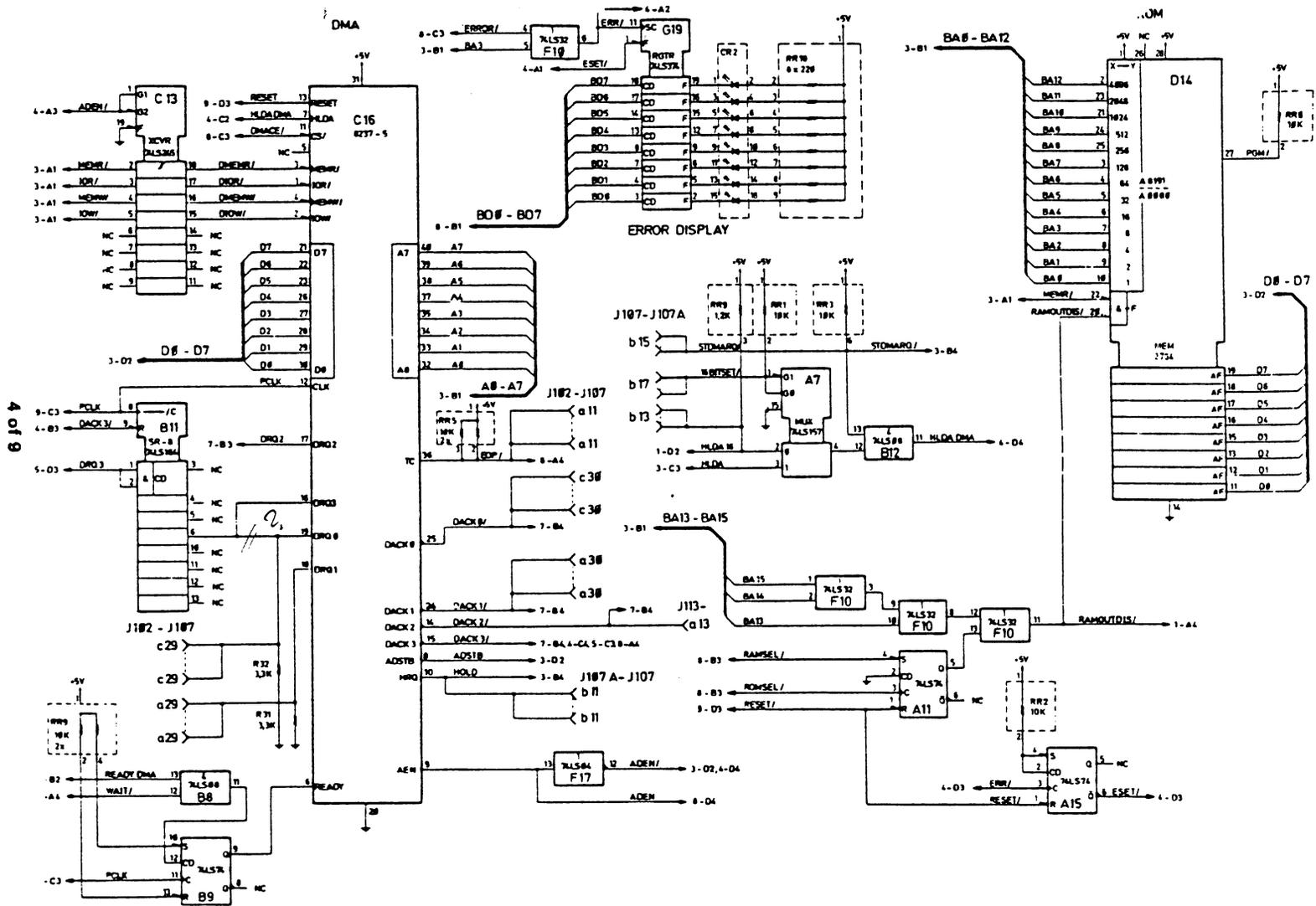
| a  | b      | c         |
|----|--------|-----------|
| 1  | +5V    | 1 +5V     |
| 2  | NC     | 2 NC      |
| 3  | AOUT 7 | 3 NC      |
| 4  | AOUT 6 | 4 AOUT 5  |
| 5  | AOUT 4 | 5 AOUT 3  |
| 6  | NC     | 6 NC      |
| 7  | NC     | 7 NC      |
| 8  | NC     | 8 NC      |
| 9  | NC     | 9 NC      |
| 10 | NC     | 10 AOUT 2 |
| 11 | NC     | 11 AOUT 1 |
| 12 | IO0    | 12 AOUT 0 |
| 13 | IO1    | 13 IO2    |
| 14 | IO3    | 14 NC     |
| 15 | NC     | 15 NC     |
| 16 | LGRO   | 16 LGRO   |
| 17 | NC     | 17 NC     |
| 18 | NC     | 18 NC     |
| 19 | IO8    | 19 NC     |
| 20 | IO1    | 20 NC     |
| 21 | IO2    | 21 NC     |
| 22 | IO3    | 22 NC     |
| 23 | IO4    | 23 NC     |
| 24 | IO5    | 24 NC     |
| 25 | IO6    | 25 NC     |
| 26 | IO7    | 26 NC     |
| 27 | CAS 2/ | 27 CAS 1/ |
| 28 | CAS 3/ | 28 NC     |
| 29 | IO4    | 29 IO5    |
| 30 | RAS/   | 30 WE/    |
| 31 | IO6    | 31 IO7    |
| 32 | LGRO   | 32 LGRO   |

Typical Pin assignment

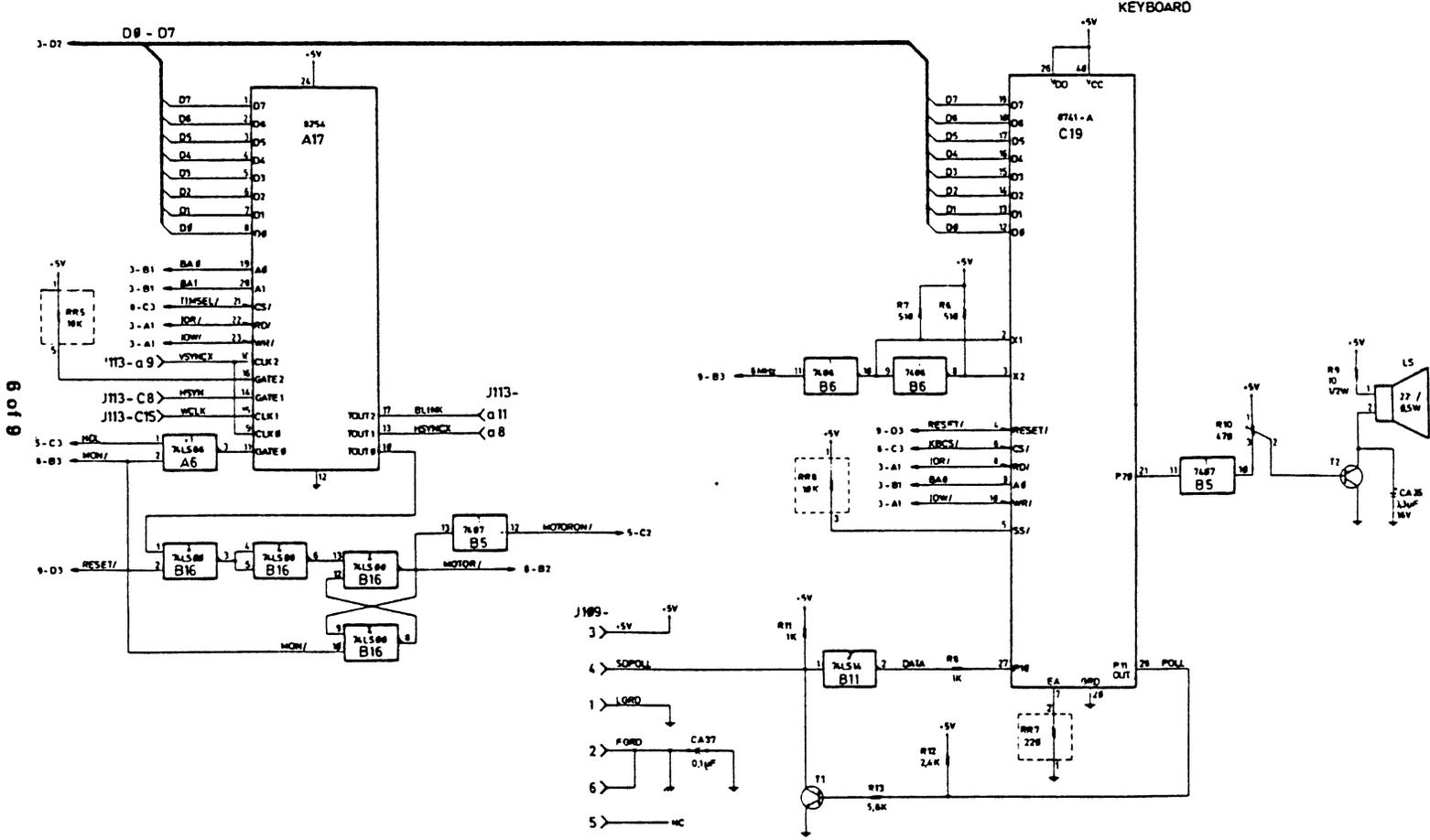


2 of 9



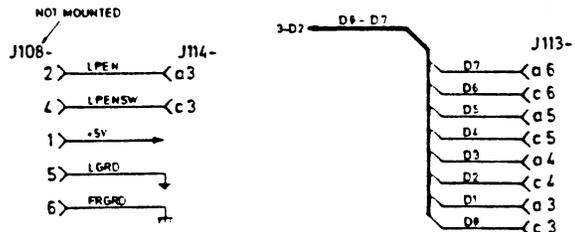






8 of 9

TO GRAPHIC BOARD



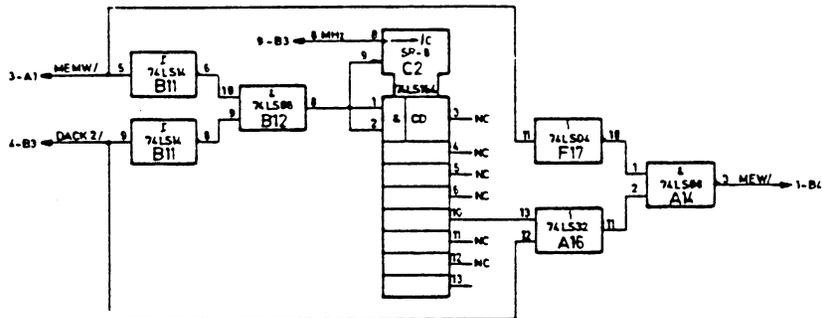
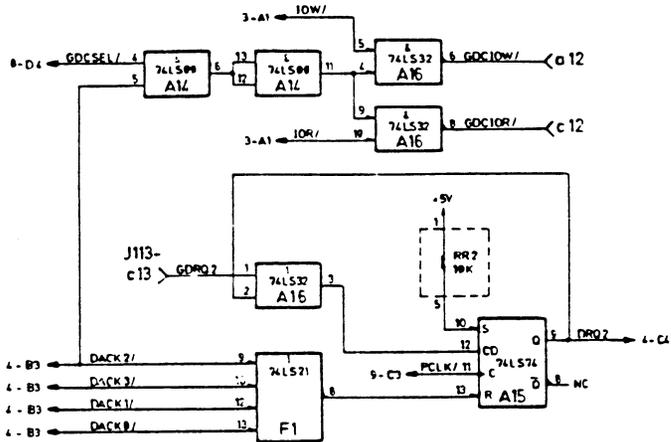
J114

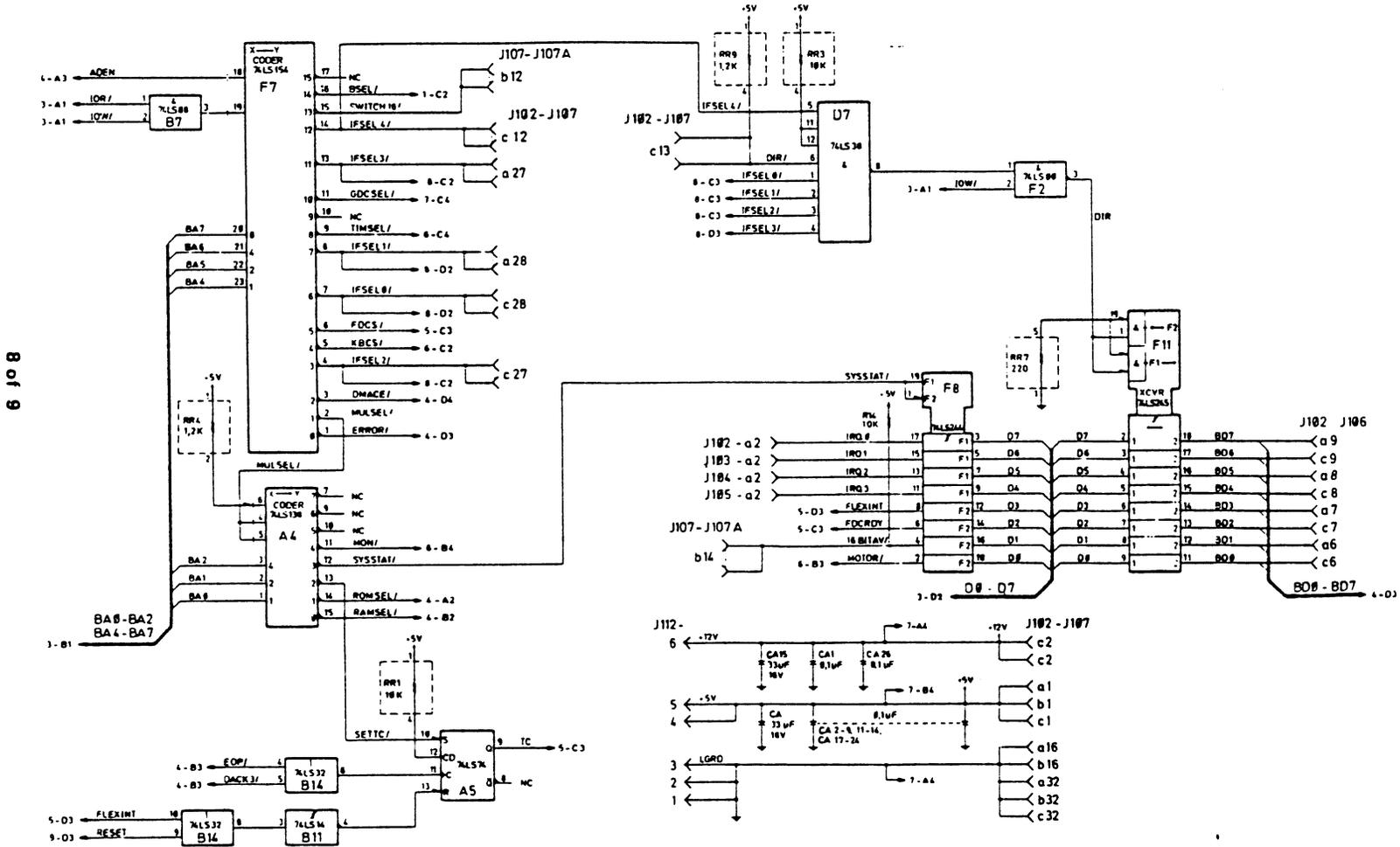
| e    |    | c      |
|------|----|--------|
| +5V  | 1  | +5V    |
| LGRO | 2  | LGRO   |
| LPEN | 3  | LPENSW |
| +12V | 4  | +12V   |
| NC   | 5  | NC     |
| NC   | 6  | NC     |
| NC   | 7  | NC     |
| NC   | 8  | NC     |
| NC   | 9  | NC     |
| NC   | 10 | NC     |
| NC   | 11 | NC     |
| NC   | 12 | NC     |
| NC   | 13 | NC     |
| NC   | 14 | NC     |
| NC   | 15 | LGRO   |
| LGRO | 16 | LGRO   |

J113

| e     |    | c     |
|-------|----|-------|
| +5V   | 1  | +5V   |
| NC    | 2  | NC    |
| D1    | 3  | D8    |
| D3    | 4  | D7    |
| D5    | 5  | D4    |
| D7    | 6  | D6    |
| NC    | 7  | NC    |
| HSYNC | 8  | HSYN  |
| VSYNC | 9  | LGRO  |
| BA1   | 10 | BA8   |
| BDWH  | 11 | NC    |
| GDCKW | 12 | GDCKR |
| DACK2 | 13 | GDCK2 |
| NC    | 14 | NC    |
| NC    | 15 | WCLK  |
| LGRO  | 16 | LGRO  |

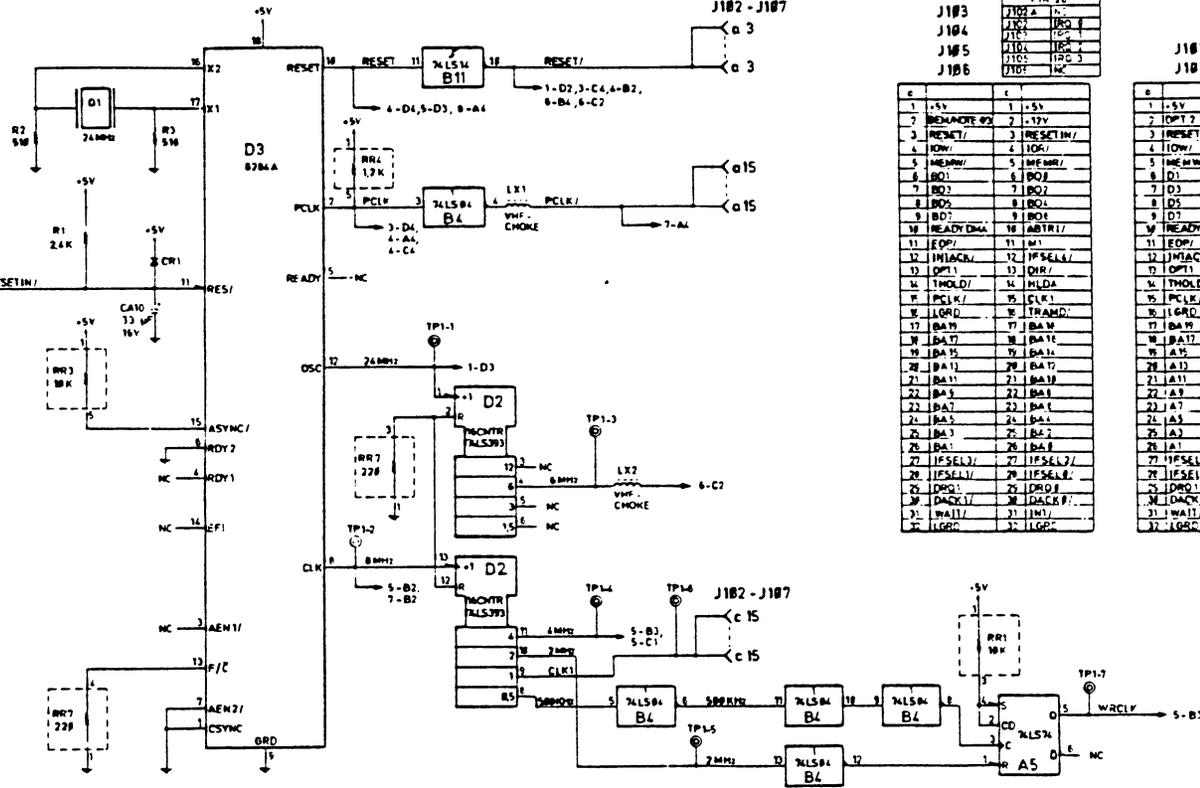
7 of 9





DMX - BUS

9 of 9



J102 A MEM/NOTE

| MEM/NOTE | PIN | 30 |
|----------|-----|----|
| J102 A   | 10  |    |
| J103     | 10  |    |
| J104     | 10  |    |
| J105     | 10  |    |
| J106     | 10  |    |

|    |           |    |          |
|----|-----------|----|----------|
| 1  | 1-SY      | 1  | 1-SY     |
| 2  | MEM/NOTE  | 2  | 1-TTY    |
| 3  | RESET/    | 3  | RESETIN/ |
| 4  | ICM/      | 4  | ICOR/    |
| 5  | MEMW/     | 5  | MEMR/    |
| 6  | BO1/      | 6  | BO2/     |
| 7  | BO2/      | 7  | BO2/     |
| 8  | BO2/      | 8  | BO2/     |
| 9  | BO2/      | 9  | BO2/     |
| 10 | READY/DMA | 10 | ABTR/    |
| 11 | EOP/      | 11 | MI/      |
| 12 | IMACK/    | 12 | IFSELS/  |
| 13 | DM1/      | 13 | DIR/     |
| 14 | HMOLD/    | 14 | MLDA/    |
| 15 | PCLK/     | 15 | CLP/     |
| 16 | LGRD/     | 16 | TRAND/   |
| 17 | BA19/     | 17 | BA19/    |
| 18 | BA17/     | 18 | BA16/    |
| 19 | BA15/     | 19 | BA14/    |
| 20 | BA13/     | 20 | BA12/    |
| 21 | BA11/     | 21 | BA10/    |
| 22 | BA9/      | 22 | BA8/     |
| 23 | BA7/      | 23 | BA6/     |
| 24 | BA5/      | 24 | BA4/     |
| 25 | BA3/      | 25 | BA2/     |
| 26 | BA1/      | 26 | BA0/     |
| 27 | IFSEL3/   | 27 | IFSEL2/  |
| 28 | IFSEL1/   | 28 | IFSEL0/  |
| 29 | LDRO1/    | 29 | LDRO0/   |
| 30 | DACK1/    | 30 | DACK0/   |
| 31 | WAIT/     | 31 | INT/     |
| 32 | LGRD/     | 32 | LGRD/    |

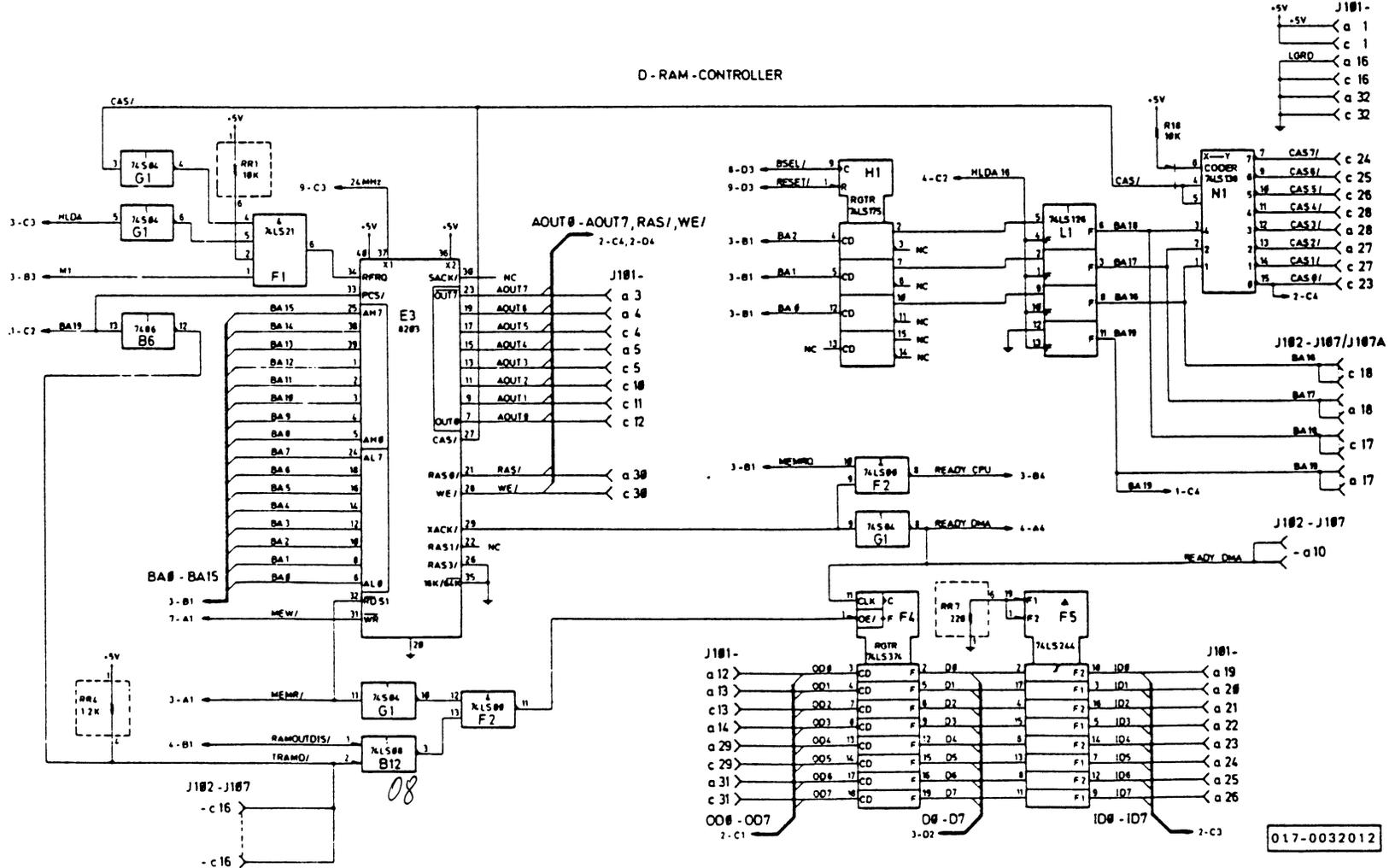
J107 DIAGNOSTIC - MODULE  
J107 A 16 BIT - PROC

| a  | b         | c  |          |
|----|-----------|----|----------|
| 1  | 1-SY      | 1  | 1-SY     |
| 2  | OPT 2     | 2  | 1-TTY    |
| 3  | RESET/    | 3  | RESETIN/ |
| 4  | ICM/      | 4  | ICOR/    |
| 5  | MEMW/     | 5  | MEMR/    |
| 6  | DI        | 6  | DF       |
| 7  | DI        | 7  | DI       |
| 8  | DI        | 8  | DI       |
| 9  | DI        | 9  | DI       |
| 10 | READY/DMA | 10 | READYP   |
| 11 | EOP/      | 11 | MI       |
| 12 | IMACK/    | 12 | SWITCH/  |
| 13 | DM1/      | 13 | MLDA     |
| 14 | HMOLD/    | 14 | MLDA     |
| 15 | PCLK/     | 15 | STDMARQ/ |
| 16 | LGRD/     | 16 | LGRD     |
| 17 | BA19/     | 17 | BITSET   |
| 18 | BA17/     | 18 | BA16     |
| 19 | BA15/     | 19 | BA14     |
| 20 | BA13/     | 20 | MEMO/    |
| 21 | BA11/     | 21 | BA10     |
| 22 | BA9/      | 22 | BA8      |
| 23 | BA7/      | 23 | BA6      |
| 24 | BA5/      | 24 | BA4      |
| 25 | BA3/      | 25 | BA2      |
| 26 | BA1/      | 26 | BA0      |
| 27 | IFSEL3/   | 27 | IFSEL2/  |
| 28 | IFSEL1/   | 28 | IFSEL0/  |
| 29 | LDRO1/    | 29 | LDRO0/   |
| 30 | DACK1/    | 30 | DACK0/   |
| 31 | WAIT/     | 31 | INT/     |
| 32 | LGRD/     | 32 | LGRD     |

