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.

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

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

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

DIMENSIONS

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

CABLES

	Power	Interconnection
3273	3.5 m (11.5 ft.)	2.0 m (Adapters) (6.6 ft.)
Keyboard		0.5 m (Extendable) (1.6 ft.)
3282	3.5 m (11.5 ft.)	2.0 m (3282 to 3273) (6.6 ft.) 0.5 m (3282 to 3282)

VOLTAGE AND FREQUENCY

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

POWER

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

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.

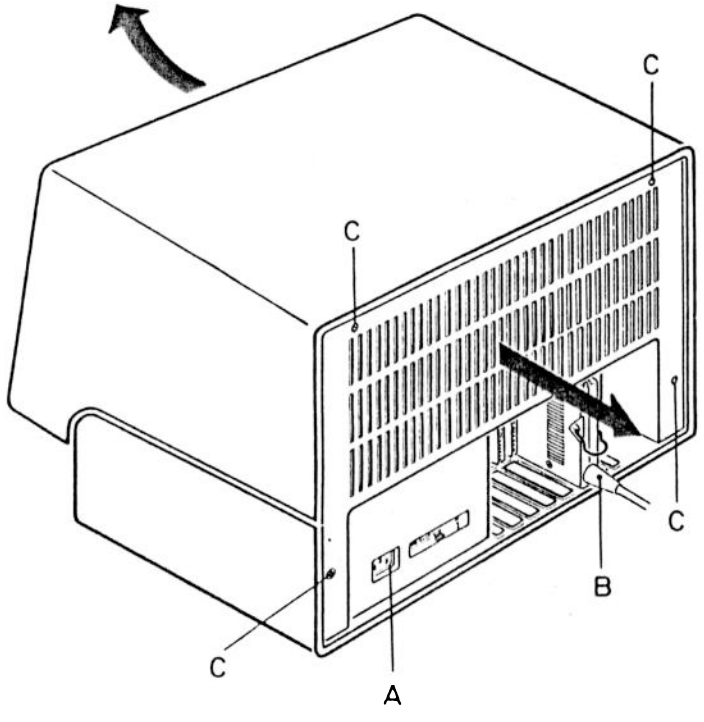


Figure 2.1 Cabinet removal

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.

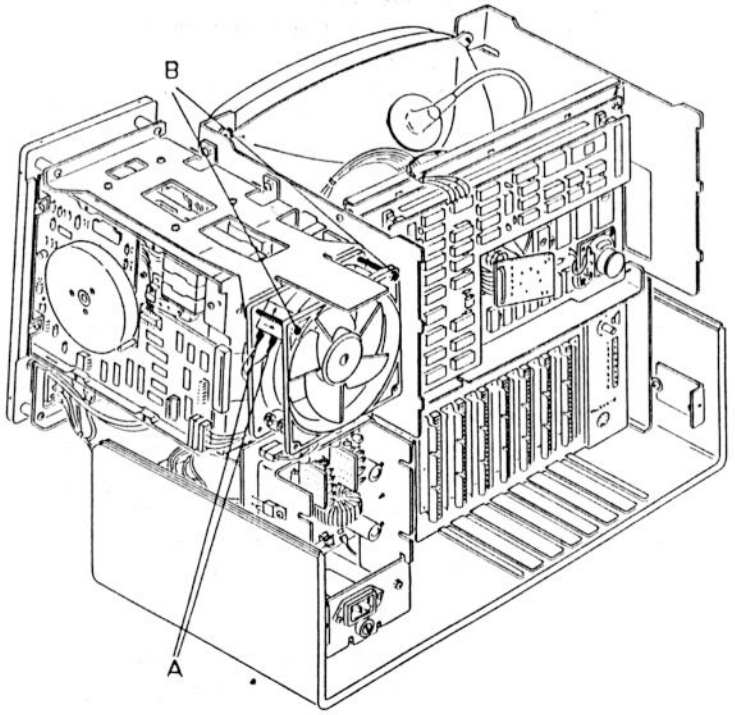


Figure 2.2 Fan removal

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:

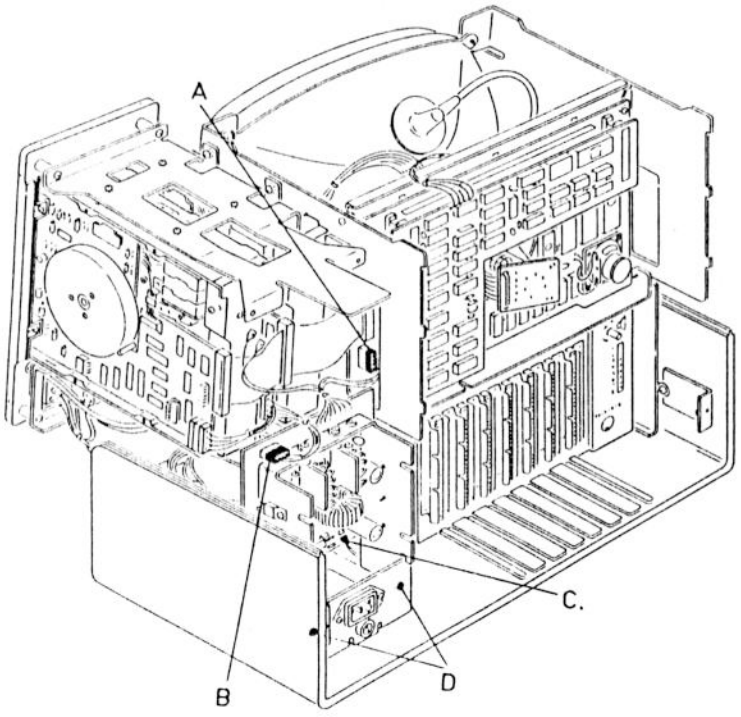


Figure 2.3 Regulator board (separate) removal

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

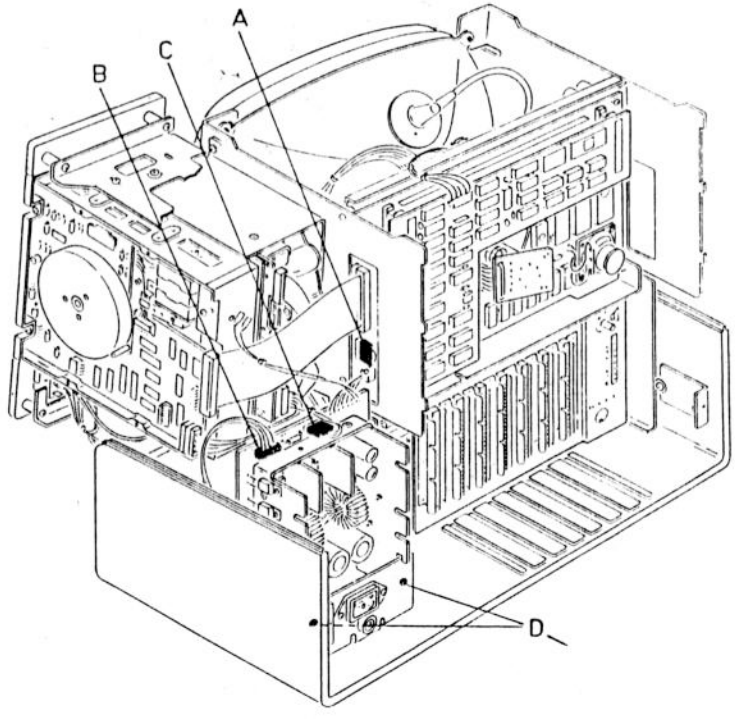


Figure 2.4 Regulator/rectifier board removal

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.