D - RAM - CONTROLLER

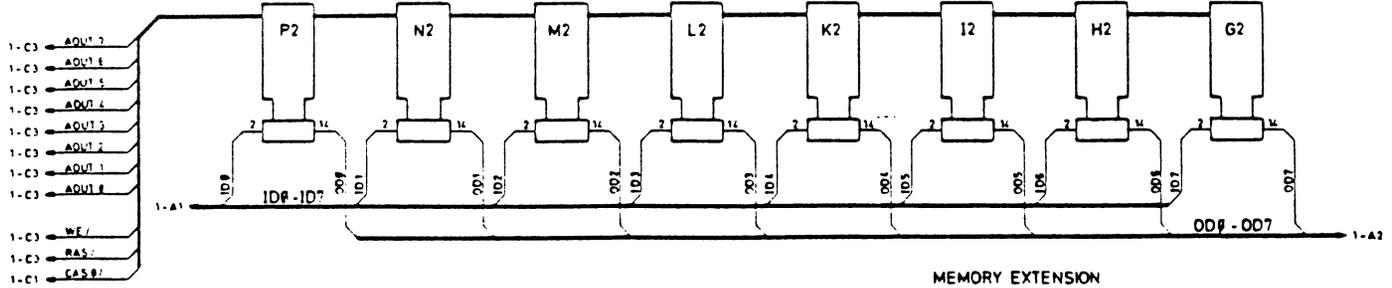
PCB Controller 017-0032012 Rev.H 1 of 9

8-21



017-0032012

D RAM

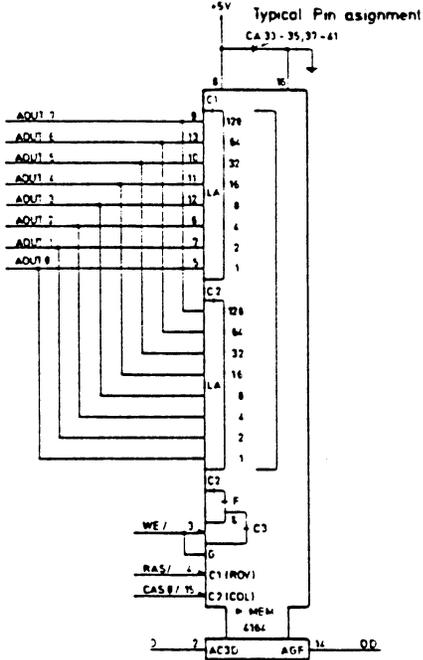


MEMORY EXTENSION

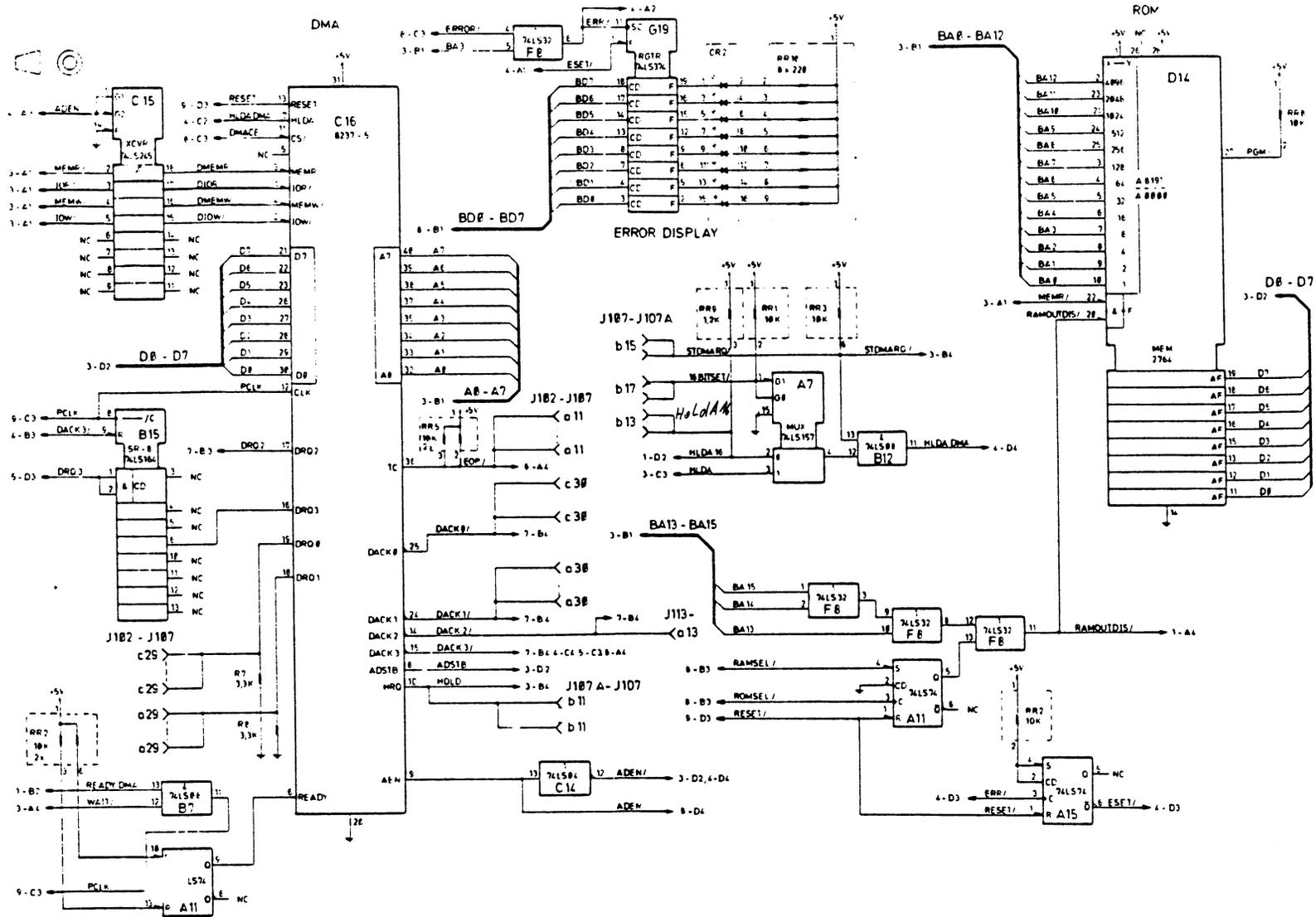
J101

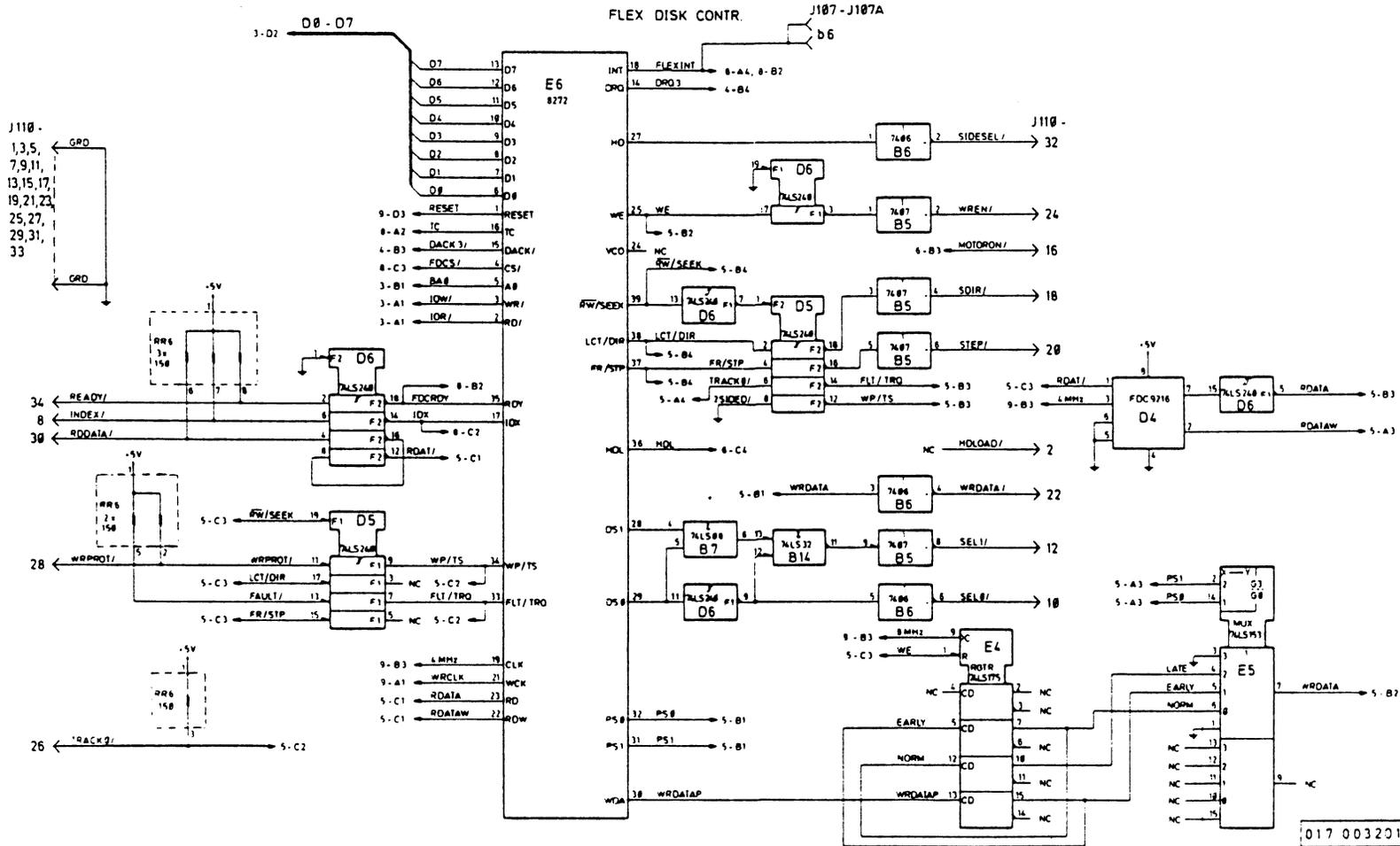
| a   | c      |
|-----|--------|
| 1   | +5V    |
| 2   | MC     |
| 3   | ADUT 7 |
| 4   | ADUT 8 |
| 5   | ADUT 4 |
| 6   | MC     |
| 7   | MC     |
| 8   | MC     |
| 9   | MC     |
| 10  | MC     |
| 11  | MC     |
| 12  | ADUT 2 |
| 13  | ADUT 1 |
| 14  | ADUT 8 |
| 15  | ADUT 7 |
| 16  | ADUT 4 |
| 17  | ADUT 3 |
| 18  | ADUT 2 |
| 19  | ADUT 1 |
| 20  | ADUT 8 |
| 21  | ADUT 7 |
| 22  | ADUT 4 |
| 23  | ADUT 3 |
| 24  | ADUT 2 |
| 25  | ADUT 1 |
| 26  | ADUT 8 |
| 27  | ADUT 7 |
| 28  | ADUT 4 |
| 29  | ADUT 3 |
| 30  | ADUT 2 |
| 31  | ADUT 1 |
| 32  | ADUT 8 |
| 33  | ADUT 7 |
| 34  | ADUT 4 |
| 35  | ADUT 3 |
| 36  | ADUT 2 |
| 37  | ADUT 1 |
| 38  | ADUT 8 |
| 39  | ADUT 7 |
| 40  | ADUT 4 |
| 41  | ADUT 3 |
| 42  | ADUT 2 |
| 43  | ADUT 1 |
| 44  | ADUT 8 |
| 45  | ADUT 7 |
| 46  | ADUT 4 |
| 47  | ADUT 3 |
| 48  | ADUT 2 |
| 49  | ADUT 1 |
| 50  | ADUT 8 |
| 51  | ADUT 7 |
| 52  | ADUT 4 |
| 53  | ADUT 3 |
| 54  | ADUT 2 |
| 55  | ADUT 1 |
| 56  | ADUT 8 |
| 57  | ADUT 7 |
| 58  | ADUT 4 |
| 59  | ADUT 3 |
| 60  | ADUT 2 |
| 61  | ADUT 1 |
| 62  | ADUT 8 |
| 63  | ADUT 7 |
| 64  | ADUT 4 |
| 65  | ADUT 3 |
| 66  | ADUT 2 |
| 67  | ADUT 1 |
| 68  | ADUT 8 |
| 69  | ADUT 7 |
| 70  | ADUT 4 |
| 71  | ADUT 3 |
| 72  | ADUT 2 |
| 73  | ADUT 1 |
| 74  | ADUT 8 |
| 75  | ADUT 7 |
| 76  | ADUT 4 |
| 77  | ADUT 3 |
| 78  | ADUT 2 |
| 79  | ADUT 1 |
| 80  | ADUT 8 |
| 81  | ADUT 7 |
| 82  | ADUT 4 |
| 83  | ADUT 3 |
| 84  | ADUT 2 |
| 85  | ADUT 1 |
| 86  | ADUT 8 |
| 87  | ADUT 7 |
| 88  | ADUT 4 |
| 89  | ADUT 3 |
| 90  | ADUT 2 |
| 91  | ADUT 1 |
| 92  | ADUT 8 |
| 93  | ADUT 7 |
| 94  | ADUT 4 |
| 95  | ADUT 3 |
| 96  | ADUT 2 |
| 97  | ADUT 1 |
| 98  | ADUT 8 |
| 99  | ADUT 7 |
| 100 | ADUT 4 |
| 101 | ADUT 3 |
| 102 | ADUT 2 |
| 103 | ADUT 1 |
| 104 | ADUT 8 |
| 105 | ADUT 7 |
| 106 | ADUT 4 |
| 107 | ADUT 3 |
| 108 | ADUT 2 |
| 109 | ADUT 1 |
| 110 | ADUT 8 |
| 111 | ADUT 7 |
| 112 | ADUT 4 |
| 113 | ADUT 3 |
| 114 | ADUT 2 |
| 115 | ADUT 1 |
| 116 | ADUT 8 |
| 117 | ADUT 7 |
| 118 | ADUT 4 |
| 119 | ADUT 3 |
| 120 | ADUT 2 |
| 121 | ADUT 1 |
| 122 | ADUT 8 |
| 123 | ADUT 7 |
| 124 | ADUT 4 |
| 125 | ADUT 3 |
| 126 | ADUT 2 |
| 127 | ADUT 1 |
| 128 | ADUT 8 |
| 129 | ADUT 7 |
| 130 | ADUT 4 |
| 131 | ADUT 3 |
| 132 | ADUT 2 |
| 133 | ADUT 1 |
| 134 | ADUT 8 |
| 135 | ADUT 7 |
| 136 | ADUT 4 |
| 137 | ADUT 3 |
| 138 | ADUT 2 |
| 139 | ADUT 1 |
| 140 | ADUT 8 |
| 141 | ADUT 7 |
| 142 | ADUT 4 |
| 143 | ADUT 3 |
| 144 | ADUT 2 |
| 145 | ADUT 1 |
| 146 | ADUT 8 |
| 147 | ADUT 7 |
| 148 | ADUT 4 |
| 149 | ADUT 3 |
| 150 | ADUT 2 |
| 151 | ADUT 1 |
| 152 | ADUT 8 |
| 153 | ADUT 7 |
| 154 | ADUT 4 |
| 155 | ADUT 3 |
| 156 | ADUT 2 |
| 157 | ADUT 1 |
| 158 | ADUT 8 |
| 159 | ADUT 7 |
| 160 | ADUT 4 |
| 161 | ADUT 3 |
| 162 | ADUT 2 |
| 163 | ADUT 1 |
| 164 | ADUT 8 |
| 165 | ADUT 7 |
| 166 | ADUT 4 |
| 167 | ADUT 3 |
| 168 | ADUT 2 |
| 169 | ADUT 1 |
| 170 | ADUT 8 |
| 171 | ADUT 7 |
| 172 | ADUT 4 |
| 173 | ADUT 3 |
| 174 | ADUT 2 |
| 175 | ADUT 1 |
| 176 | ADUT 8 |
| 177 | ADUT 7 |
| 178 | ADUT 4 |
| 179 | ADUT 3 |
| 180 | ADUT 2 |
| 181 | ADUT 1 |
| 182 | ADUT 8 |
| 183 | ADUT 7 |
| 184 | ADUT 4 |
| 185 | ADUT 3 |
| 186 | ADUT 2 |
| 187 | ADUT 1 |
| 188 | ADUT 8 |
| 189 | ADUT 7 |
| 190 | ADUT 4 |
| 191 | ADUT 3 |
| 192 | ADUT 2 |
| 193 | ADUT 1 |
| 194 | ADUT 8 |
| 195 | ADUT 7 |
| 196 | ADUT 4 |
| 197 | ADUT 3 |
| 198 | ADUT 2 |
| 199 | ADUT 1 |
| 200 | ADUT 8 |
| 201 | ADUT 7 |
| 202 | ADUT 4 |
| 203 | ADUT 3 |
| 204 | ADUT 2 |
| 205 | ADUT 1 |
| 206 | ADUT 8 |
| 207 | ADUT 7 |
| 208 | ADUT 4 |
| 209 | ADUT 3 |
| 210 | ADUT 2 |
| 211 | ADUT 1 |
| 212 | ADUT 8 |
| 213 | ADUT 7 |
| 214 | ADUT 4 |
| 215 | ADUT 3 |
| 216 | ADUT 2 |
| 217 | ADUT 1 |
| 218 | ADUT 8 |
| 219 | ADUT 7 |
| 220 | ADUT 4 |
| 221 | ADUT 3 |
| 222 | ADUT 2 |
| 223 | ADUT 1 |
| 224 | ADUT 8 |
| 225 | ADUT 7 |
| 226 | ADUT 4 |
| 227 | ADUT 3 |
| 228 | ADUT 2 |
| 229 | ADUT 1 |
| 230 | ADUT 8 |
| 231 | ADUT 7 |
| 232 | ADUT 4 |
| 233 | ADUT 3 |
| 234 | ADUT 2 |
| 235 | ADUT 1 |
| 236 | ADUT 8 |
| 237 | ADUT 7 |
| 238 | ADUT 4 |
| 239 | ADUT 3 |
| 240 | ADUT 2 |
| 241 | ADUT 1 |
| 242 | ADUT 8 |
| 243 | ADUT 7 |
| 244 | ADUT 4 |
| 245 | ADUT 3 |
| 246 | ADUT 2 |
| 247 | ADUT 1 |
| 248 | ADUT 8 |
| 249 | ADUT 7 |
| 250 | ADUT 4 |
| 251 | ADUT 3 |
| 252 | ADUT 2 |
| 253 | ADUT 1 |
| 254 | ADUT 8 |
| 255 | ADUT 7 |
| 256 | ADUT 4 |
| 257 | ADUT 3 |
| 258 | ADUT 2 |
| 259 | ADUT 1 |
| 260 | ADUT 8 |
| 261 | ADUT 7 |
| 262 | ADUT 4 |
| 263 | ADUT 3 |
| 264 | ADUT 2 |
| 265 | ADUT 1 |
| 266 | ADUT 8 |
| 267 | ADUT 7 |
| 268 | ADUT 4 |
| 269 | ADUT 3 |
| 270 | ADUT 2 |
| 271 | ADUT 1 |
| 272 | ADUT 8 |
| 273 | ADUT 7 |
| 274 | ADUT 4 |
| 275 | ADUT 3 |
| 276 | ADUT 2 |
| 277 | ADUT 1 |
| 278 | ADUT 8 |
| 279 | ADUT 7 |
| 280 | ADUT 4 |
| 281 | ADUT 3 |
| 282 | ADUT 2 |
| 283 | ADUT 1 |
| 284 | ADUT 8 |
| 285 | ADUT 7 |
| 286 | ADUT 4 |
| 287 | ADUT 3 |
| 288 | ADUT 2 |
| 289 | ADUT 1 |
| 290 | ADUT 8 |
| 291 | ADUT 7 |
| 292 | ADUT 4 |
| 293 | ADUT 3 |
| 294 | ADUT 2 |
| 295 | ADUT 1 |
| 296 | ADUT 8 |
| 297 | ADUT 7 |
| 298 | ADUT 4 |
| 299 | ADUT 3 |
| 300 | ADUT 2 |
| 301 | ADUT 1 |
| 302 | ADUT 8 |
| 303 | ADUT 7 |
| 304 | ADUT 4 |
| 305 | ADUT 3 |
| 306 | ADUT 2 |
| 307 | ADUT 1 |
| 308 | ADUT 8 |
| 309 | ADUT 7 |
| 310 | ADUT 4 |
| 311 | ADUT 3 |
| 312 | ADUT 2 |
| 313 | ADUT 1 |
| 314 | ADUT 8 |
| 315 | ADUT 7 |
| 316 | ADUT 4 |
| 317 | ADUT 3 |
| 318 | ADUT 2 |
| 319 | ADUT 1 |
| 320 | ADUT 8 |
| 321 | ADUT 7 |
| 322 | ADUT 4 |
| 323 | ADUT 3 |
| 324 | ADUT 2 |
| 325 | ADUT 1 |
| 326 | ADUT 8 |
| 327 | ADUT 7 |
| 328 | ADUT 4 |
| 329 | ADUT 3 |
| 330 | ADUT 2 |
| 331 | ADUT 1 |
| 332 | ADUT 8 |
| 333 | ADUT 7 |
| 334 | ADUT 4 |
| 335 | ADUT 3 |
| 336 | ADUT 2 |
| 337 | ADUT 1 |

2 of 9

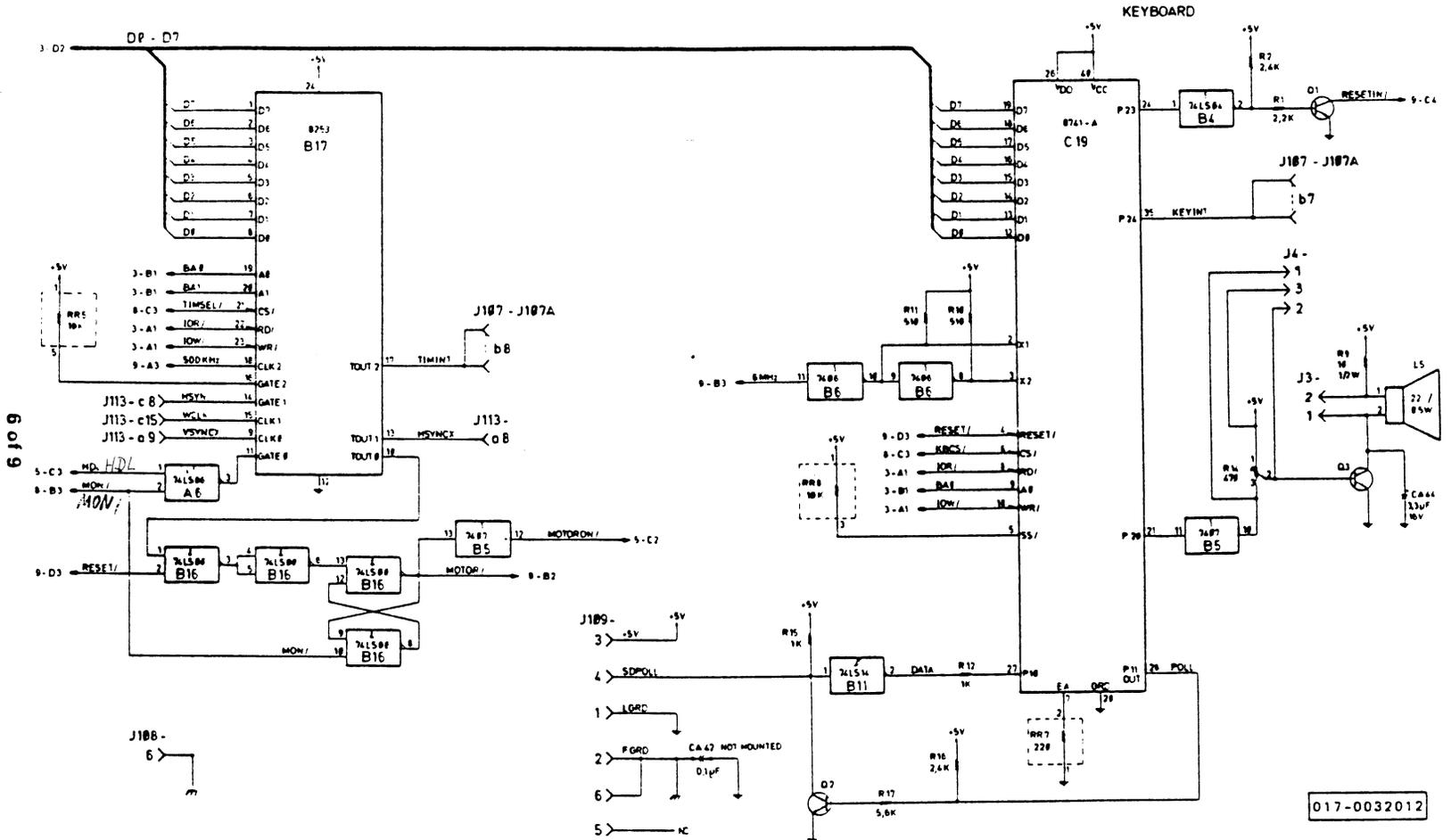








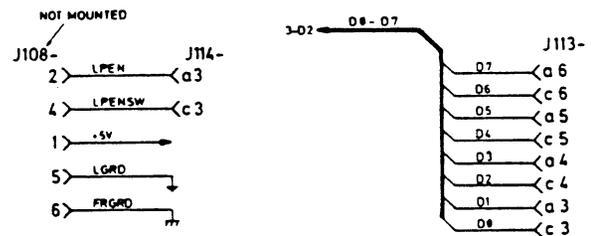
017 0032012



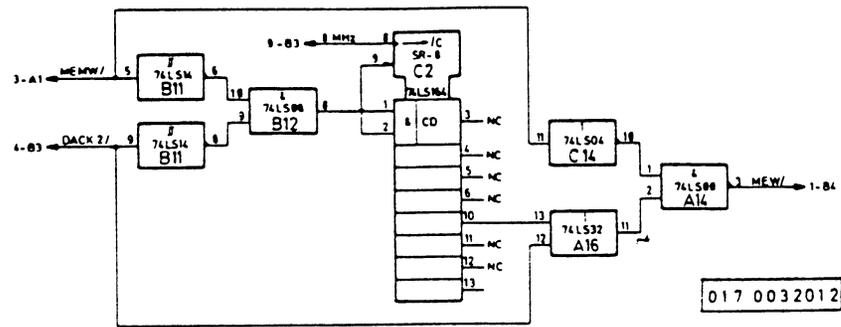
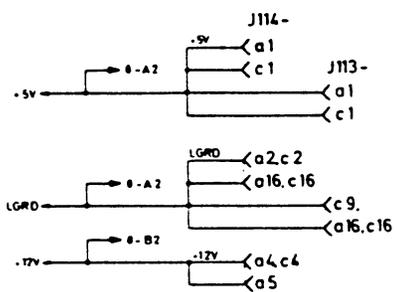
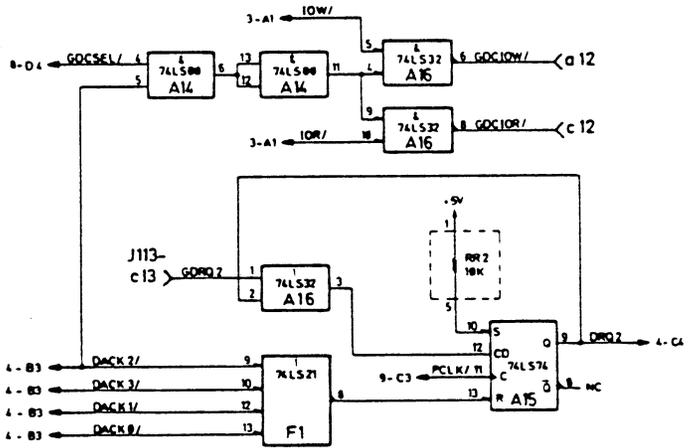
017-0032012

TO GRAPHIC BOARD

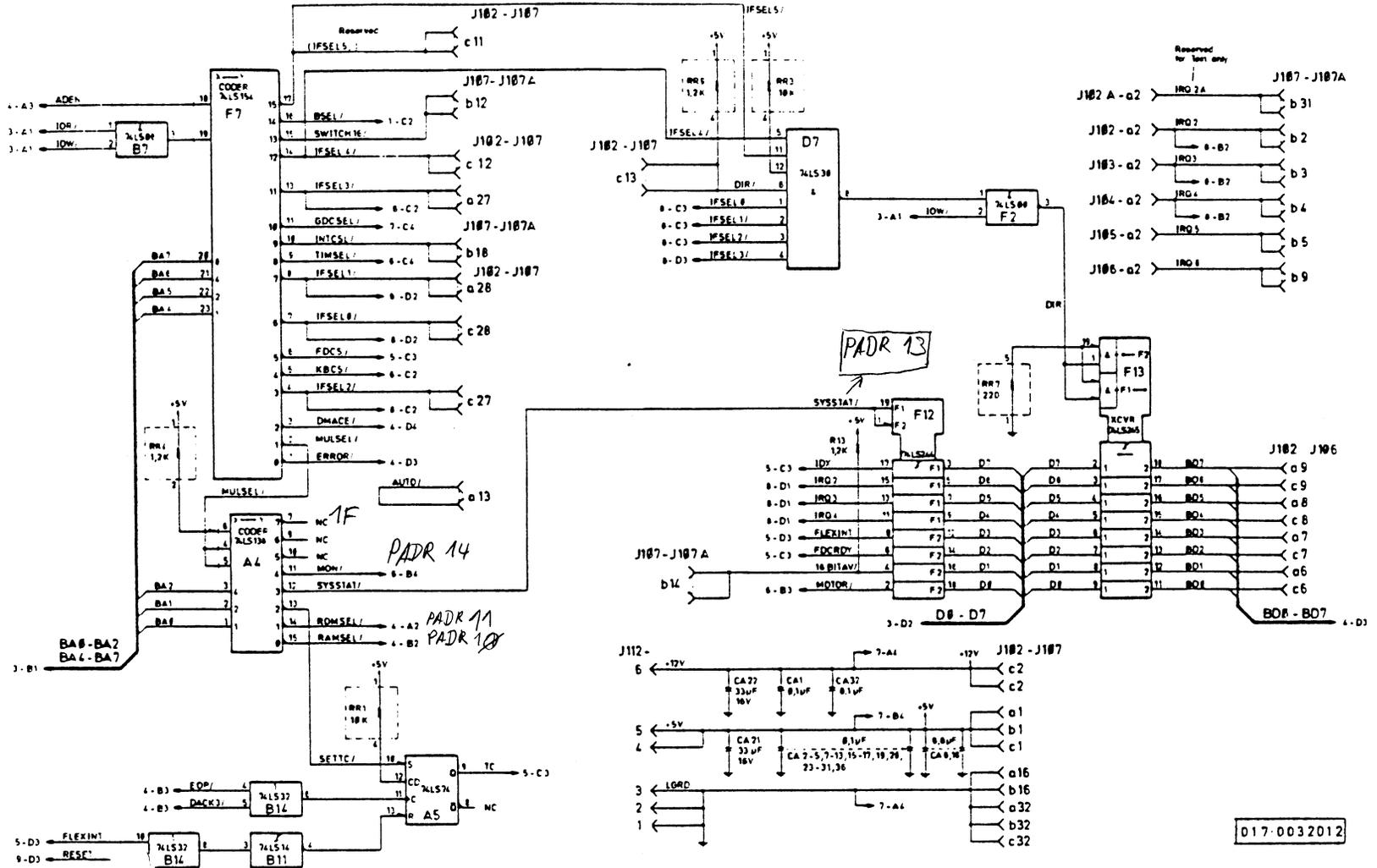
| J114 |    |        | J113     |    |          |
|------|----|--------|----------|----|----------|
| a    | b  | c      | a        | b  | c        |
| -5V  | 1  | -5V    | -5V      | 1  | -5V      |
| LGRD | 2  | LGRD   | NC       | 2  | NC       |
| LPEN | 3  | LPENSW | D1       | 3  | D8       |
| -12V | 4  | -12V   | D3       | 5  | D7       |
| NC   | 5  | NC     | D5       | 5  | D4       |
| NC   | 6  | NC     | D7       | 5  | D8       |
| NC   | 7  | NC     | NC       | 7  | NC       |
| NC   | 8  | NC     | H5THCX   | 8  | H5TH     |
| NC   | 9  | NC     | V5THCX   | 9  | LGRD     |
| NC   | 10 | NC     | BA1      | 10 | BA#      |
| NC   | 11 | NC     | BLHX     | 11 | NC       |
| NC   | 12 | NC     | GOCIOR// | 12 | GOCIOR// |
| NC   | 13 | NC     | DACK 2// | 13 | GARB 2   |
| NC   | 14 | NC     | NC       | 14 | NC       |
| NC   | 15 | LGRD   | NC       | 15 | WCLK     |
| LGRD | 16 | LGRD   | LGRD     | 16 | LGRD     |

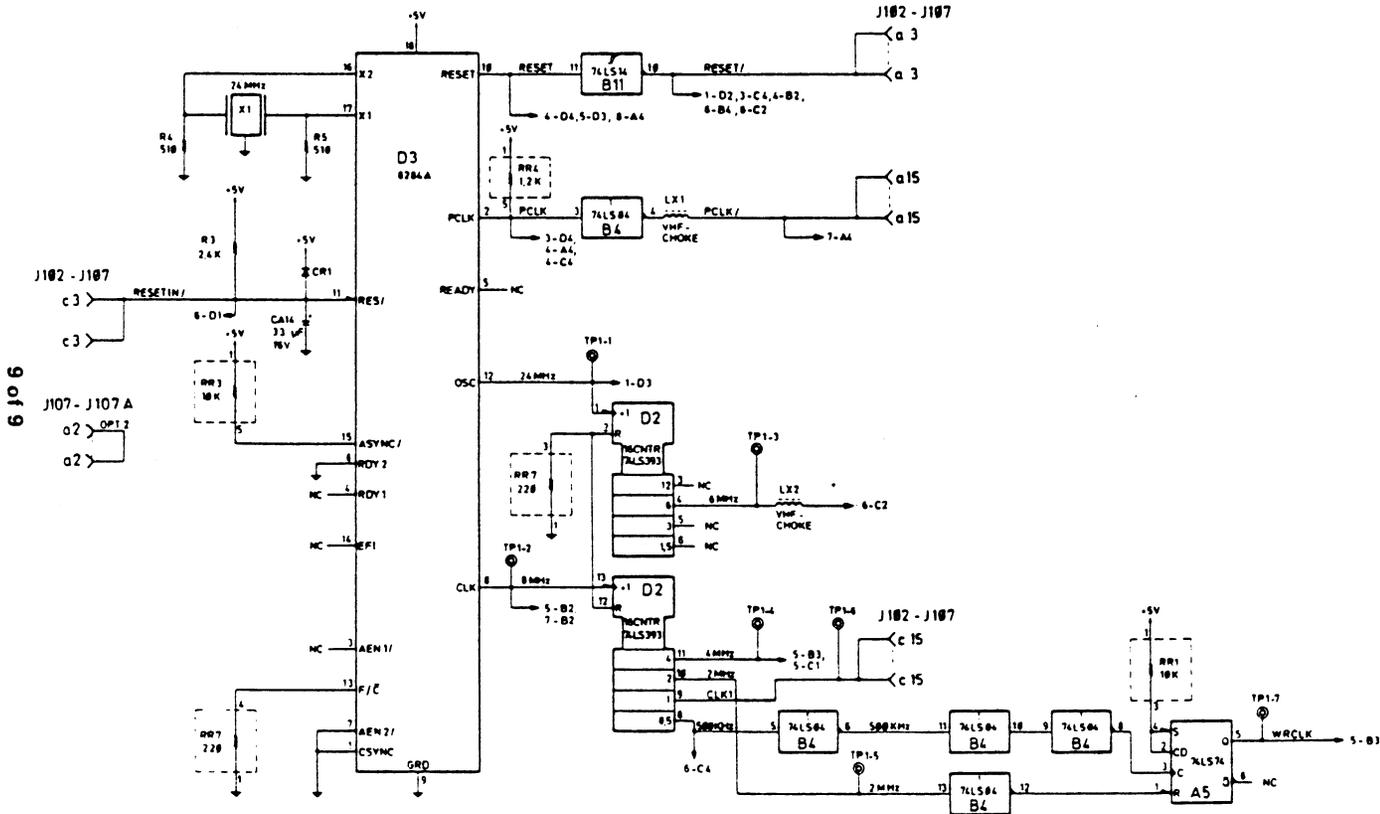


7 of 9



017 0032012



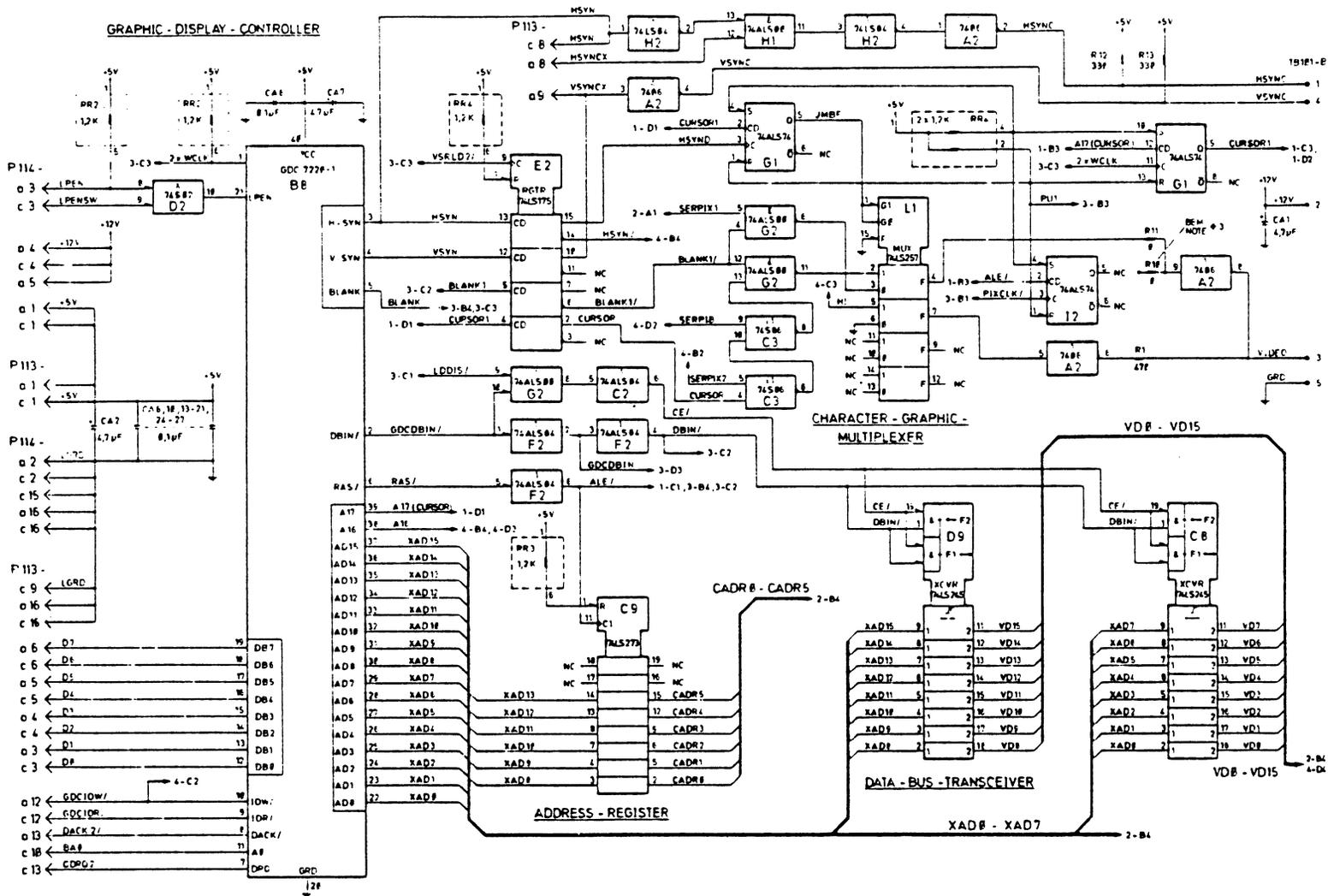


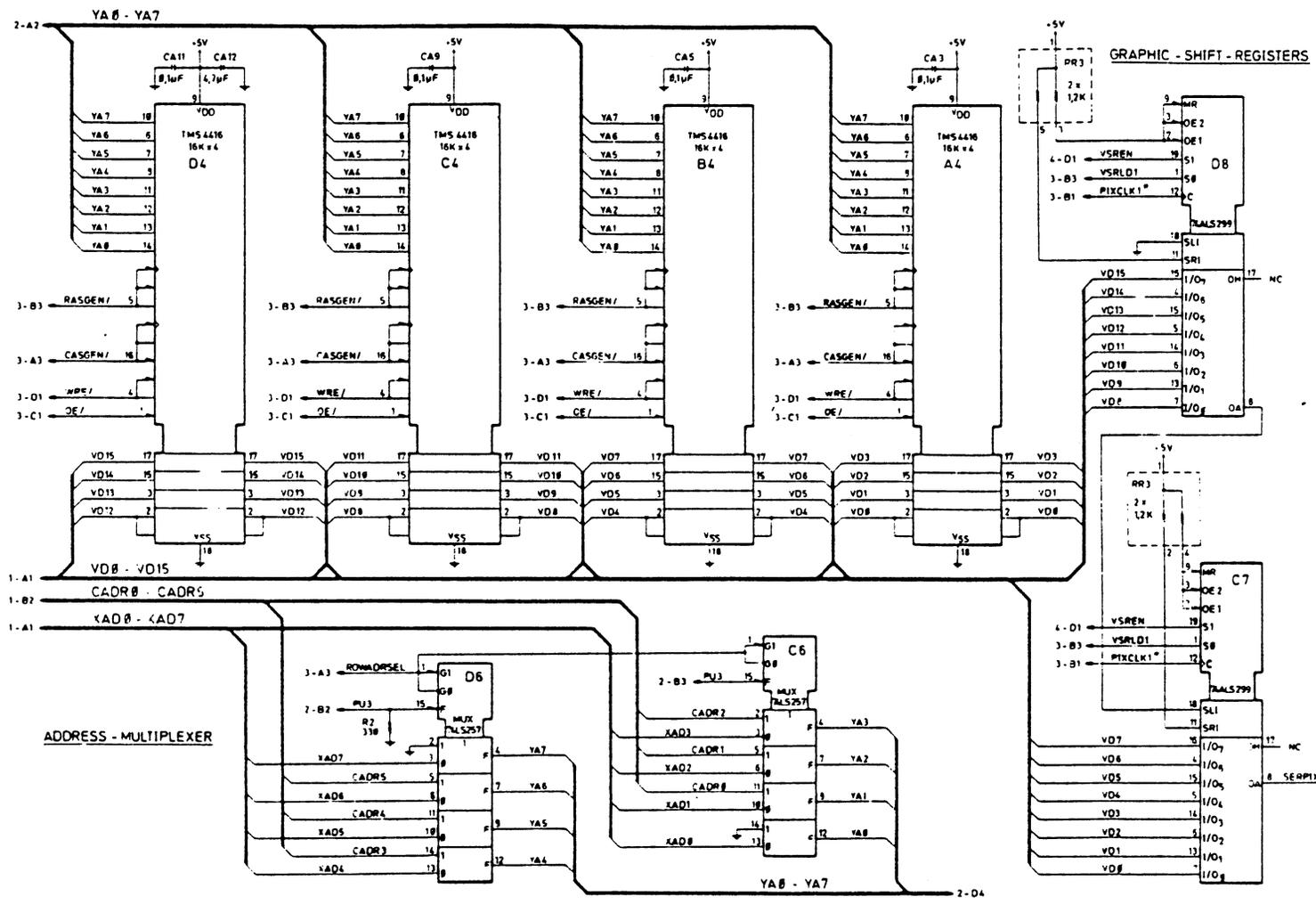
017 0032012

9 of 9

ROK

GRAPHIC - DISPLAY - CONTROLLER





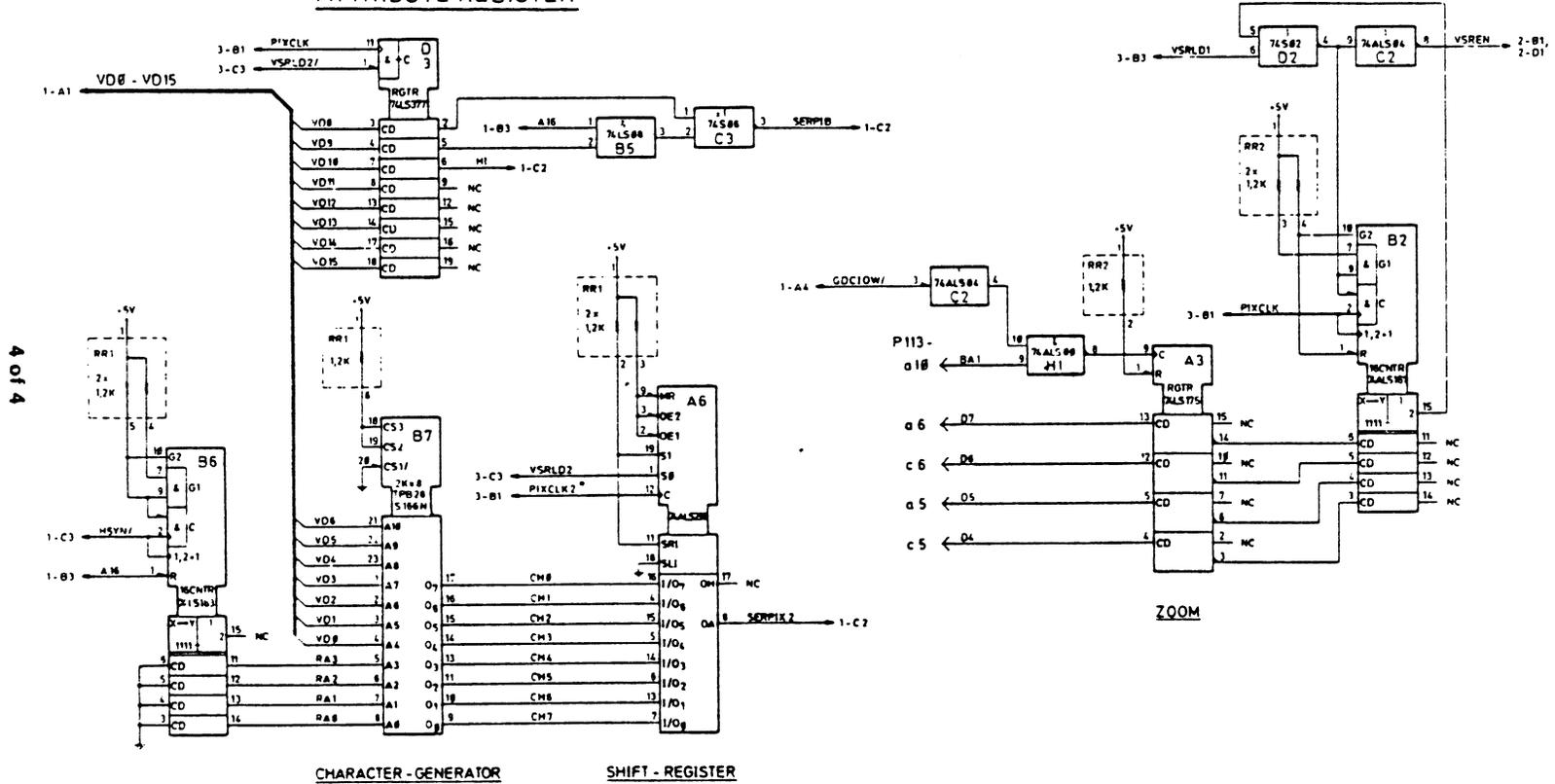
2 of 4

8-31

1-02



ATTRIBUTE-REGISTER



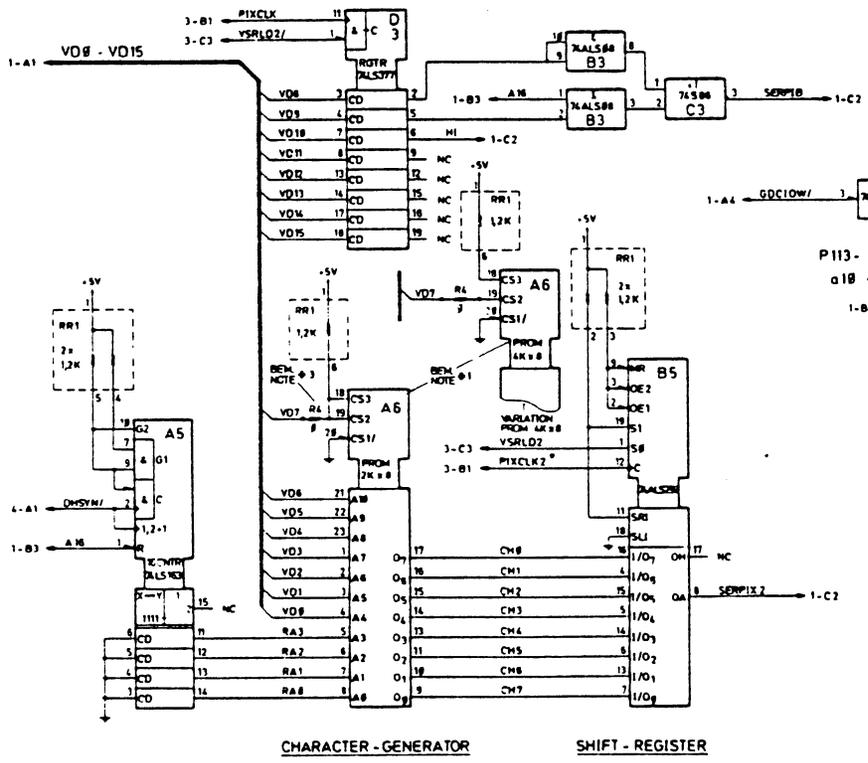
4 of 4



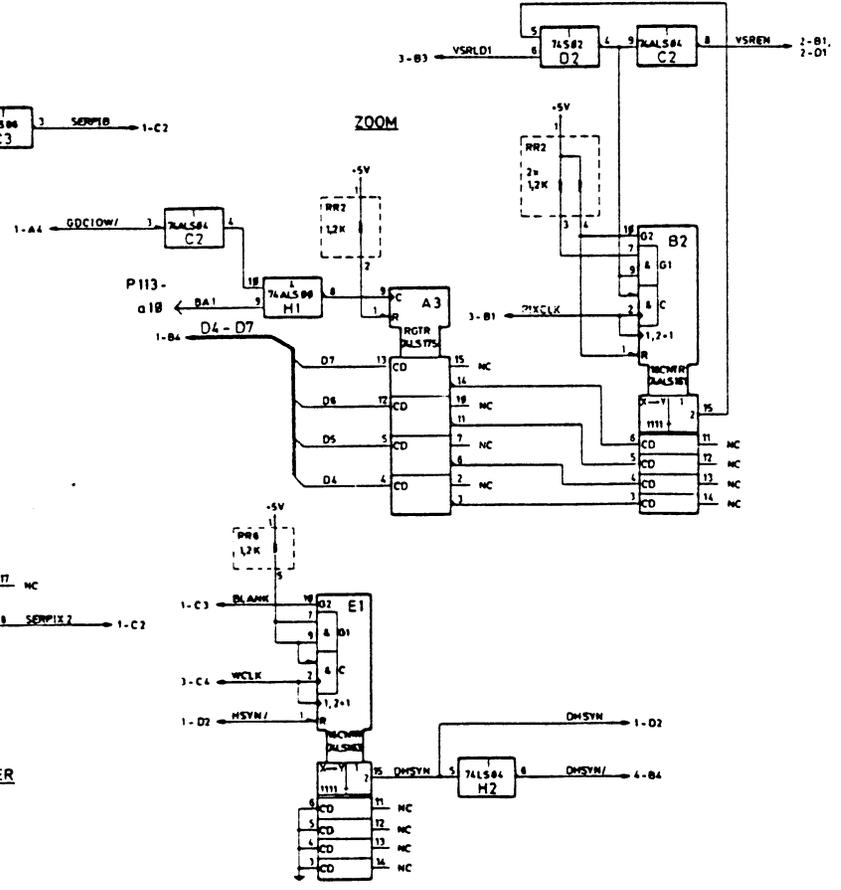




ATTRIBUTE-REGISTER



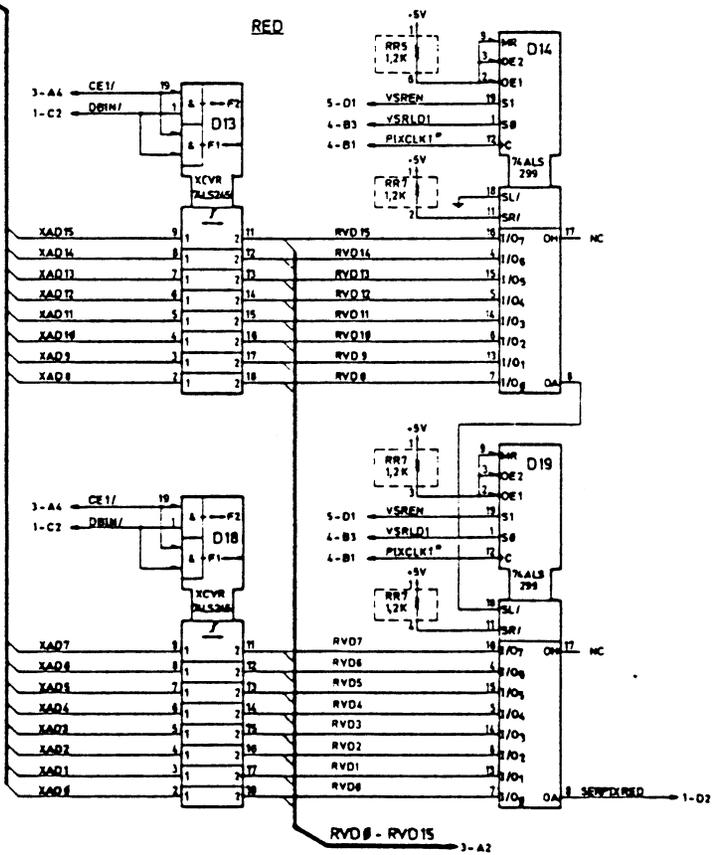
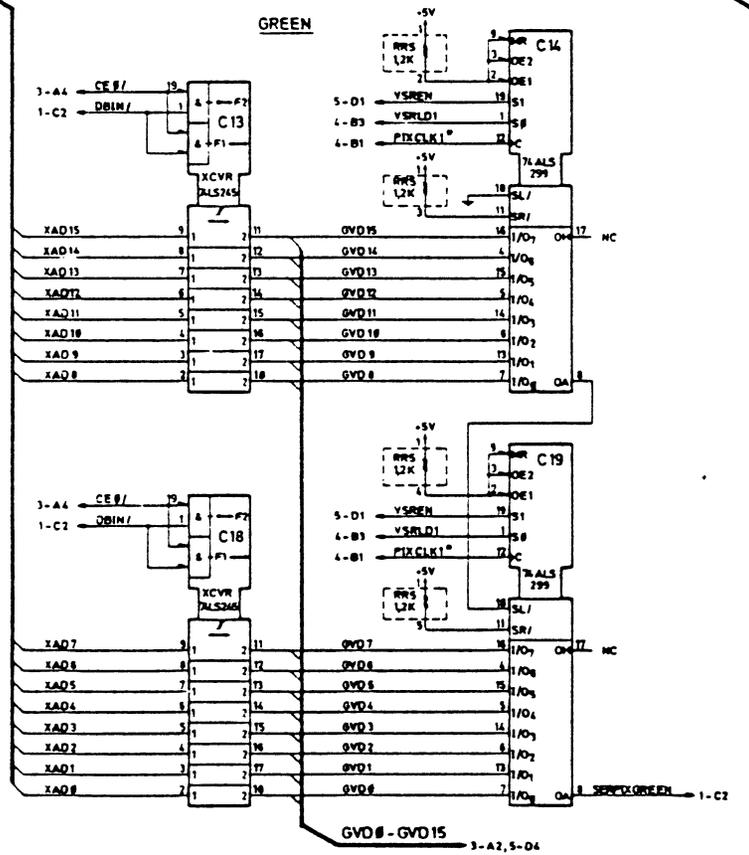
ZOOM

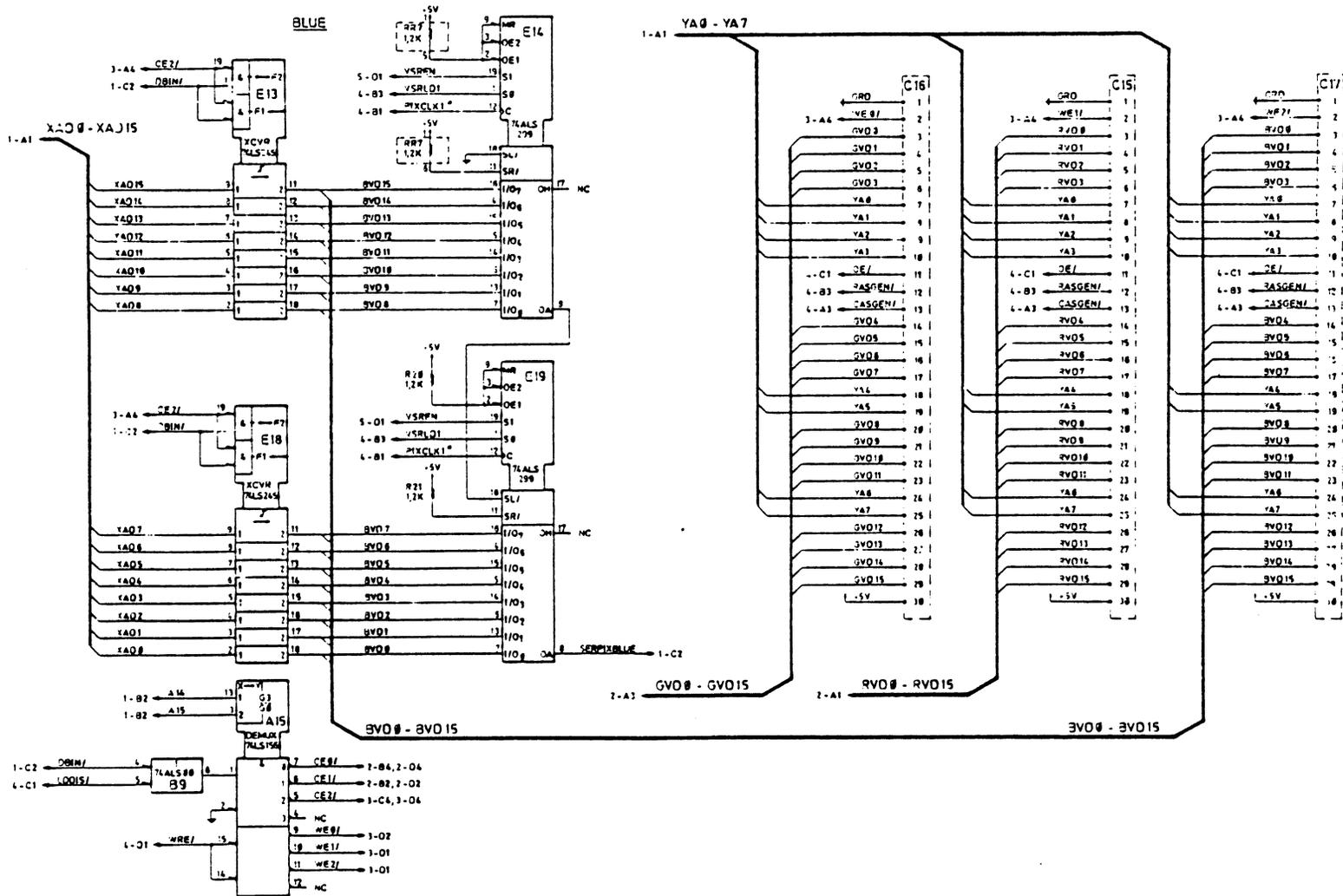


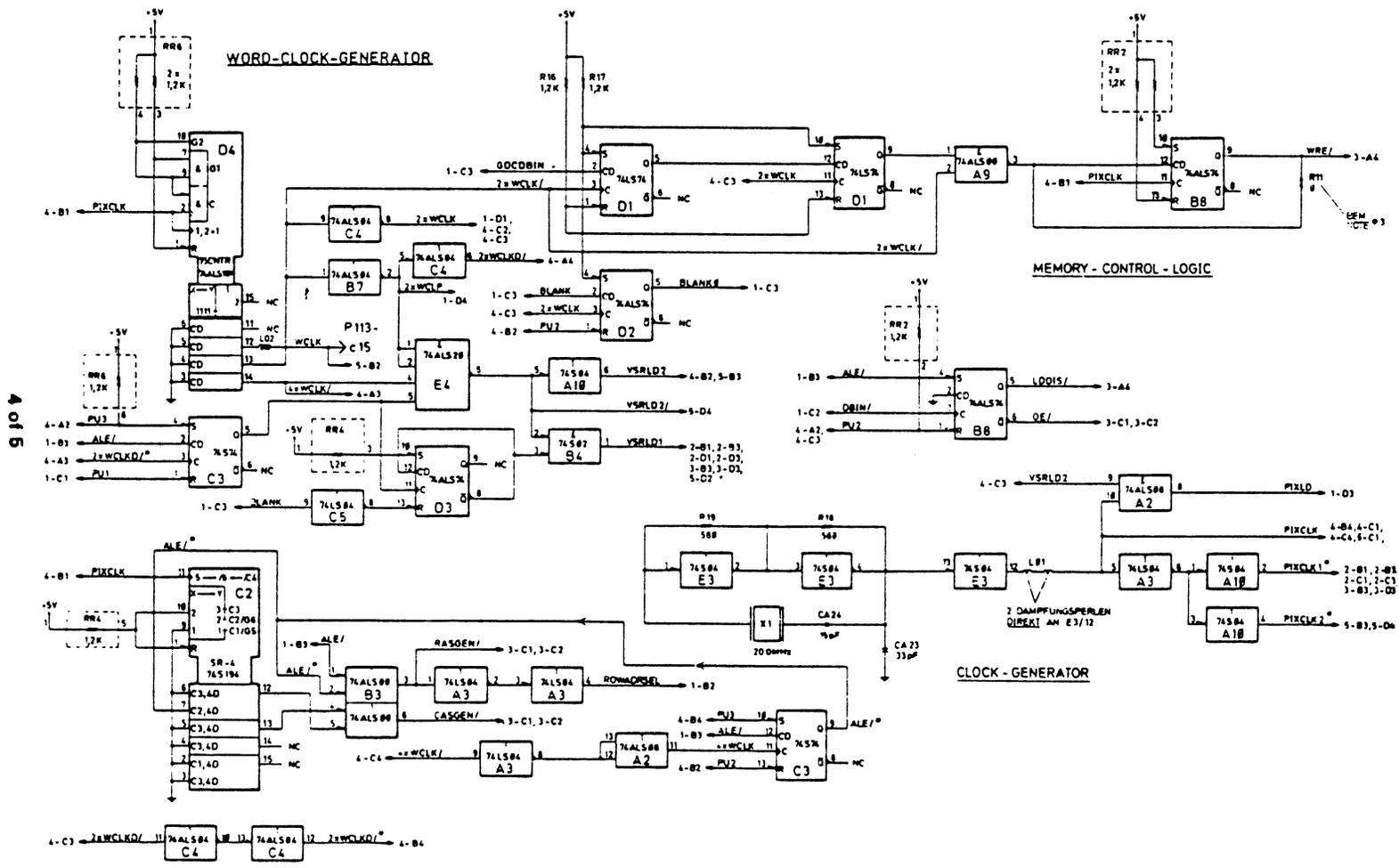
4 of 4



1-1-A1 XAD# - XAD15



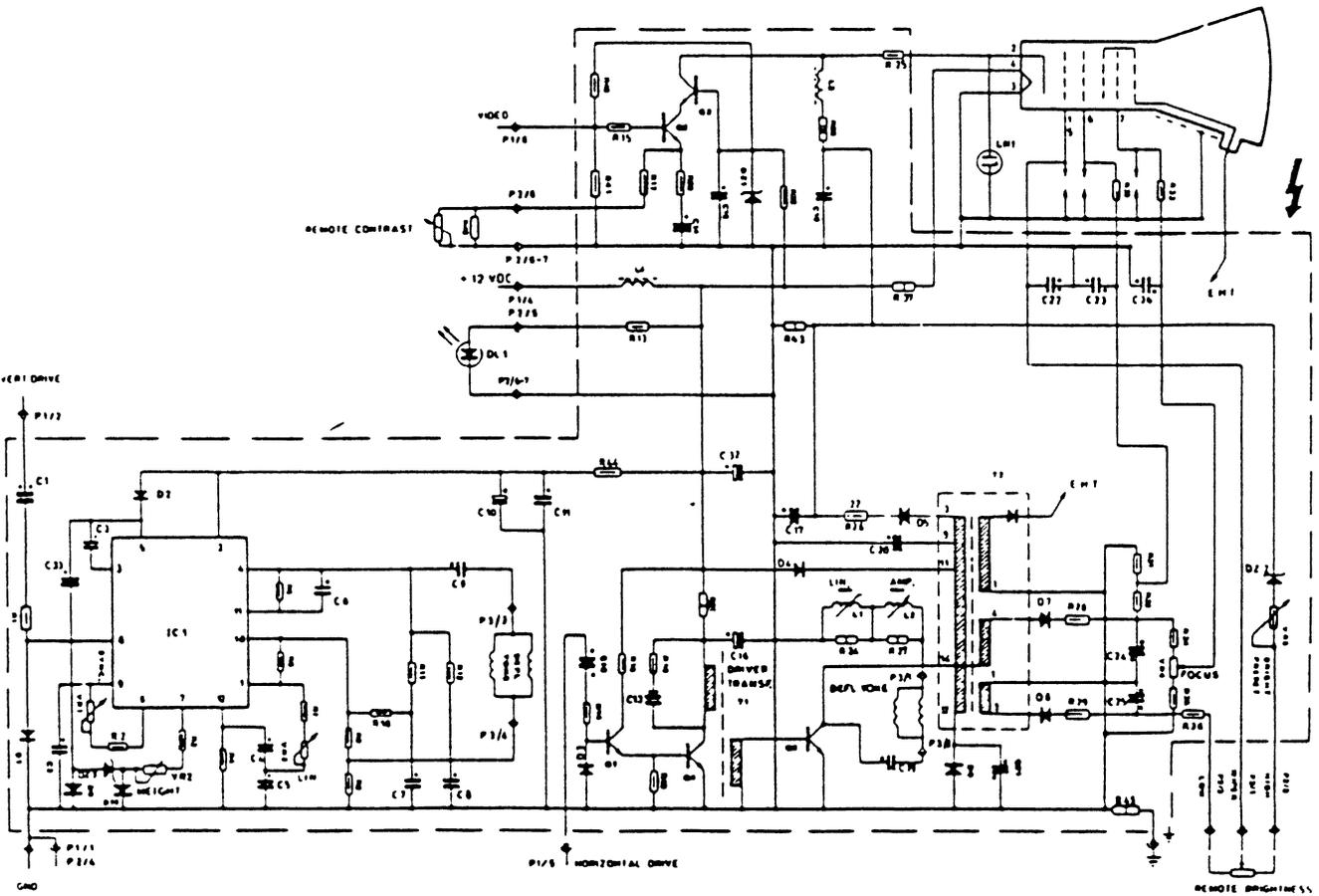




4 of 5

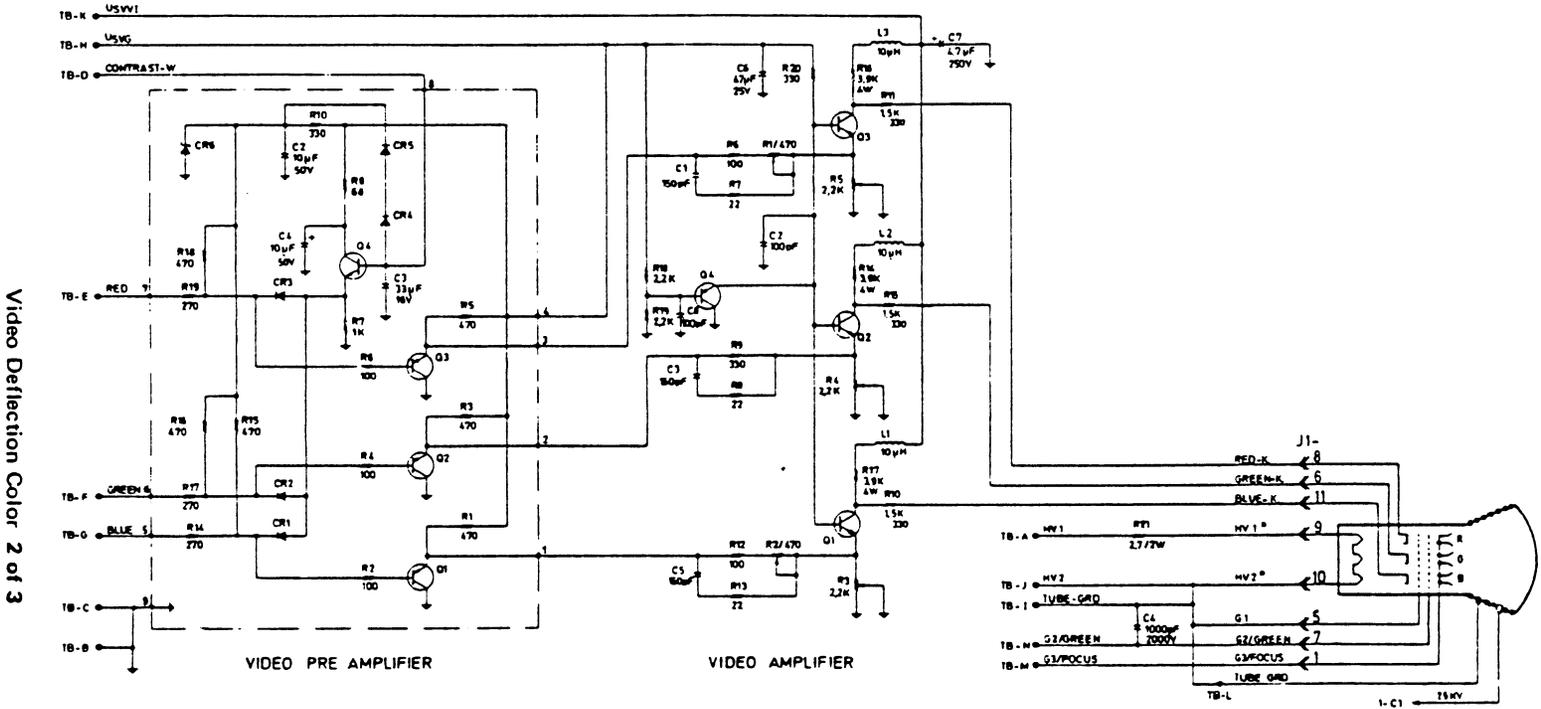
8-41



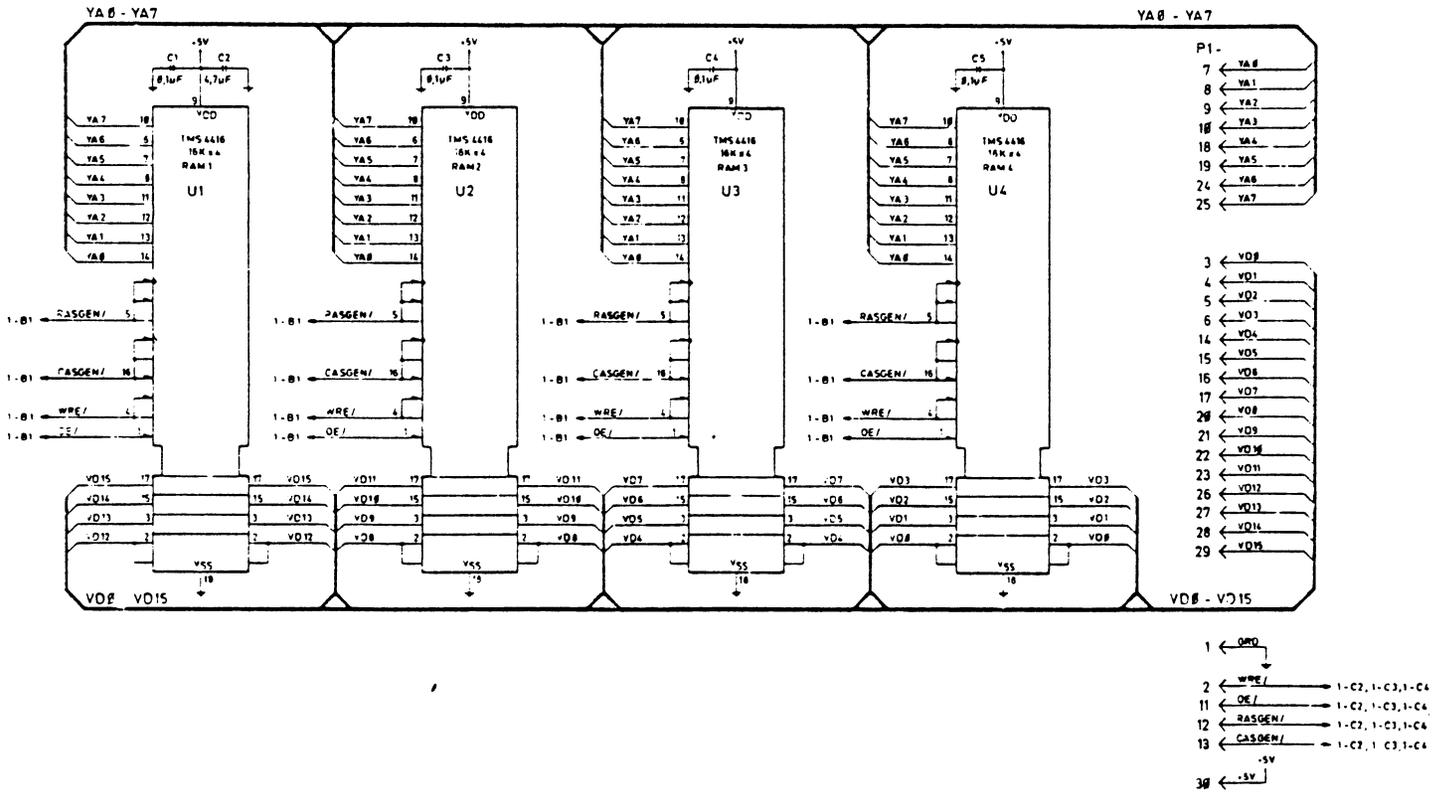


Deflection Monochrome 017-0031979 Rev. D



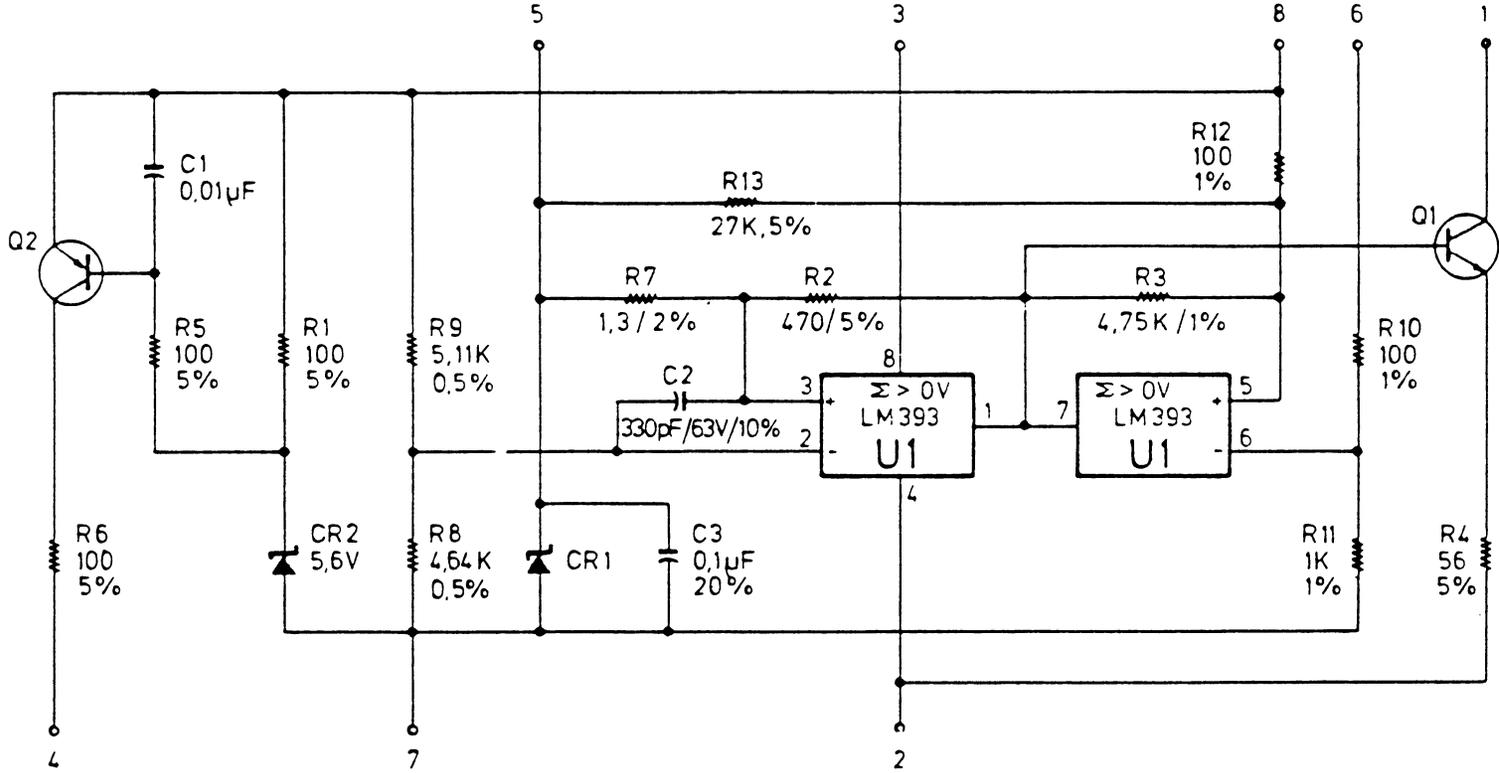


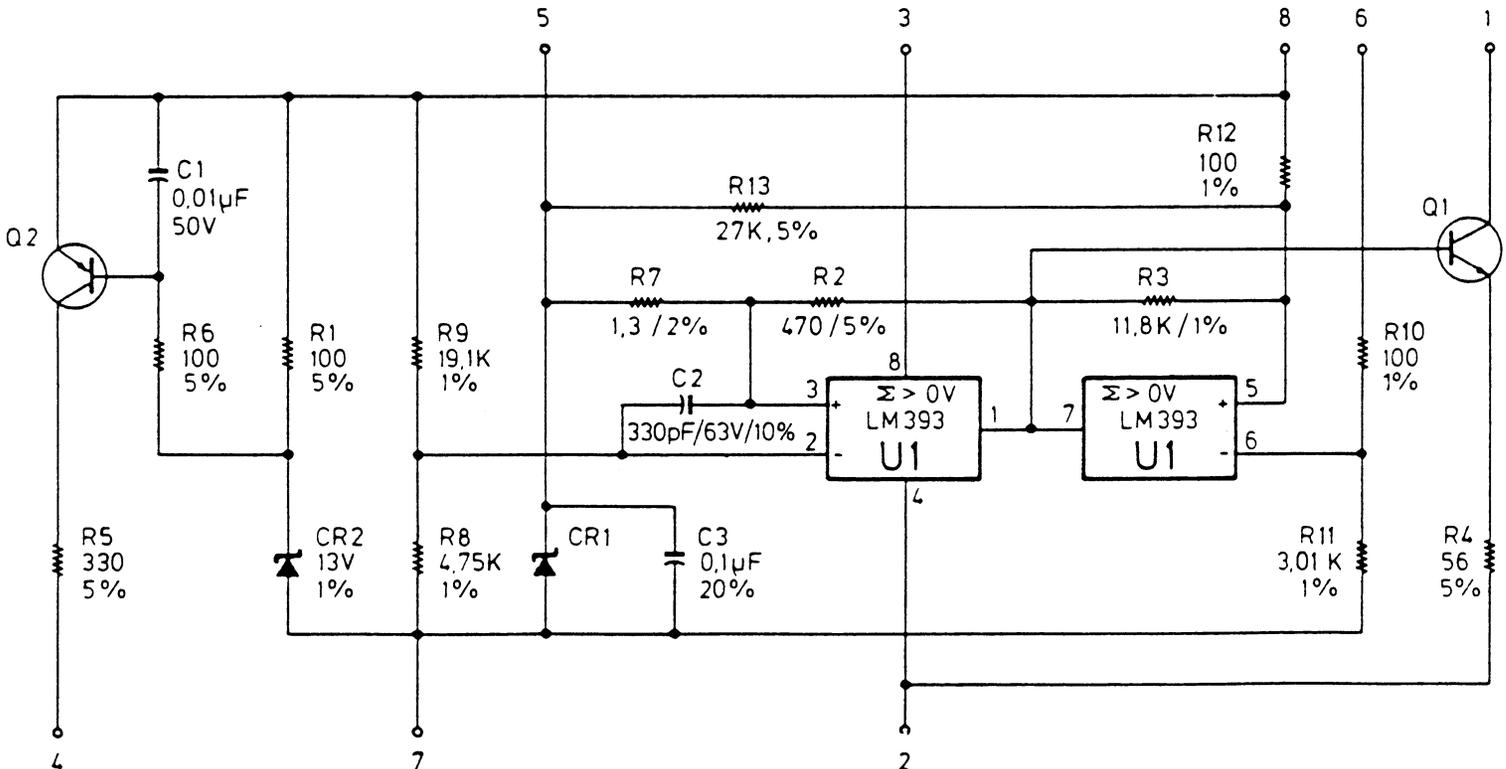




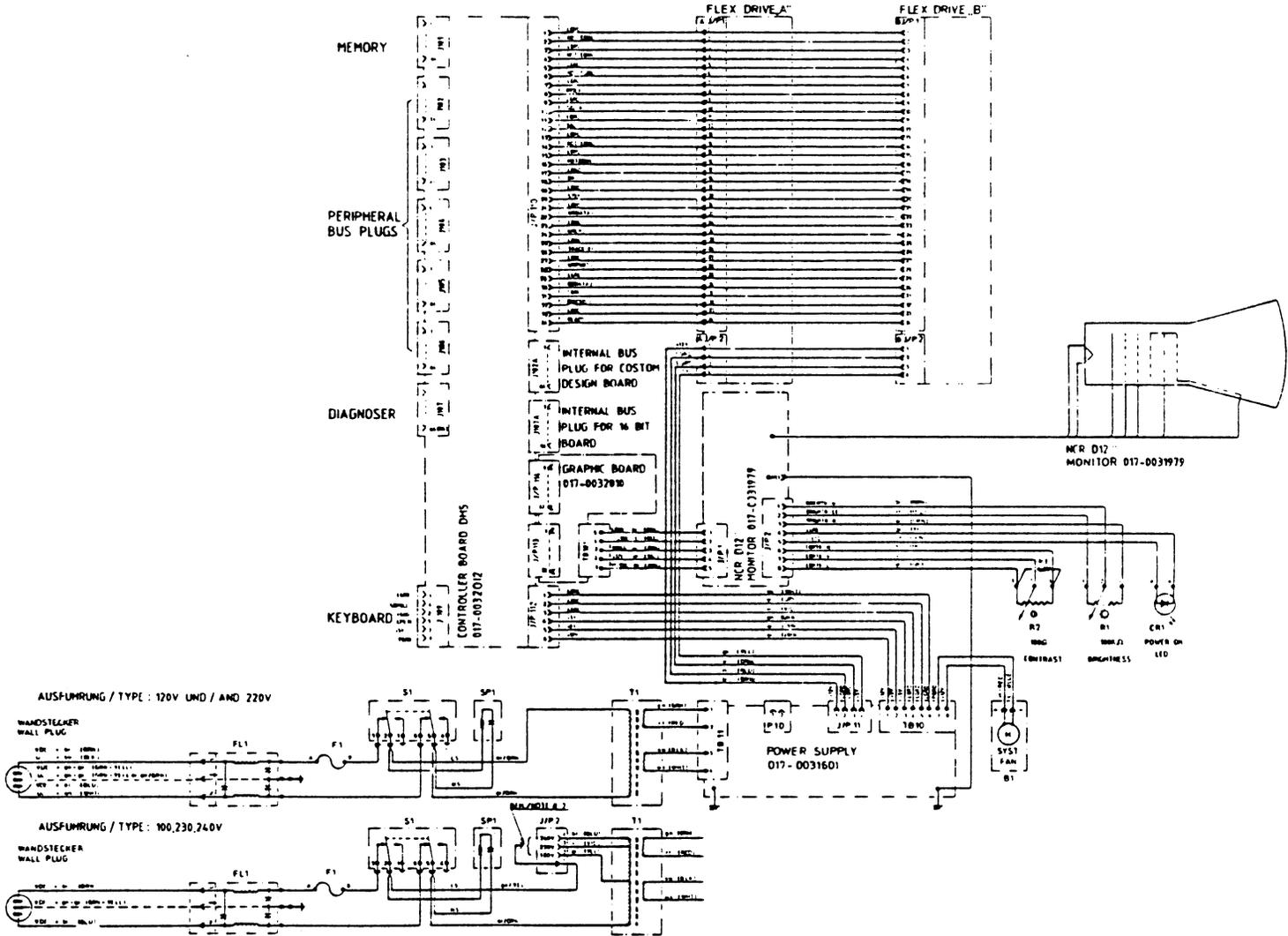
Memory Hybrid 32K 017-0032511 Rev. B

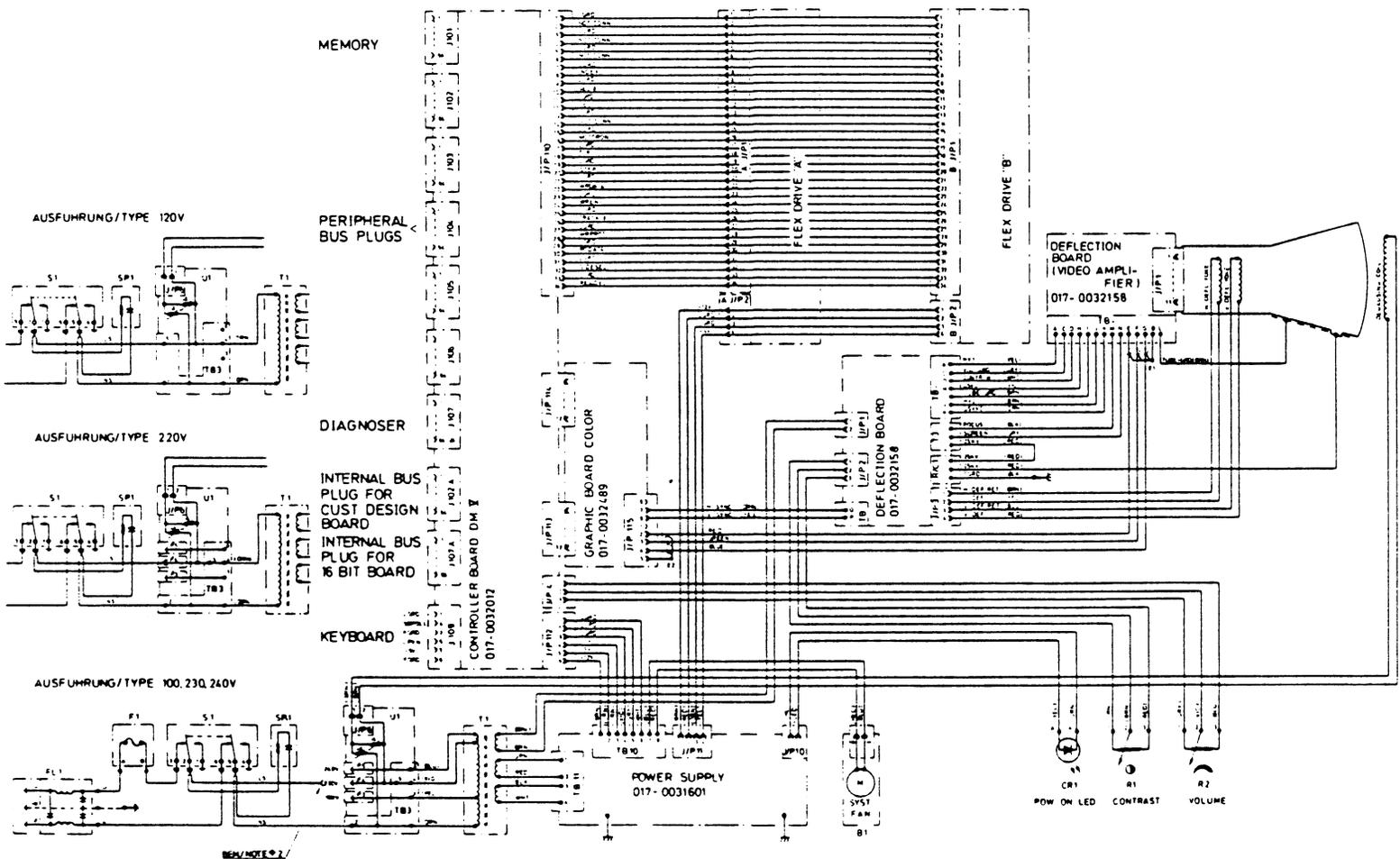
+5V Hybrid 017-0031624 Rev. D





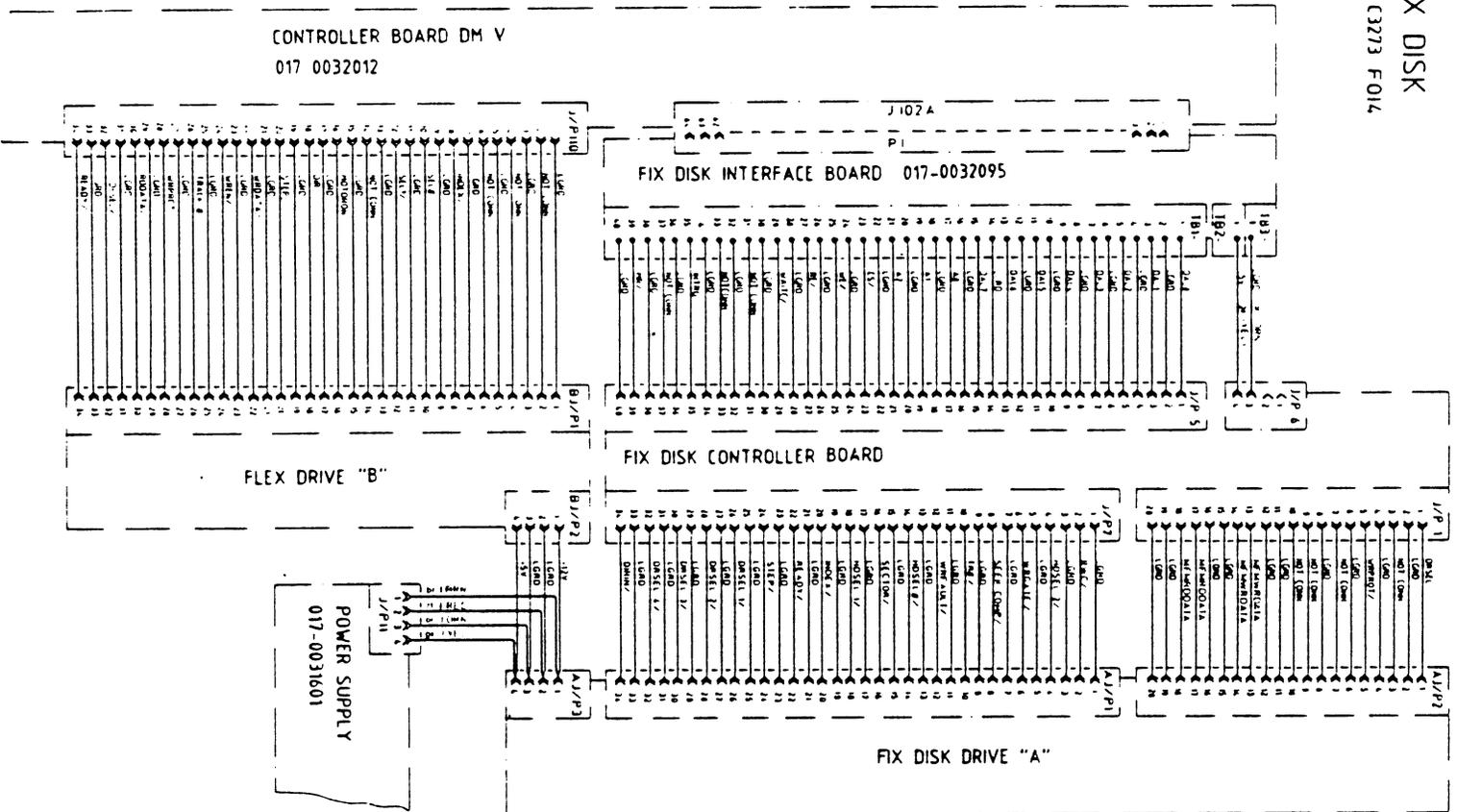
+12V Hybrid 017-0031944 Rev. D

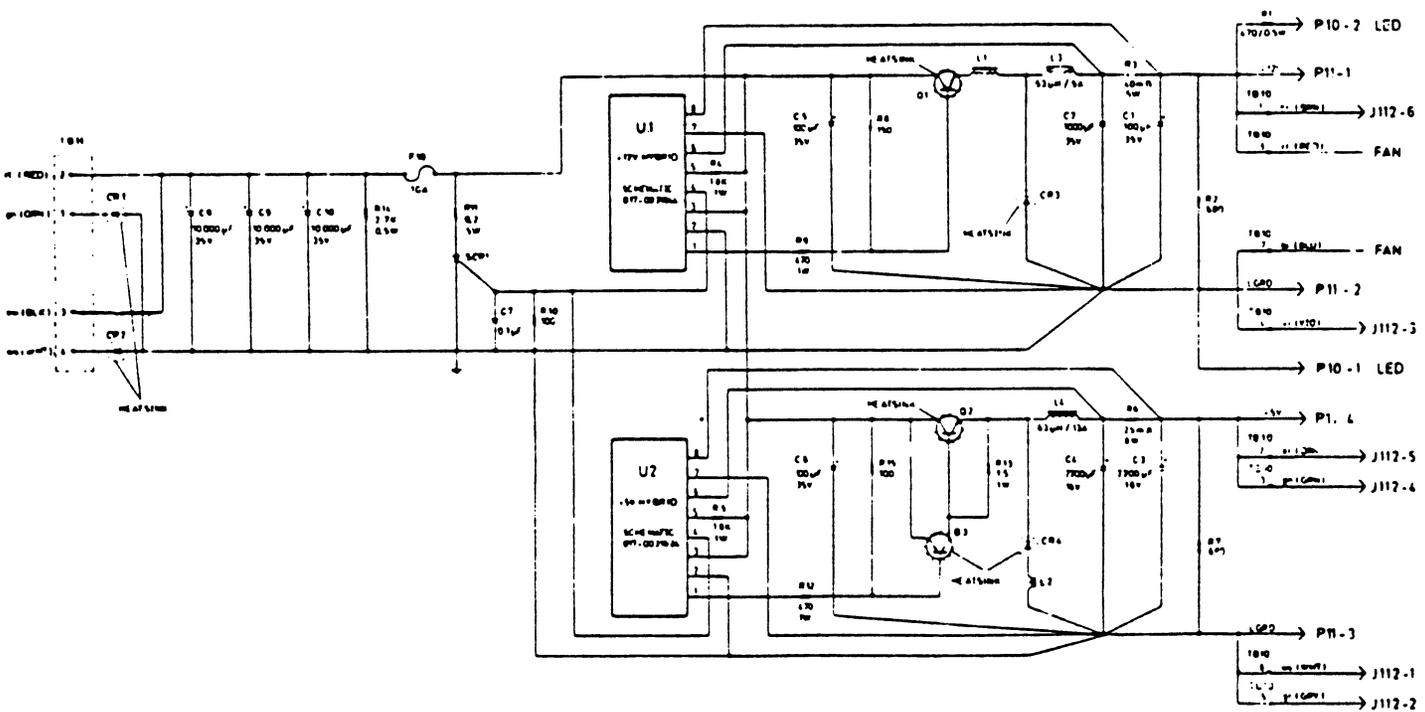




Wiring (color) 017-0031570 Rev. B 2 of 3

FIX DISK  
C3273 F014

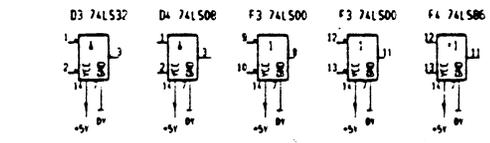
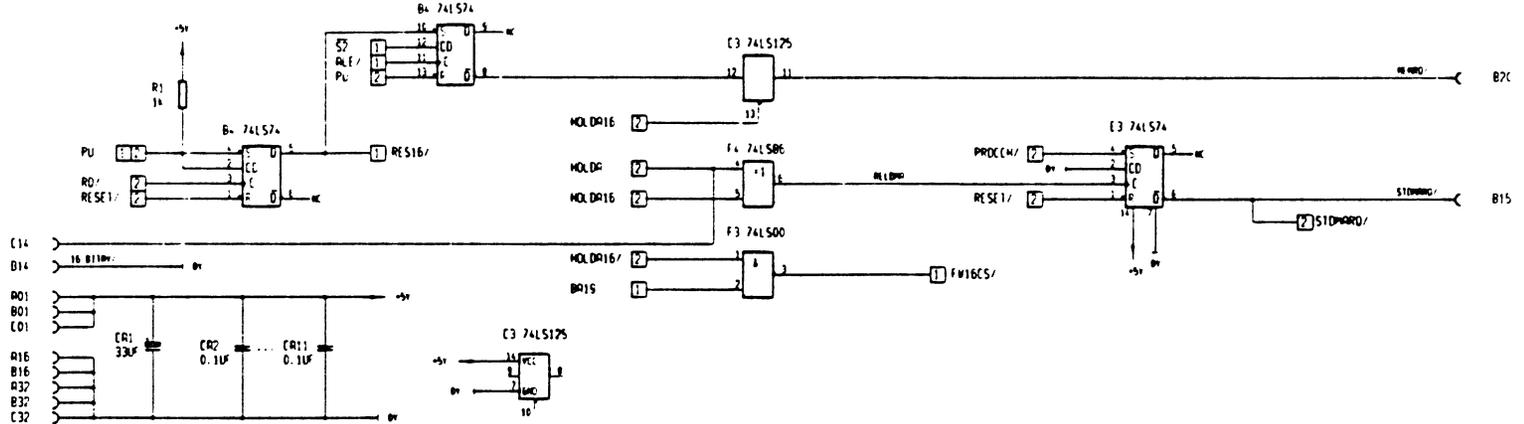
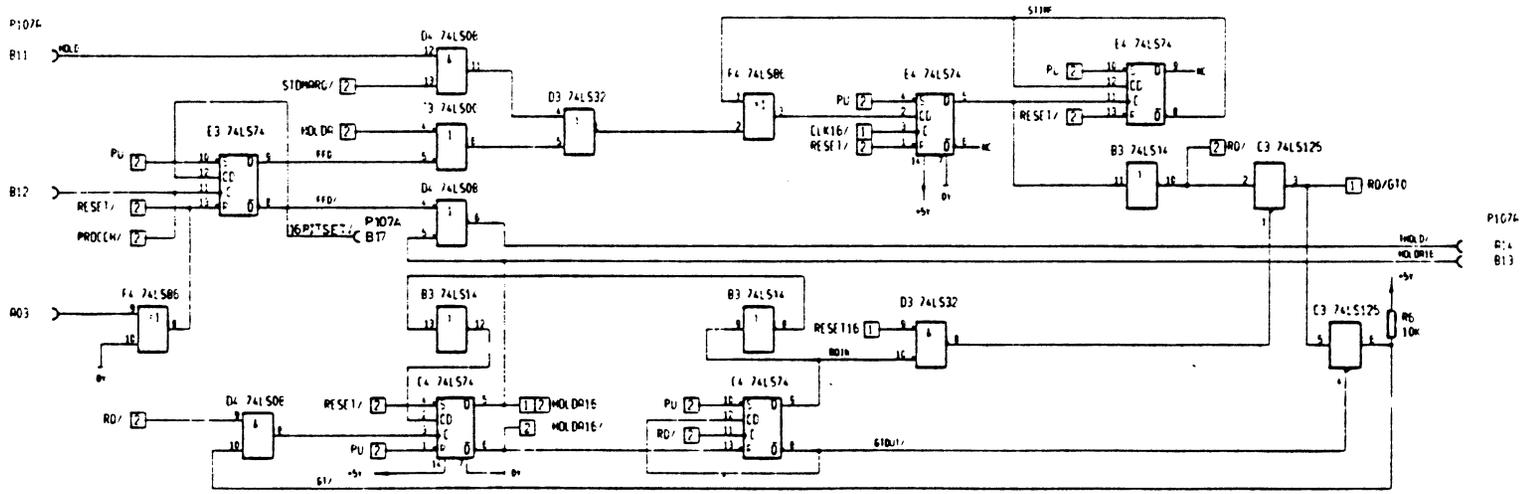




Power Supply 017-0031601 Rev. F



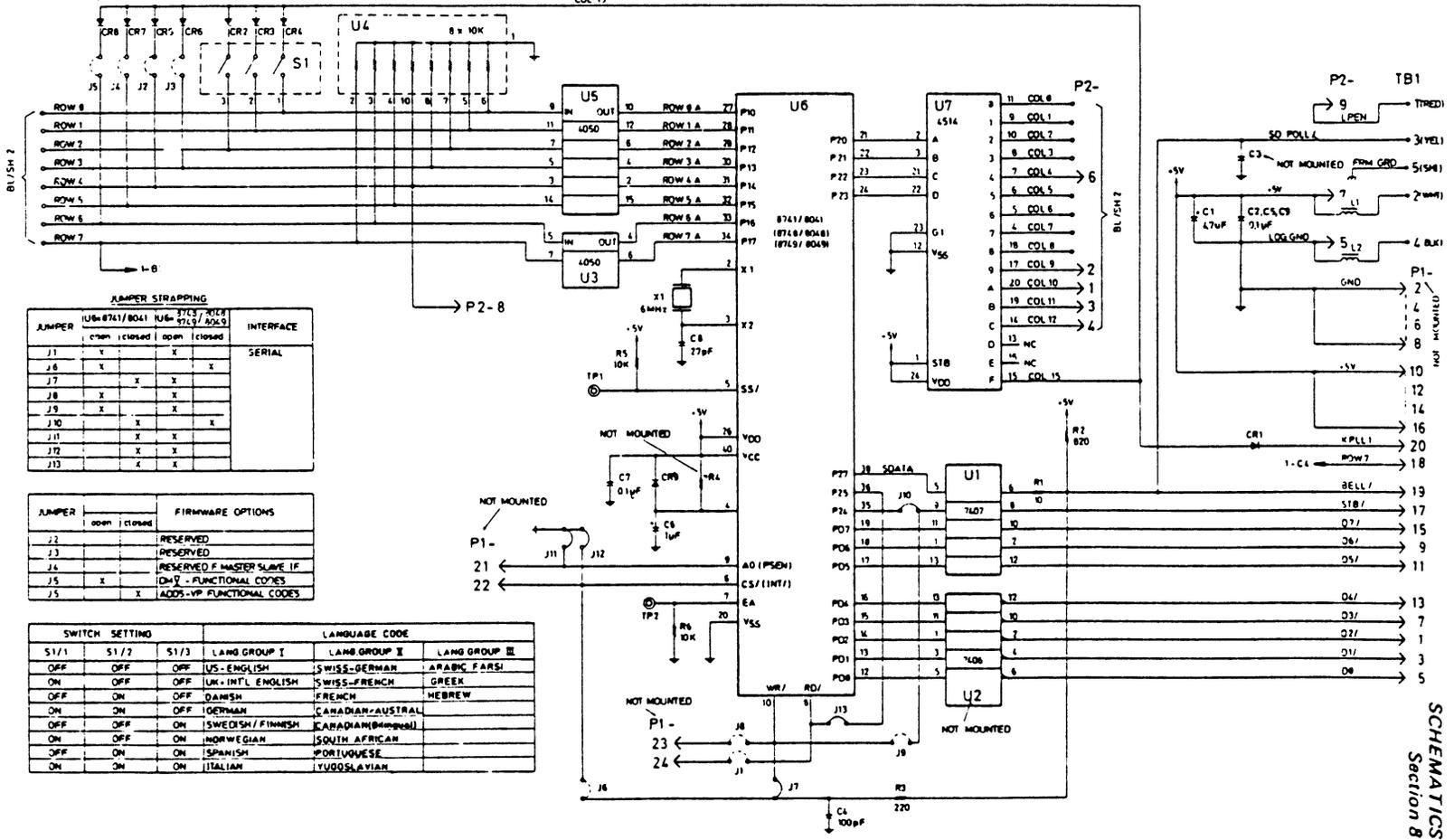




P1074  
D14  
B13

B7C

B15



**JUMPER STRAPPING**

| JUMPER | U5=8741/8041 | U6=8743/8043 | U6=8749/8049 | INTERFACE |
|--------|--------------|--------------|--------------|-----------|
|        | closed       | closed       | open         | closed    |
| J1     | X            |              | X            | SERIAL    |
| J6     | X            |              |              |           |
| J7     | X            | X            | X            |           |
| J8     | X            | X            | X            |           |
| J9     | X            | X            | X            |           |
| J10    |              | X            | X            |           |
| J11    |              | X            | X            |           |
| J12    | X            | X            | X            |           |
| J13    |              | X            | X            |           |

**JUMPER**

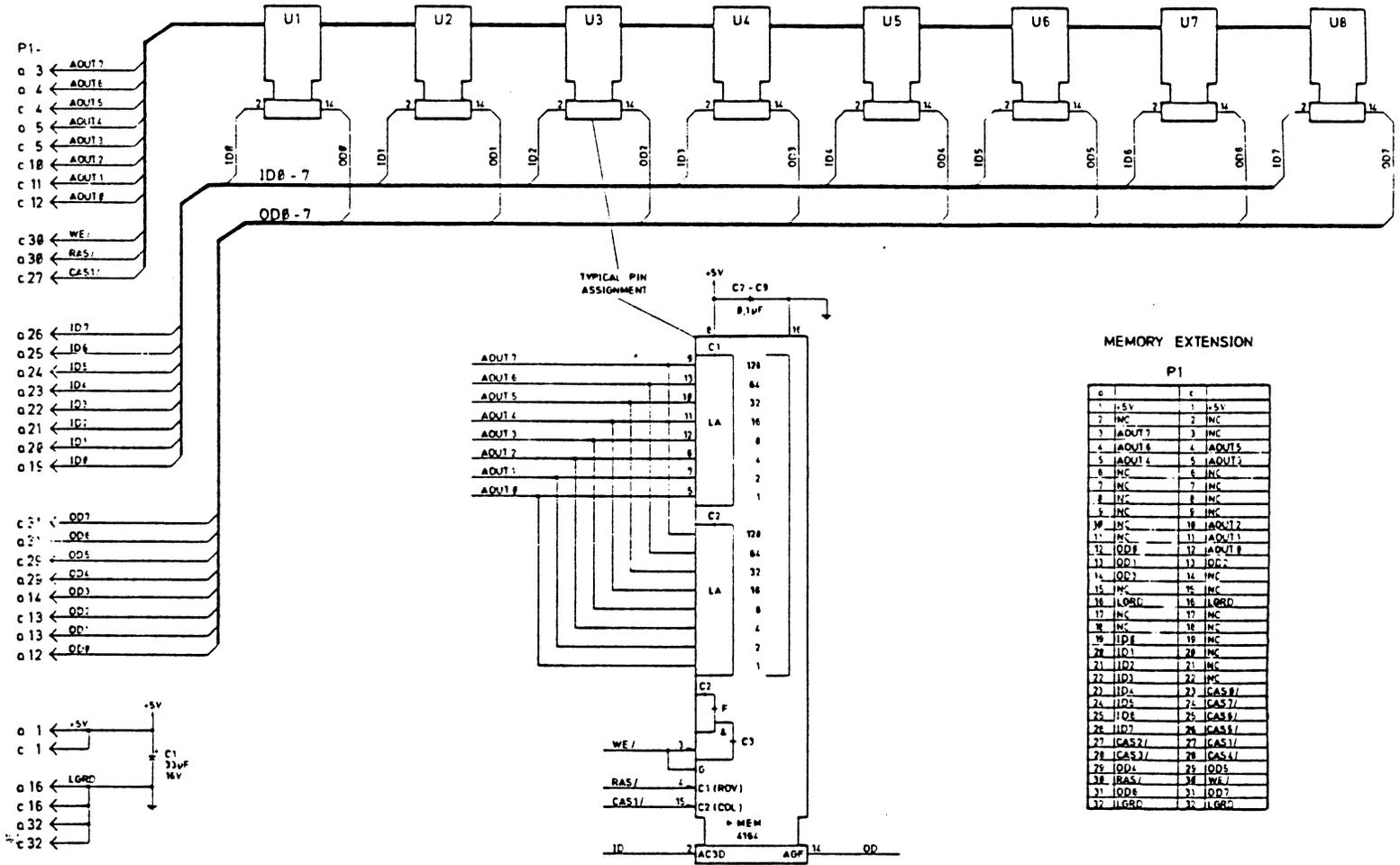
| JUMPER | open | closed | FIRMWARE OPTIONS           |
|--------|------|--------|----------------------------|
| J2     |      |        | RESERVED                   |
| J3     |      |        | RESERVED                   |
| J4     |      |        | RESERVED P MASTER SLAVE IF |
| J5     | X    |        | DM2 - FUNCTIONAL CODES     |
| J5     |      | X      | ADD5-VF FUNCTIONAL CODES   |

**SWITCH SETTING**

| S1/1 | S1/2 | S1/3 | LANGUAGE CODE   |                   |                |
|------|------|------|-----------------|-------------------|----------------|
|      |      |      | LANG GROUP I    | LANG GROUP II     | LANG GROUP III |
| OFF  | OFF  | OFF  | US-ENGLISH      | SWISS-GERMAN      | ARABIC, FARSI  |
| ON   | OFF  | OFF  | UK+INTL ENGLISH | SWISS-FRENCH      | GREEK          |
| OFF  | ON   | OFF  | DANISH          | FRENCH            | HEBREW         |
| ON   | ON   | OFF  | GERMAN          | CANADIAN-AUSTRIAN |                |
| OFF  | OFF  | ON   | SWEDISH/FINISH  | KANADIAN-FRENCH   |                |
| ON   | OFF  | ON   | NORWEGIAN       | SOUTH AFRICAN     |                |
| OFF  | ON   | ON   | SPANISH         | PORTUGUESE        |                |
| ON   | ON   | ON   | ITALIAN         | YUGOSLAVIAN       |                |

Keyboard 017-0031563 Rev. G

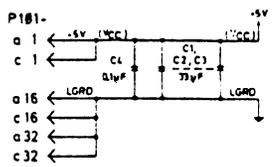
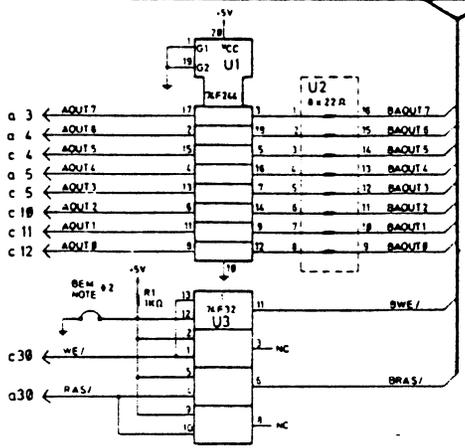
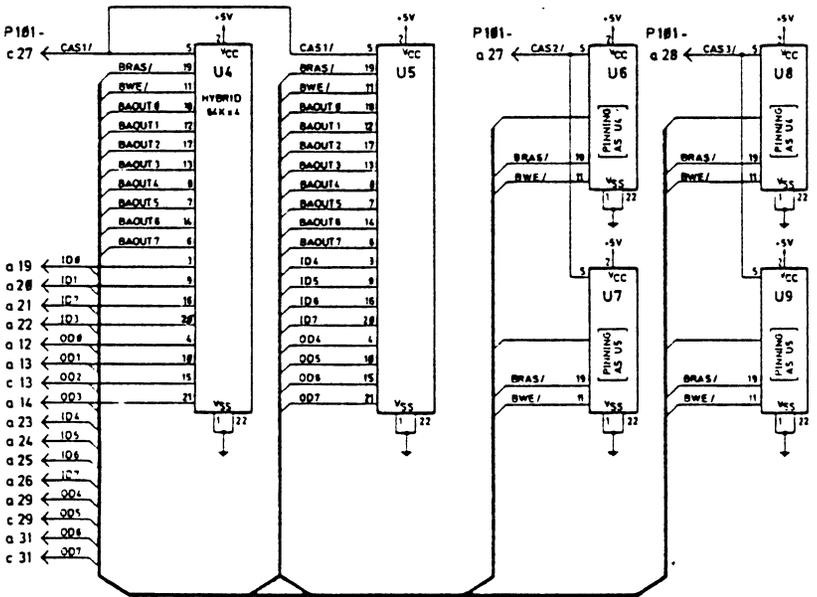
Memory Extension 64K (K200) 017-0032558 Rev. A



MEMORY EXTENSION

P1

| P1 | Pin | Signal |
|----|-----|--------|
| 1  | 1   | +5V    |
| 2  | 2   | INC    |
| 3  | 3   | AOUT 7 |
| 4  | 4   | AOUT 6 |
| 5  | 5   | AOUT 4 |
| 6  | 6   | INC    |
| 7  | 7   | INC    |
| 8  | 8   | INC    |
| 9  | 9   | INC    |
| 10 | 10  | INC    |
| 11 | 11  | AOUT 1 |
| 12 | 12  | AOUT 8 |
| 13 | 13  | ID 7   |
| 14 | 14  | INC    |
| 15 | 15  | INC    |
| 16 | 16  | ILDR0  |
| 17 | 17  | INC    |
| 18 | 18  | INC    |
| 19 | 19  | INC    |
| 20 | 20  | ID 1   |
| 21 | 21  | INC    |
| 22 | 22  | INC    |
| 23 | 23  | CAS 1  |
| 24 | 24  | CAS 2  |
| 25 | 25  | CAS 1  |
| 26 | 26  | CAS 1  |
| 27 | 27  | CAS 1  |
| 28 | 28  | CAS 1  |
| 29 | 29  | OD 1   |
| 30 | 30  | RAS 1  |
| 31 | 31  | OD 7   |
| 32 | 32  | ILDR0  |

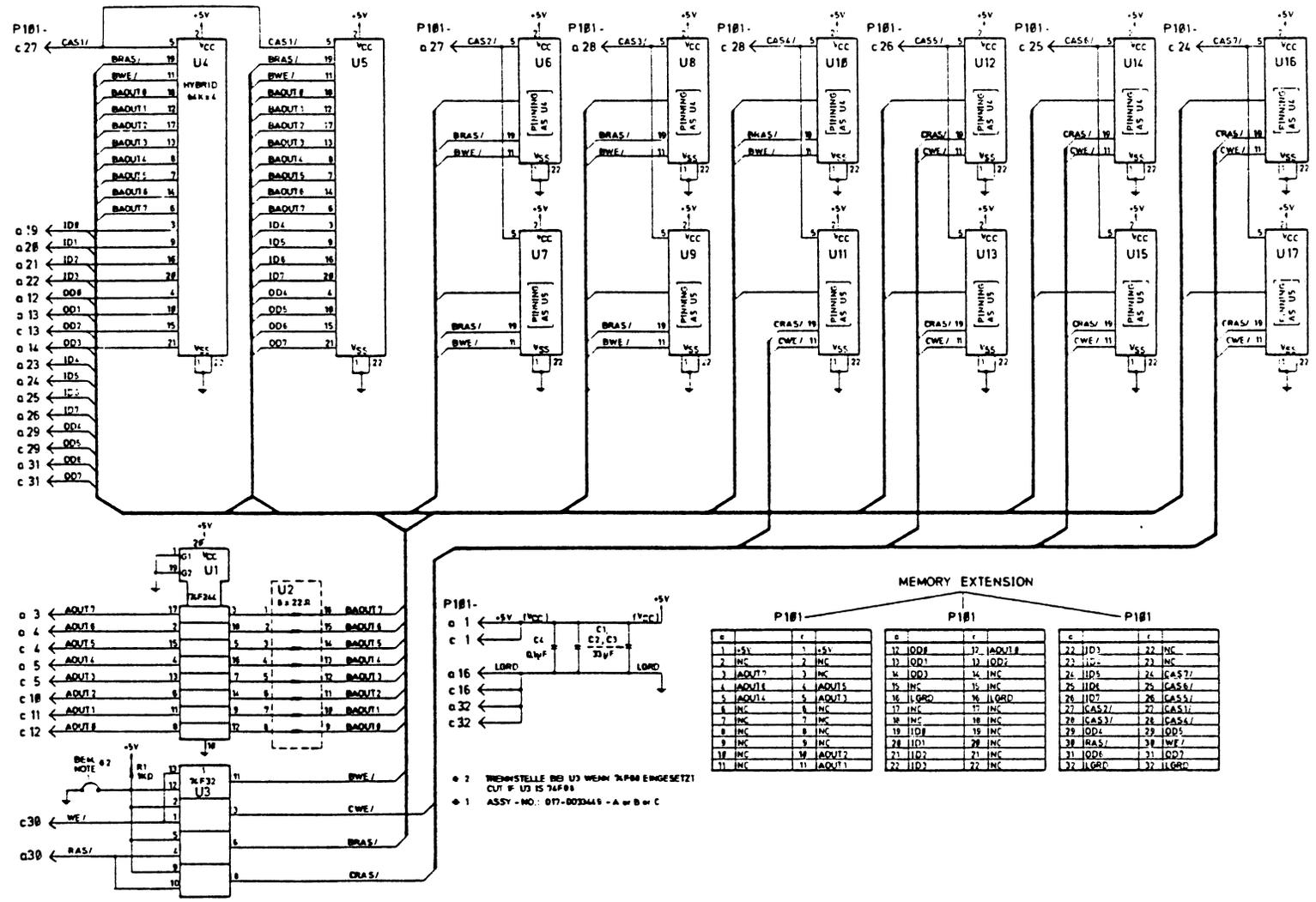


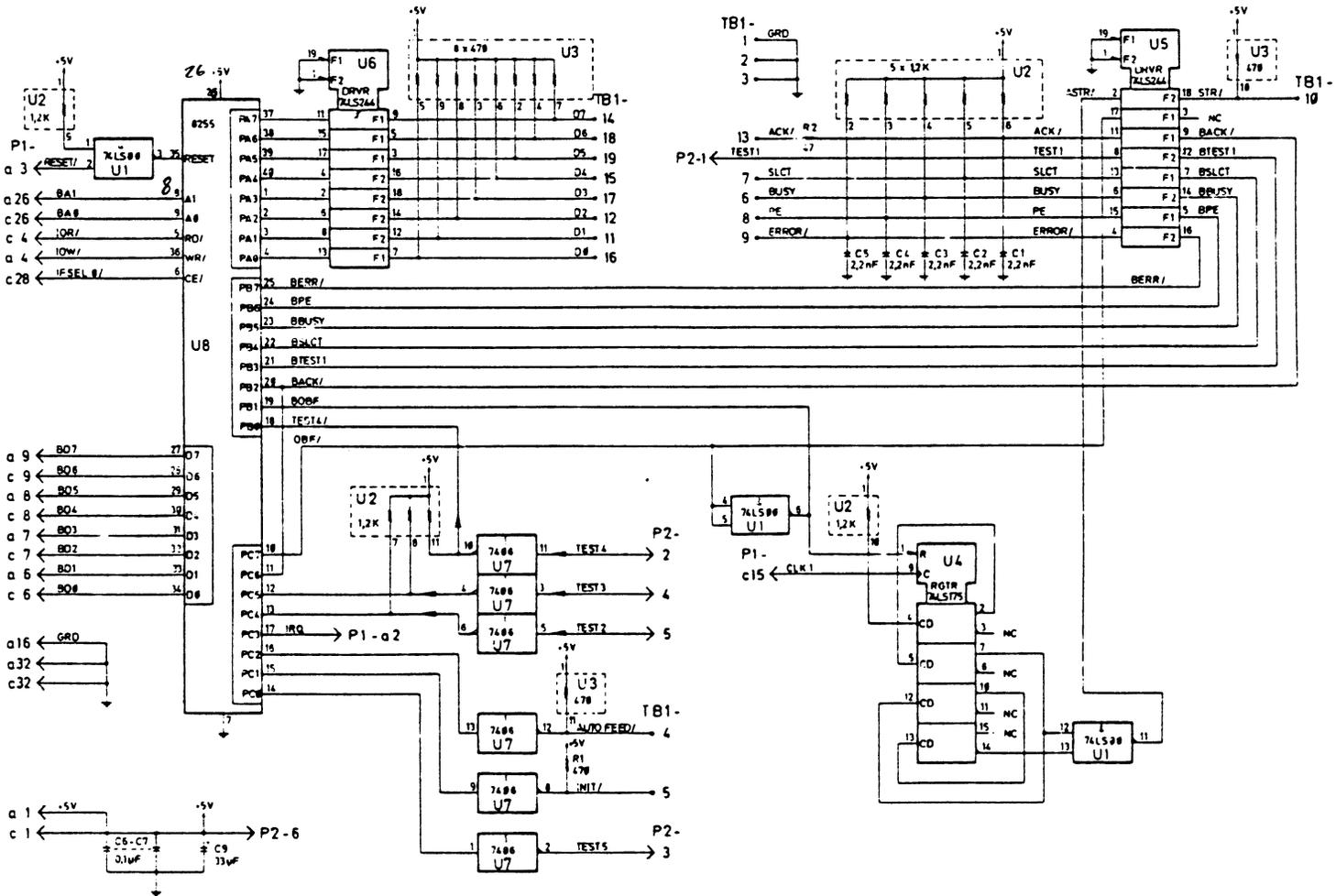
- 2 TRENNSTELLE BEI U3 WENN 74F00 EINGESETZT  
CUT # U3 IS 74F00
- 1 ASSY - NO 017-0032130 - C = D = E

MEMORY EXTENSION

| P101 |       |    | P101   |    |     | P101 |        |    |       |    |       |
|------|-------|----|--------|----|-----|------|--------|----|-------|----|-------|
| b    | c     |    | 3      | c  |     | 11   | c      |    |       |    |       |
| 1    | -5V   | 1  | -5V    | 12 | OD8 | 12   | BAOUT8 | 22 | ID7   | 22 | INC   |
| 2    | INC   | 2  | INC    | 13 | OD1 | 13   | OD2    | 23 | ID4   | 23 | INC   |
| 3    | AOUT7 | 3  | INC    | 4  | OD1 | 4    | INC    | 24 | ID5   | 24 | CAS2/ |
| 4    | AOUT8 | 4  | BAOUT5 | 5  | INC | 5    | INC    | 25 | ID4   | 25 | CAS4/ |
| 5    | AOUT4 | 5  | AOUT3  | 6  | INC | 6    | INC    | 26 | ID7   | 26 | CAS2/ |
| 6    | INC   | 6  | INC    | 7  | INC | 7    | INC    | 27 | CAS2/ | 27 | CAS3/ |
| 7    | INC   | 7  | INC    | 8  | INC | 8    | INC    | 28 | CAS3/ | 28 | CAS4/ |
| 8    | INC   | 8  | INC    | 9  | INC | 9    | INC    | 29 | OD4   | 29 | OD5   |
| 9    | INC   | 9  | INC    | 10 | ID1 | 10   | INC    | 30 | IRAS/ | 30 | IWE/  |
| 10   | INC   | 10 | BAOUT2 | 11 | ID2 | 11   | INC    | 31 | OD8   | 31 | OD7   |
| 11   | INC   | 11 | AOUT1  | 12 | ID2 | 12   | INC    | 32 | IGRD  | 32 | IGRD  |

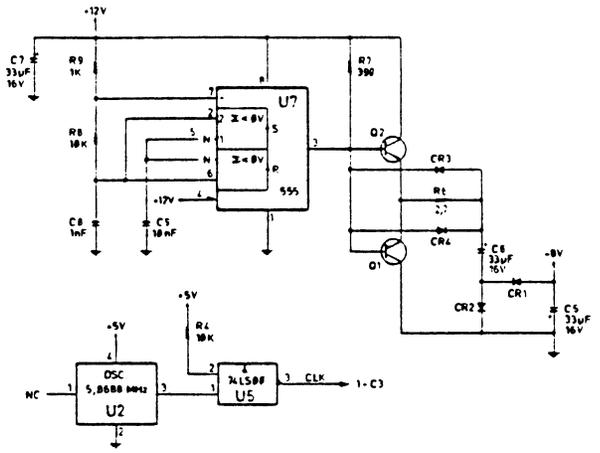
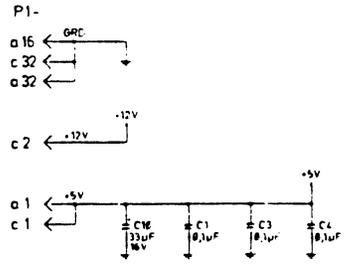
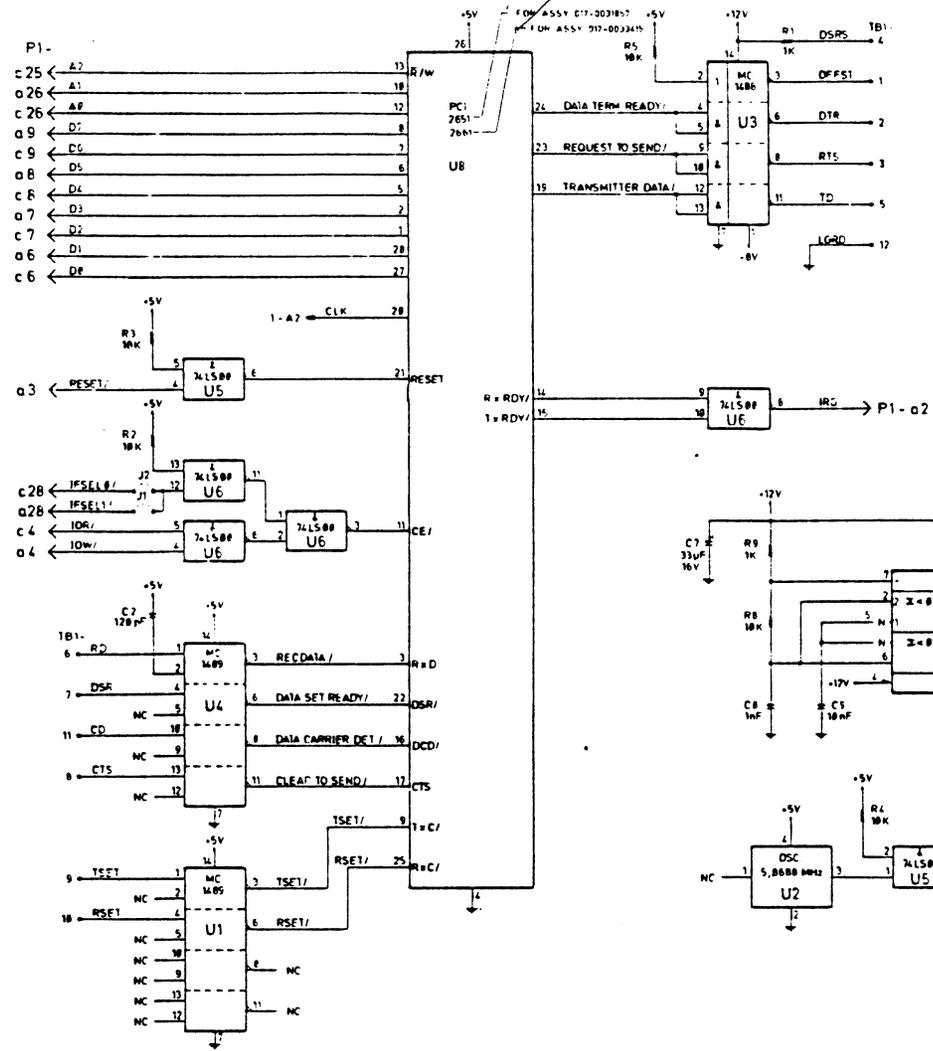
Memory Extension 192 K (K202) 017-0032138 Rev. D





Centronics Interface (K210) 017-0031554 Rev. B

017-0033415

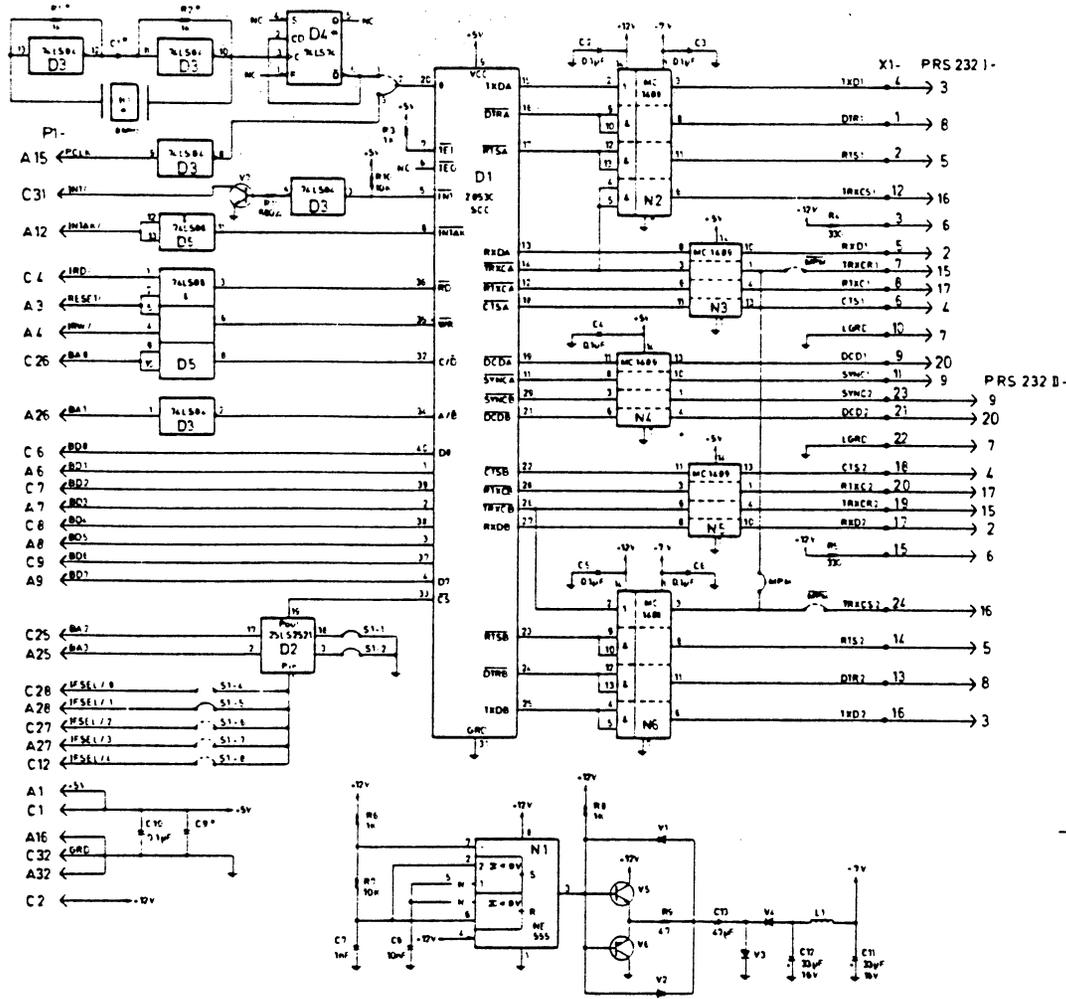


RS-232-C Interface (K211/212/213) 017-0031865 Rev. C

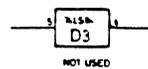
8-62



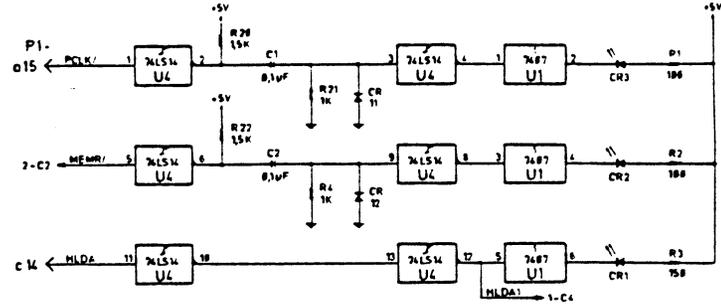
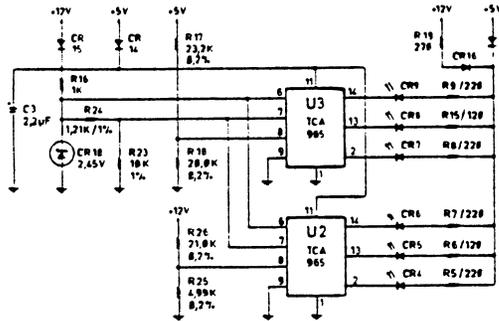
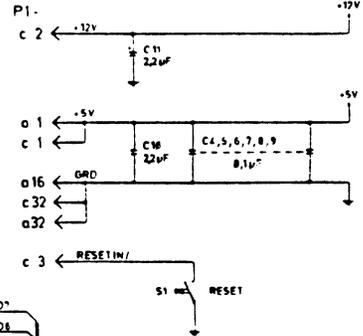
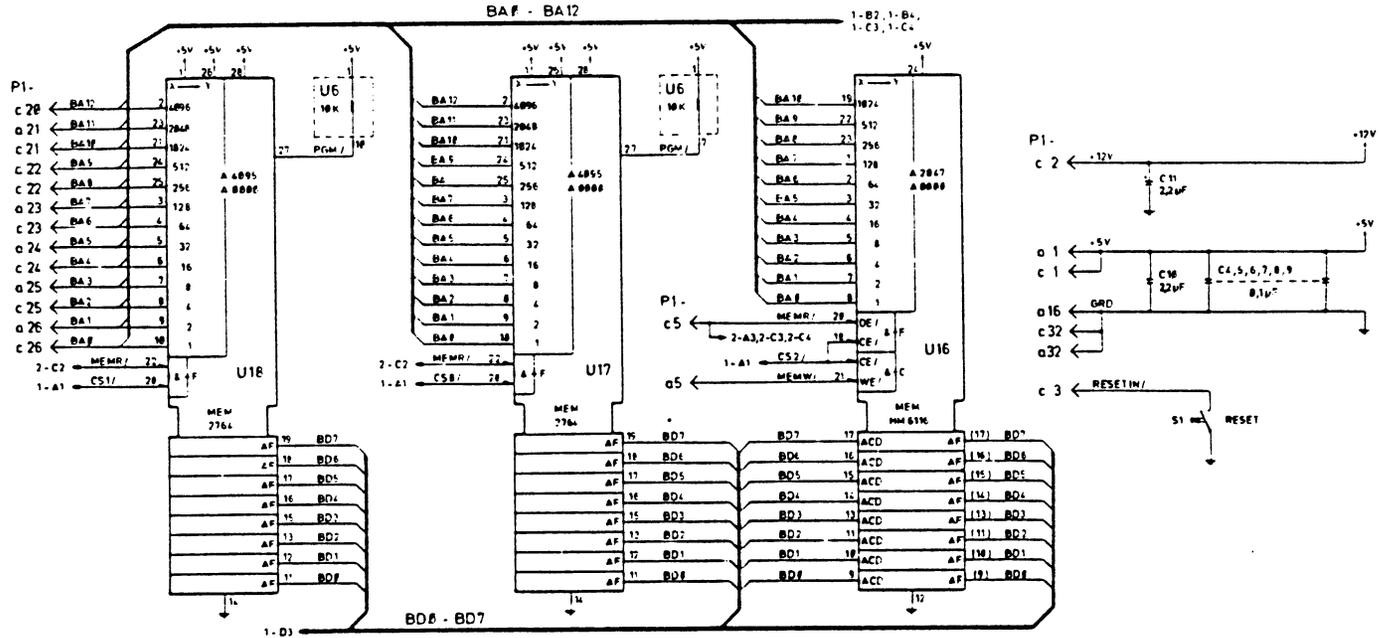
SCC Communication Interface (K216) 017-0033564 Rev. B

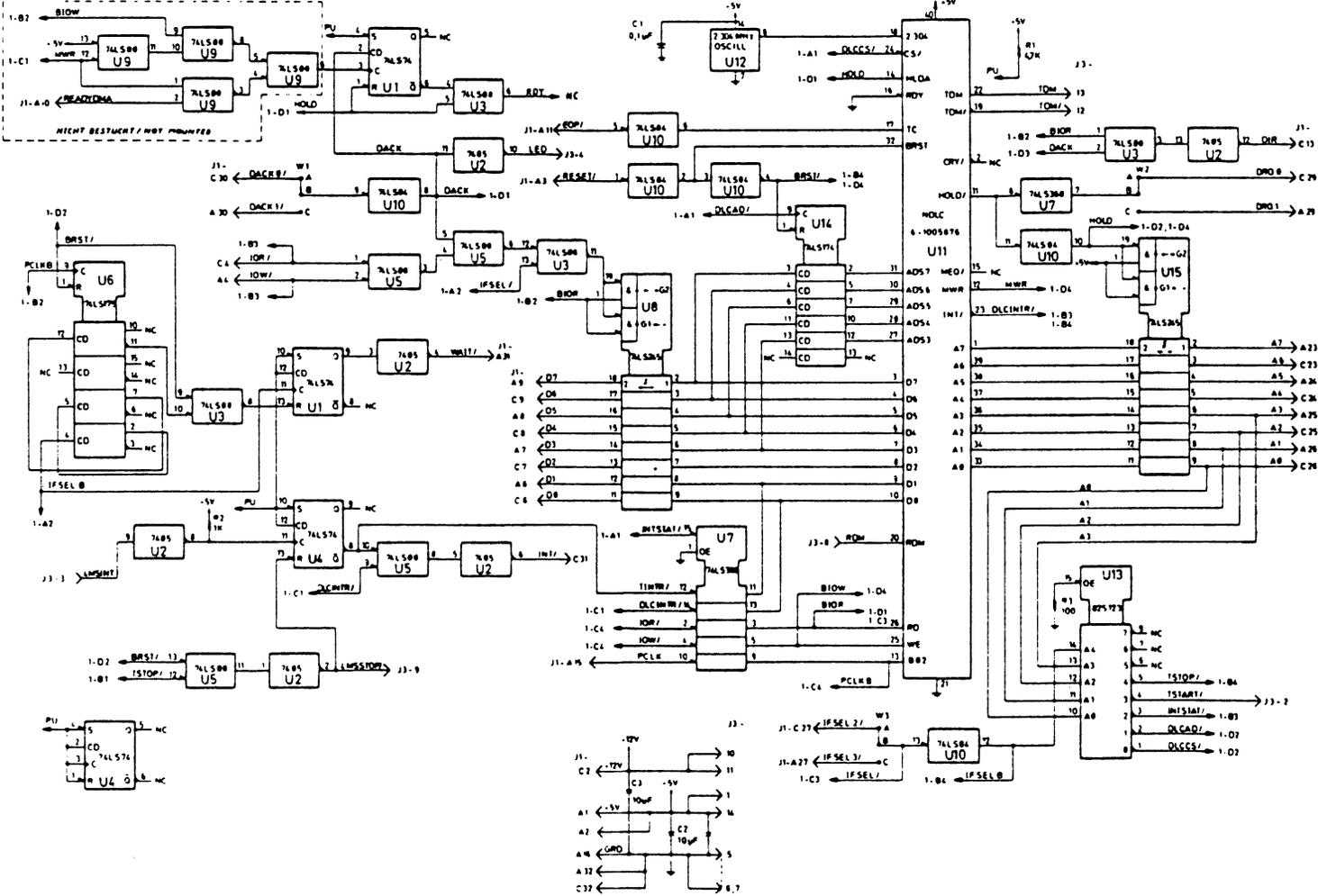


- 03 = NICHI BESTUCH = NOT MOUNTED
- 02 = ALLE WIDERSTANDSWERTE SIND IN OHM
- 01 = ASSY-NO D17-0033563



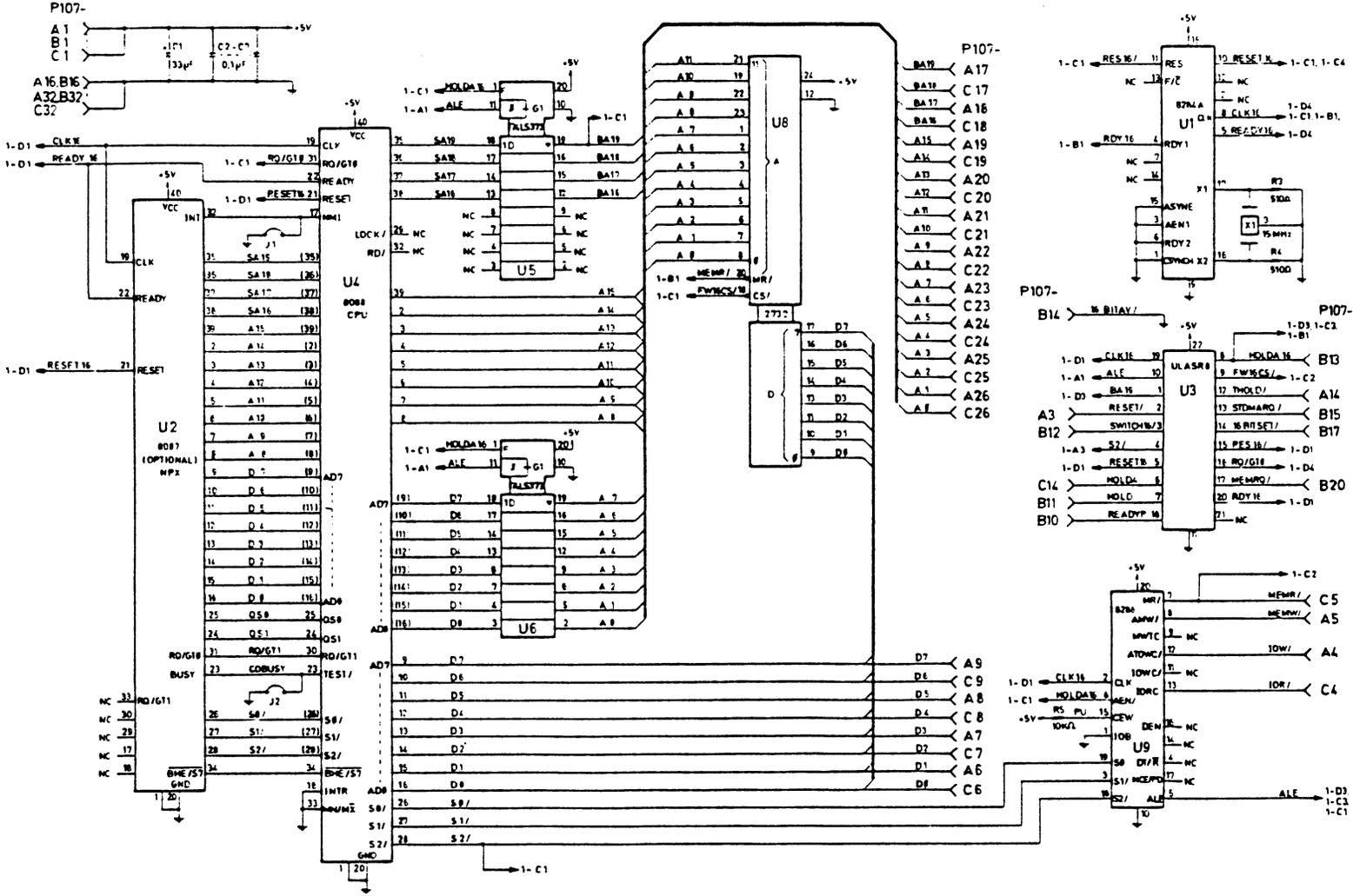


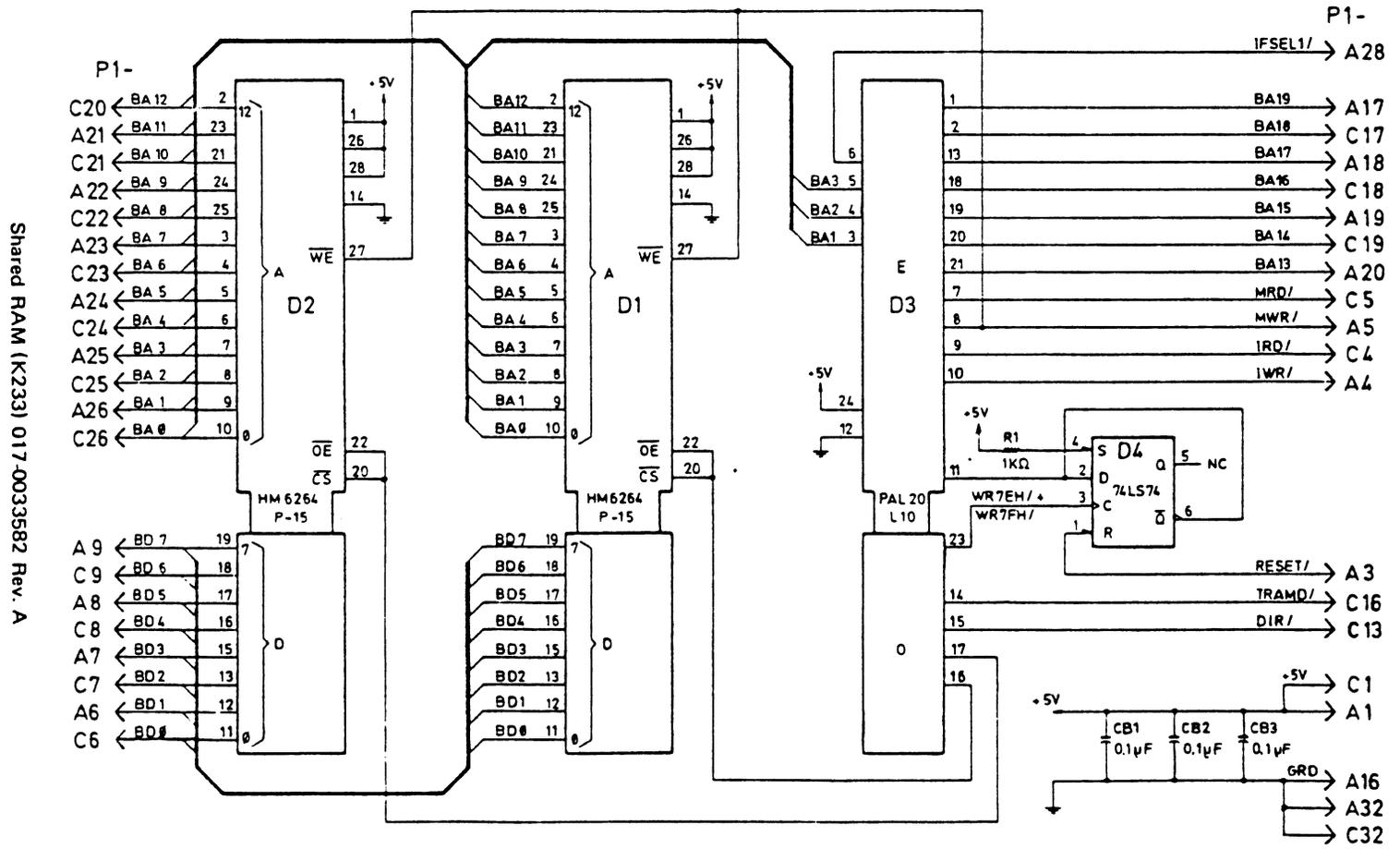


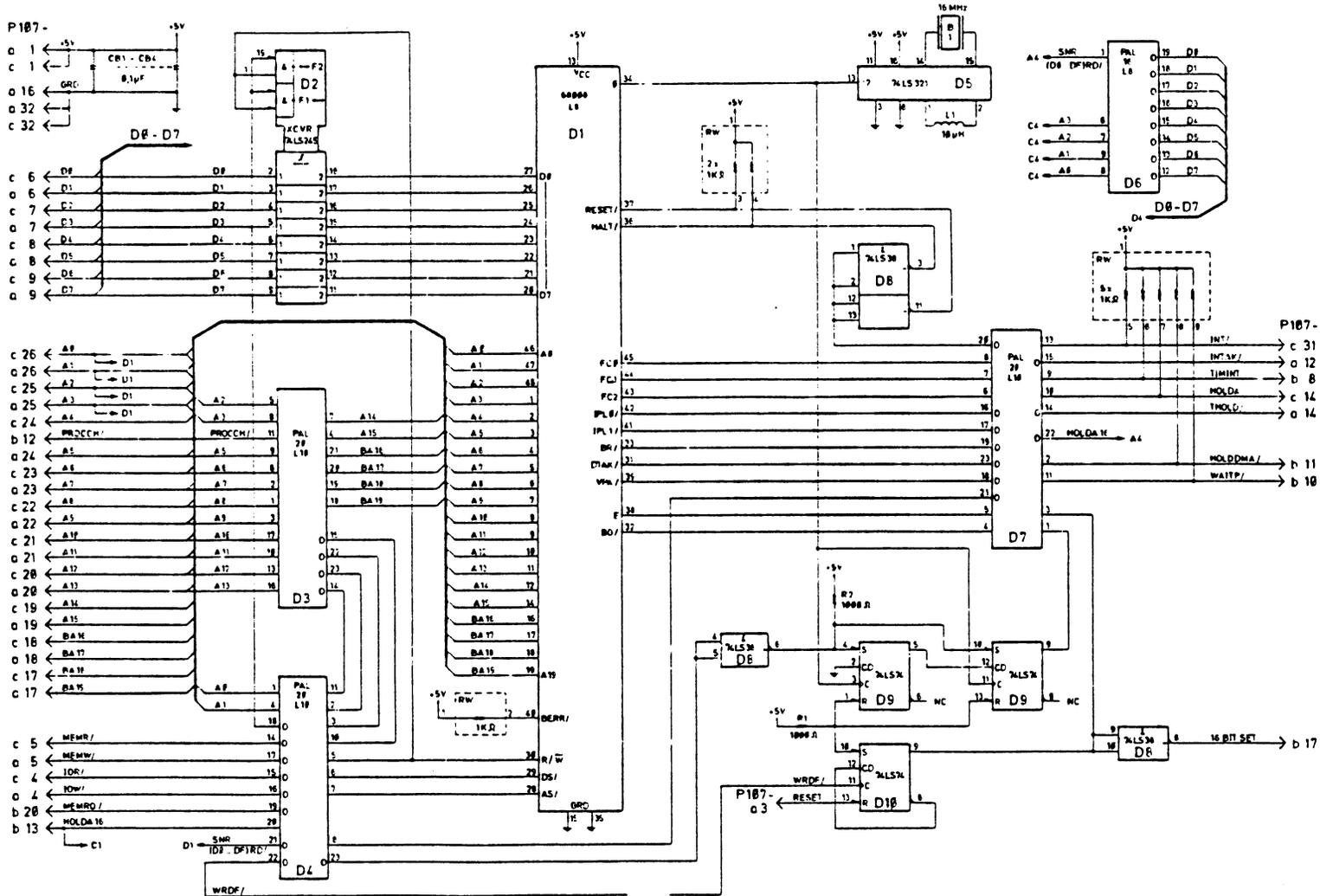


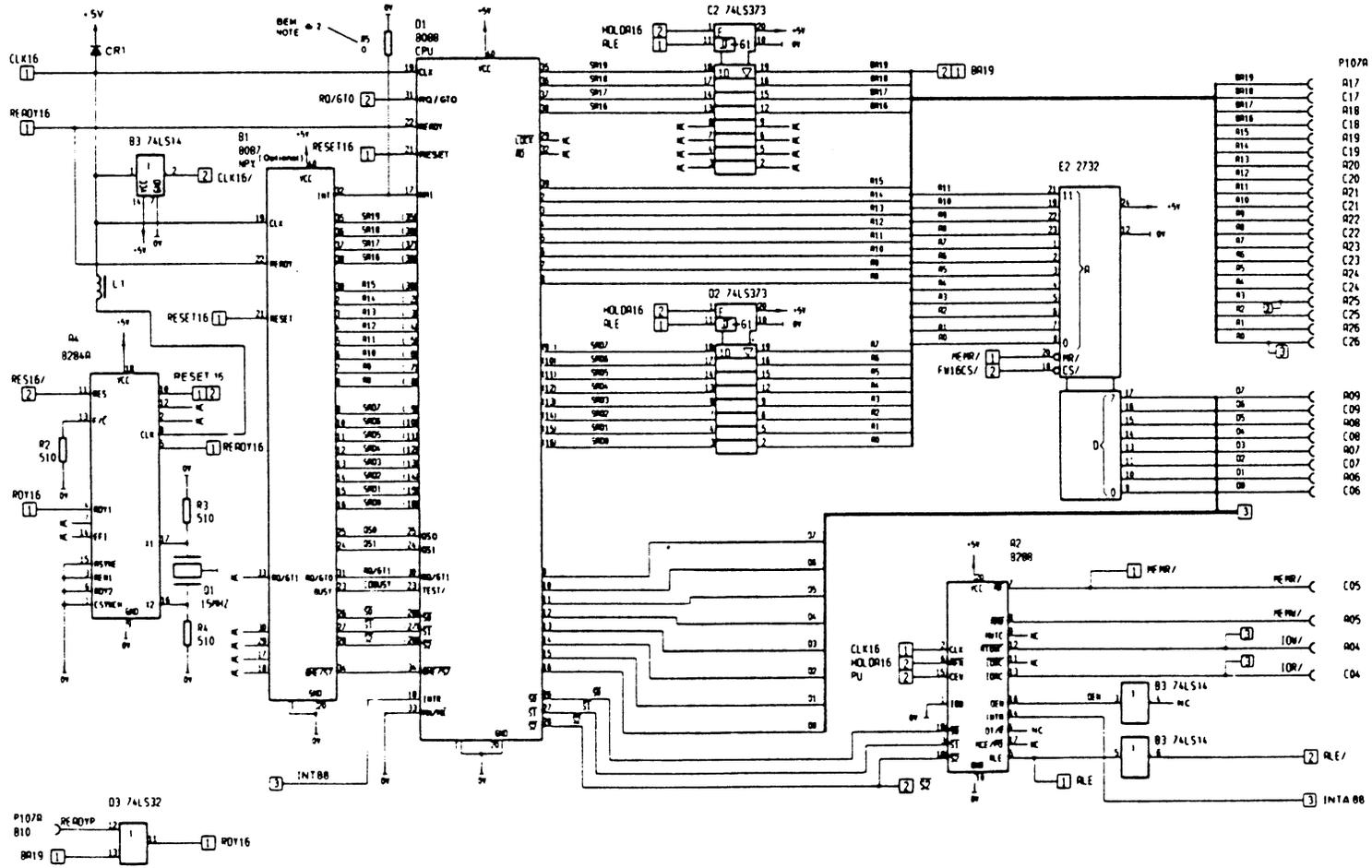
DLC Inhouse Interface (K223) 017-0033972 Rev. C

External 16-bit Processor (K231) 017-0032548 Rev. A

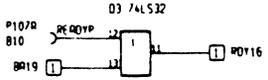






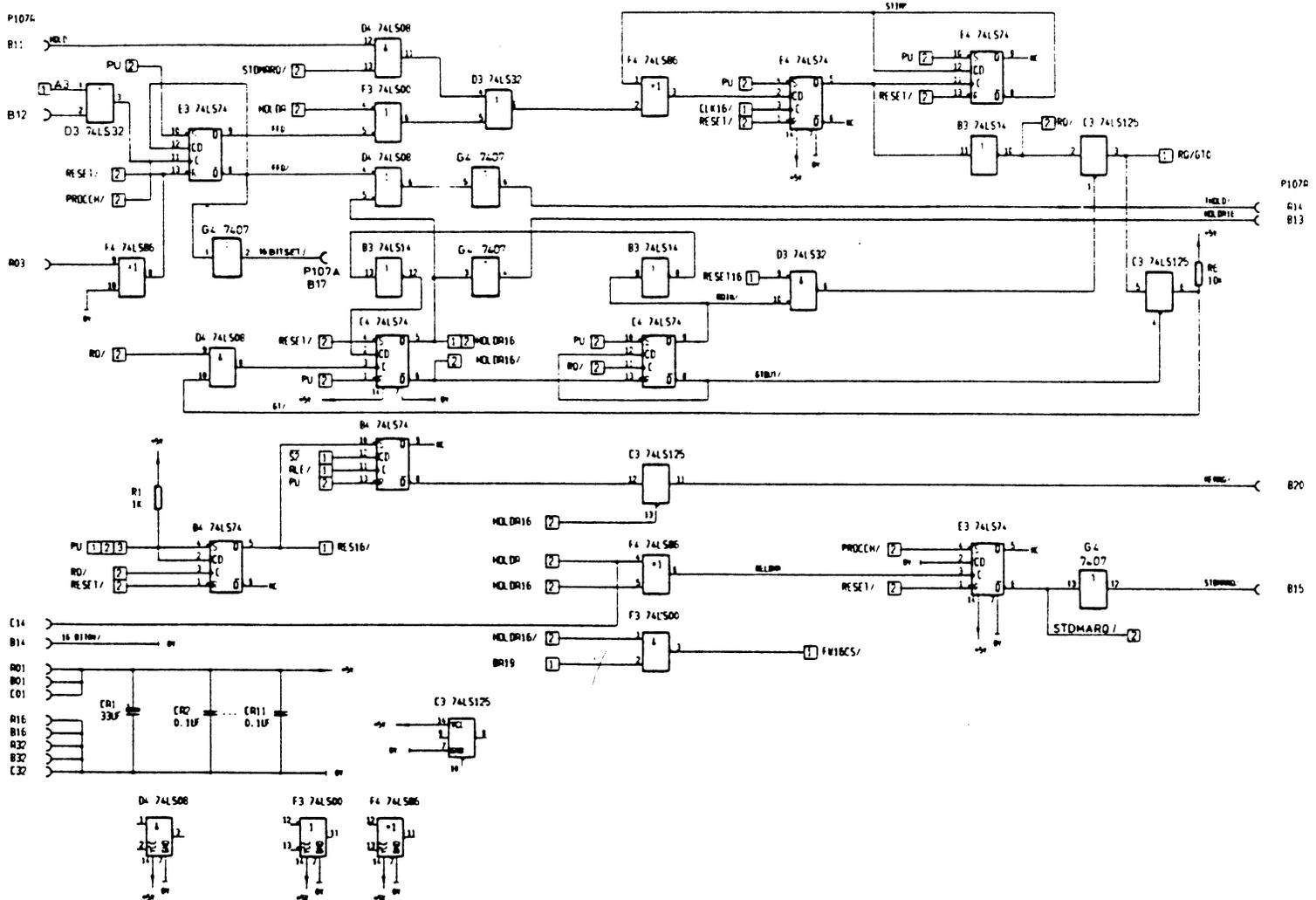


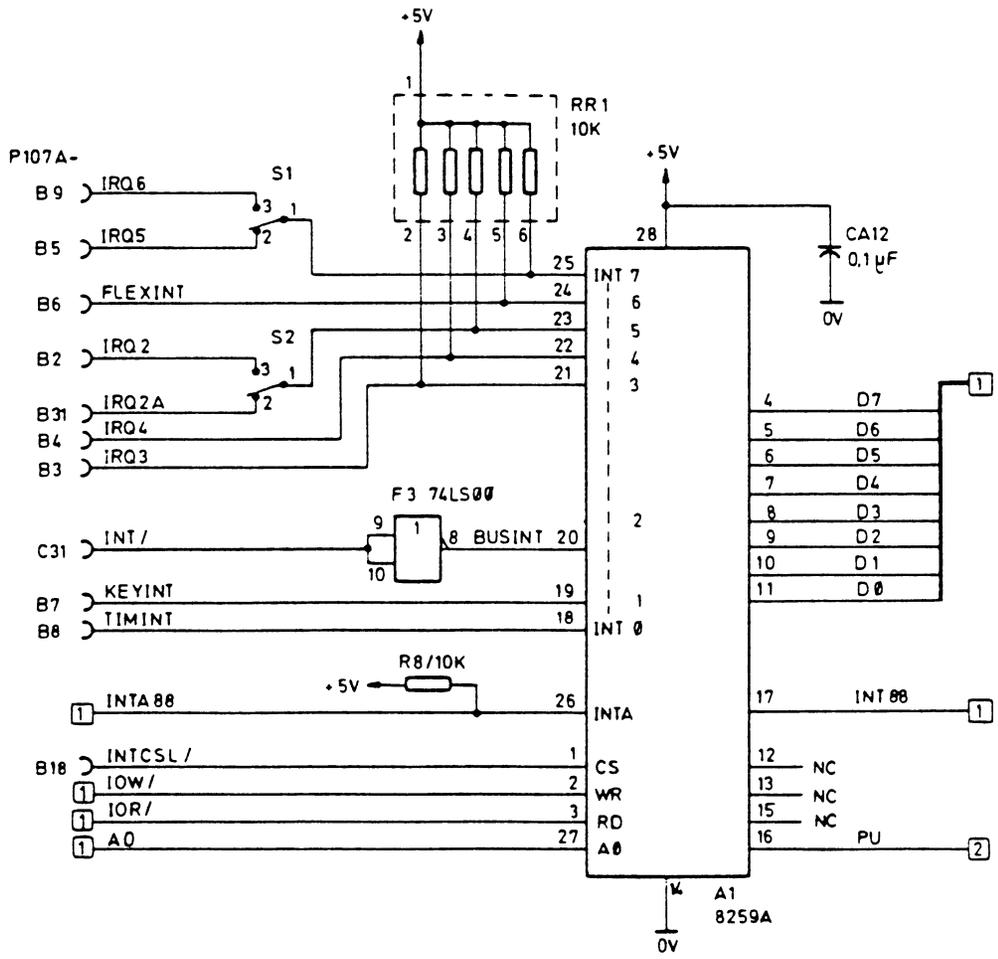
16-bit Processor with PIC (K235) 017-0033502 Rev. A  
1 of 3



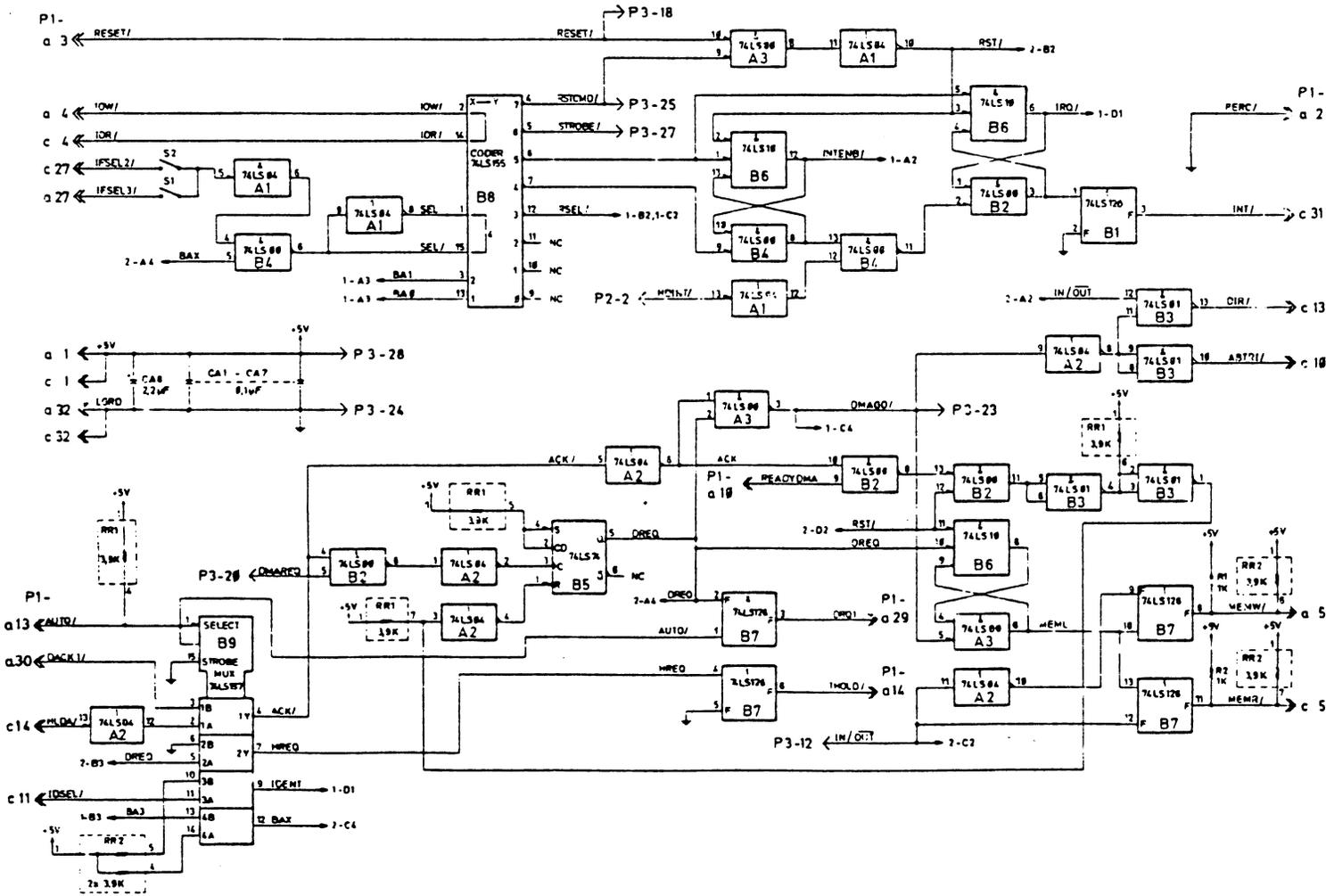
- ◆ 3 ALLE WIDERSTANDSWERTE SIND IN OHM  
ALL RESISTANCE VALUES ARE IN OHM
- ◆ 2 R5 ENTFALLT WENN IC: B1 (A087) BESTÜCKT IST  
DELETE R5 IF IC: B1 (A087) IS MOUNTED

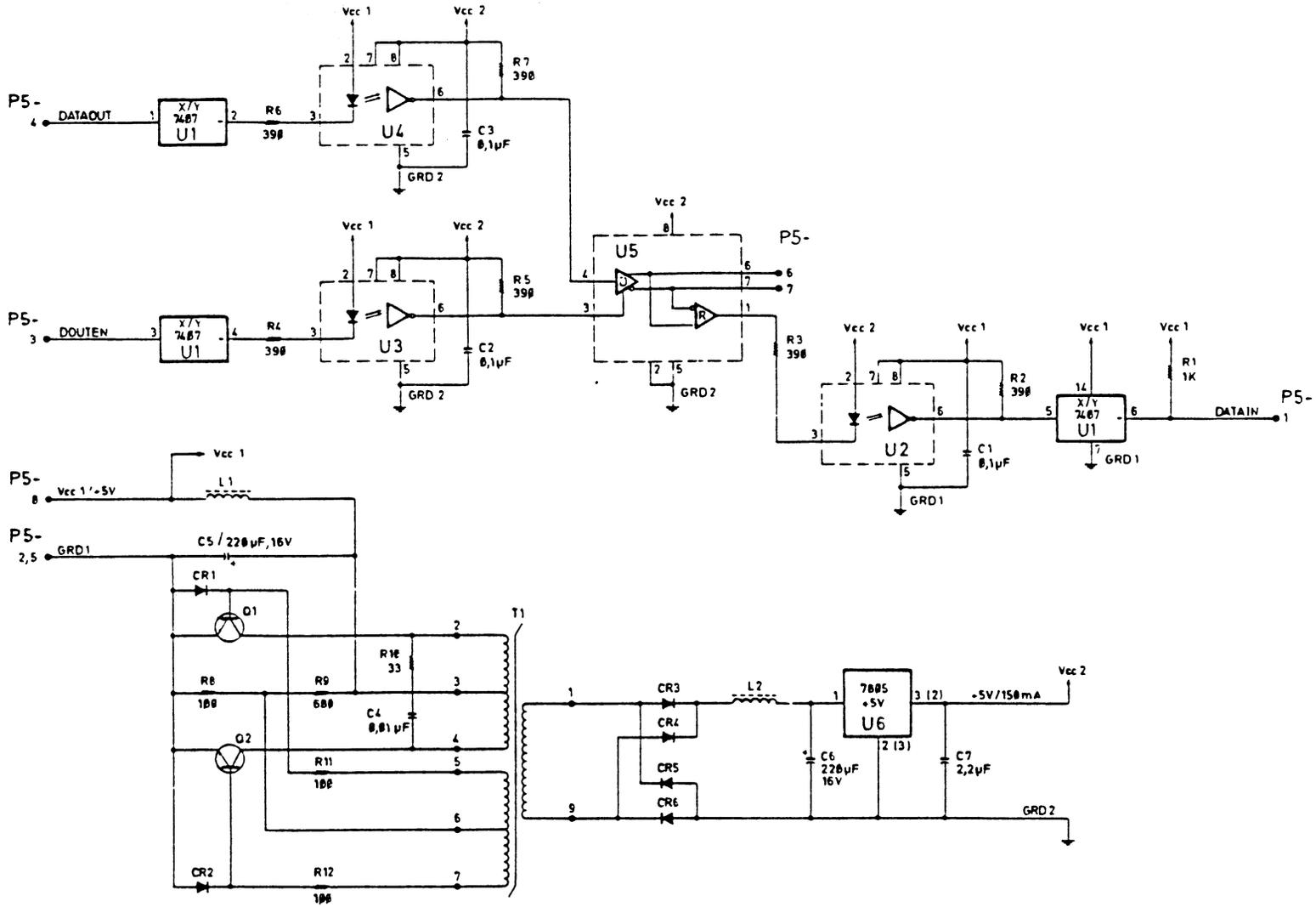
BEM / NOTE ◆ 1 ASSY 017-0033502 A

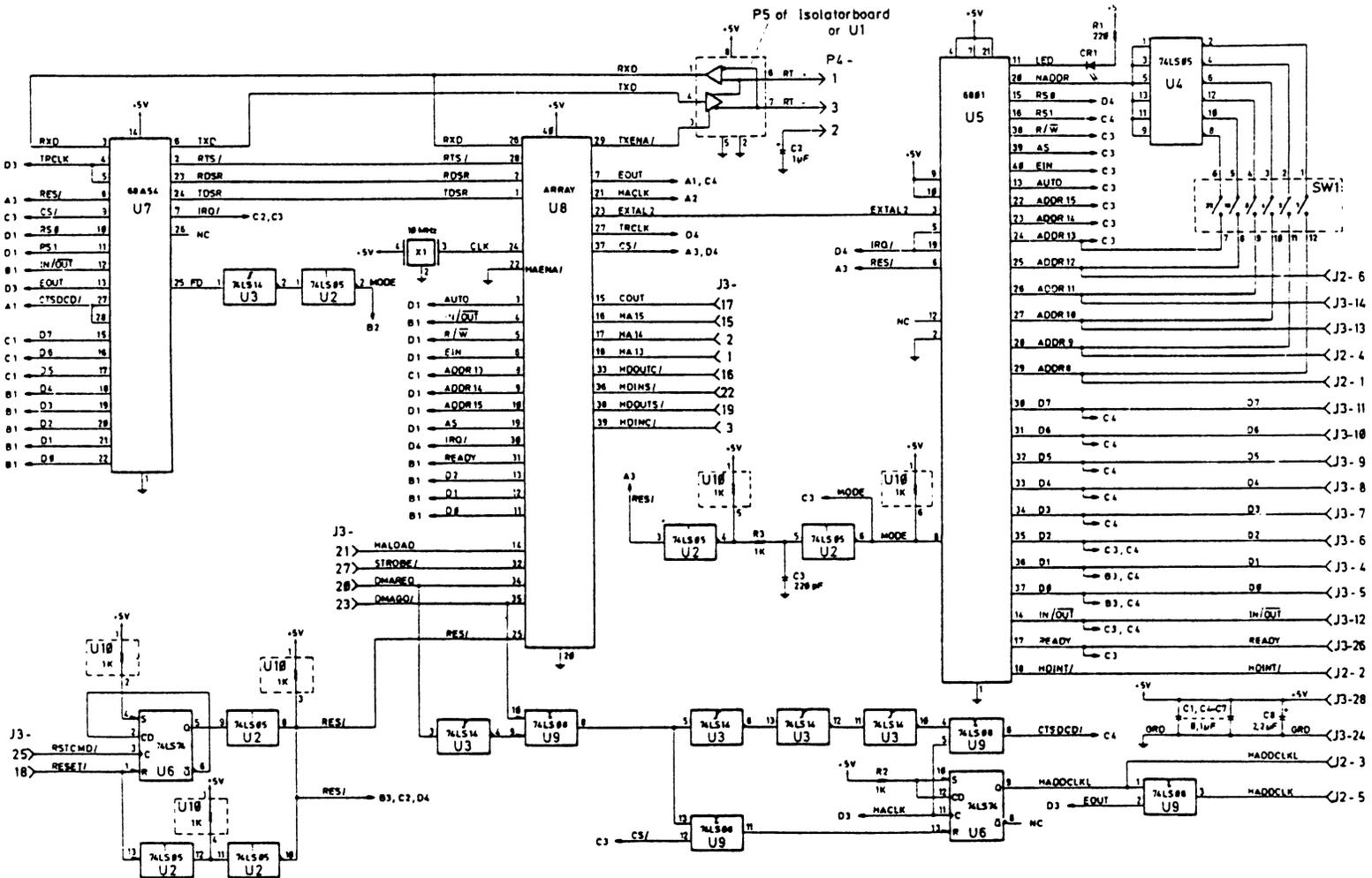






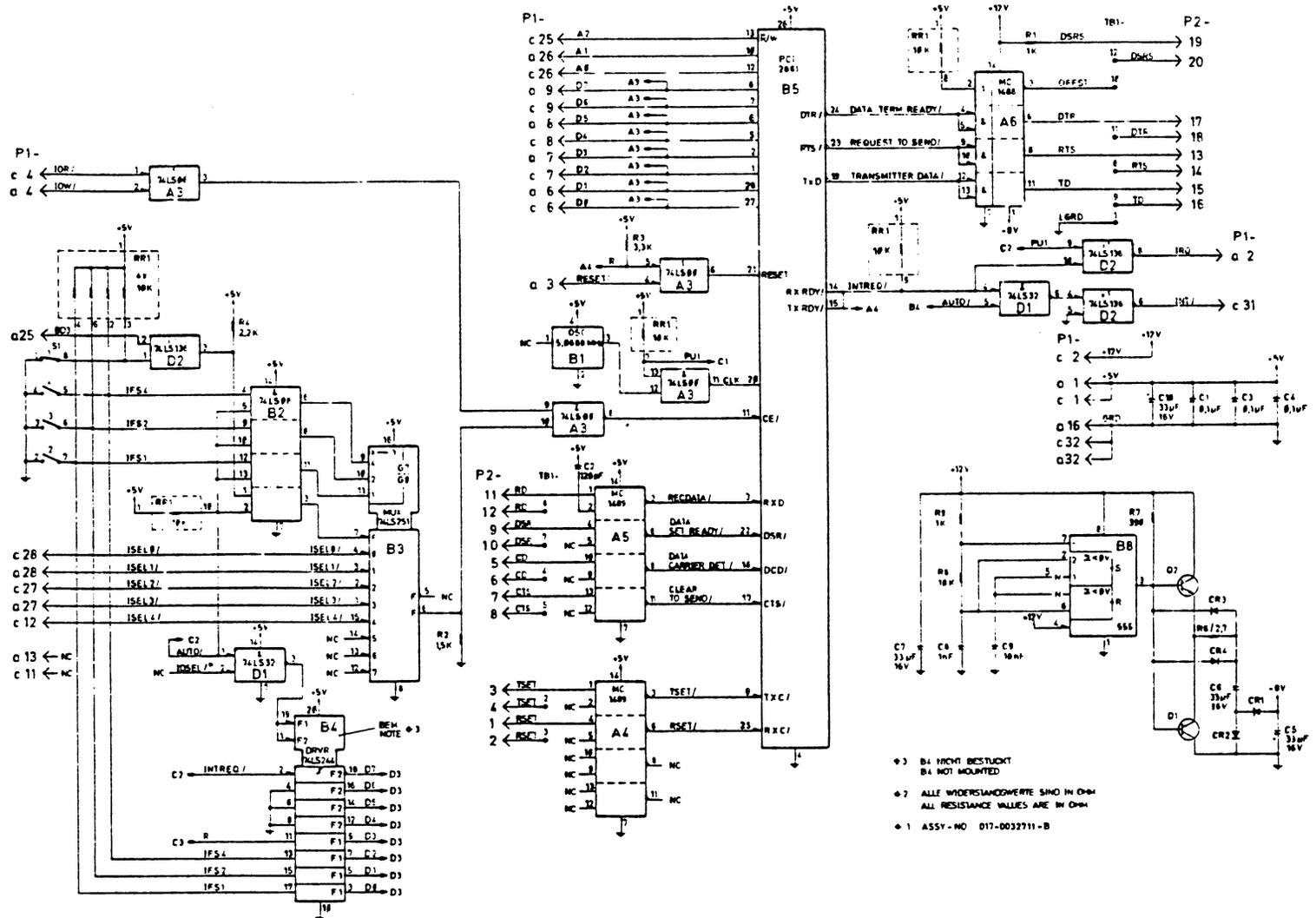






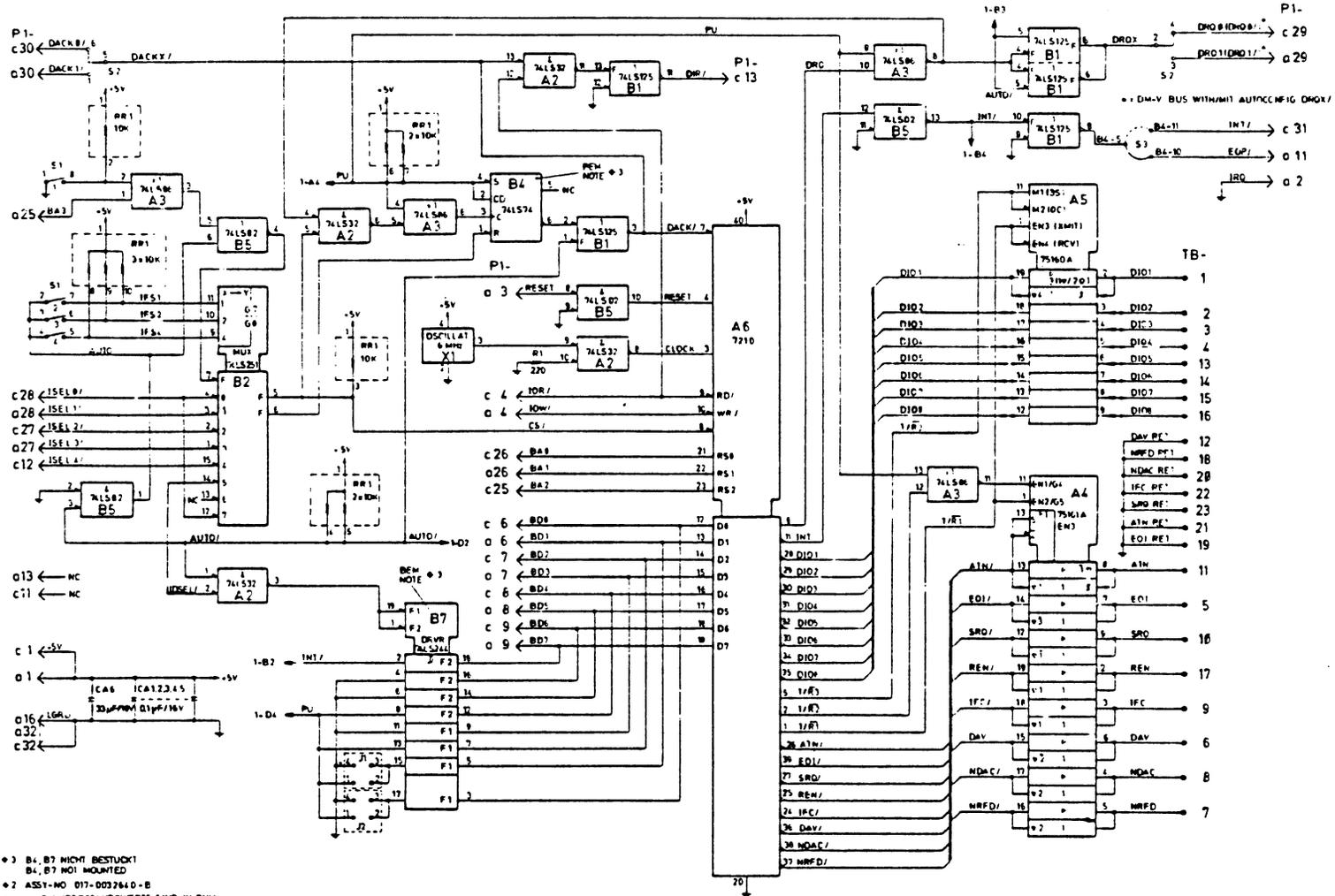
Omninet Controller (K600) 017-0032434 Rev. B

RS-232 C Switchable Interface (K801) 017-0032712 Rev. B

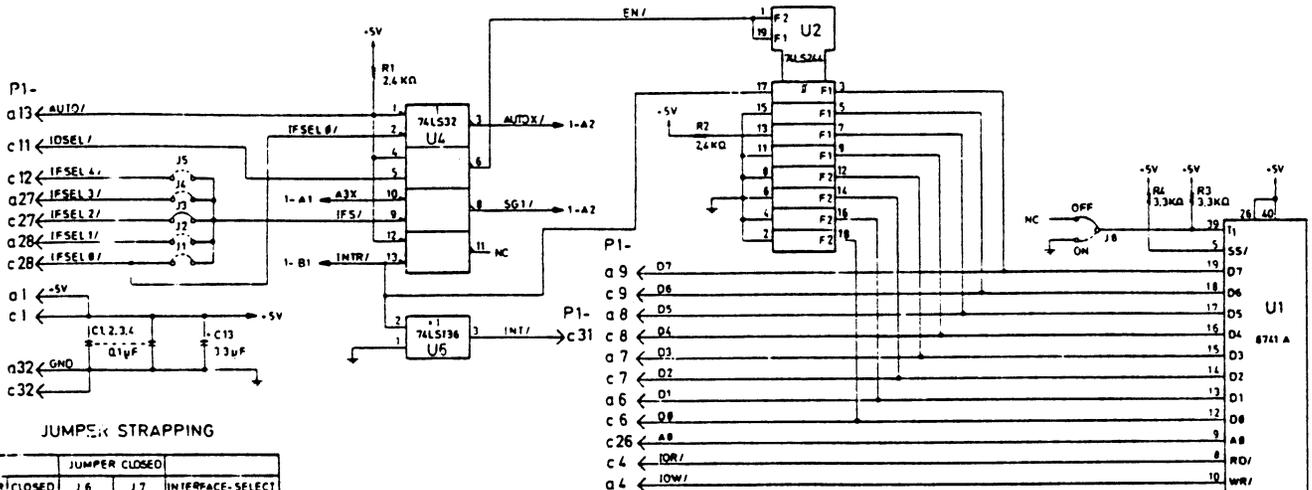




IEEE-488 Interface (K804) 017-0032641 Rev. B



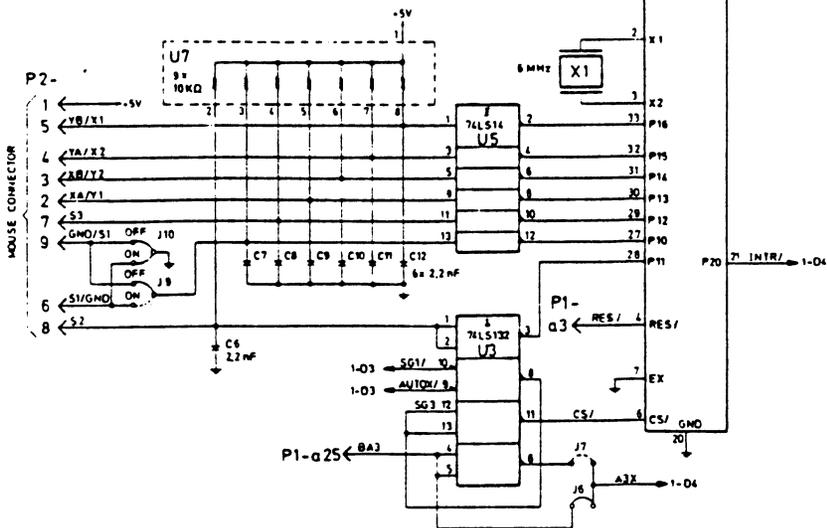
\* 3 B4, B7 NOT MOUNTED  
 B4, B7 NOT MOUNTED  
 \* 2 ASSY-NO. 017-0032640-B  
 \* 1 ALLE WIDERSTANDSWERTE SIND IN OHM  
 ALL RESISTANCE VALUES ARE IN OHM



JUMPER STRAPPING

| JUMPER CLOSED |     |     |                  |
|---------------|-----|-----|------------------|
| JUMPER CLOSED | J 6 | J 7 | INTERFACE-SELECT |
| J 1           | X   | X   | IFSEL 0 a/       |
| J 1           | X   | X   | IFSEL 0 b/       |
| J 2           | X   | X   | IFSEL 1 a/       |
| J 2           | X   | X   | IFSEL 1 b/       |
| J 3           | X   | X   | IFSEL 2 a/       |
| J 3           | X   | X   | IFSEL 2 b/       |
| J 4           | X   | X   | IFSEL 3 a/       |
| J 4           | X   | X   | IFSEL 3 b/       |
| J 5           | X   | X   | IFSEL 4 a/       |
| J 5           | X   | X   | IFSEL 4 b/       |

| SWITCHES        | SELECTED MOUSE          |
|-----------------|-------------------------|
| J8, J9, J10 OFF | HAWLEY MOUSE ALPS MOUSE |
| J8, J9, J10 ON  | DEPRAZ MOUSE            |



Mouse Interface (K806) 017-0032824 Rev. B

NCR 3282 Fixed Disk Interface 017-0027022 Rev. D

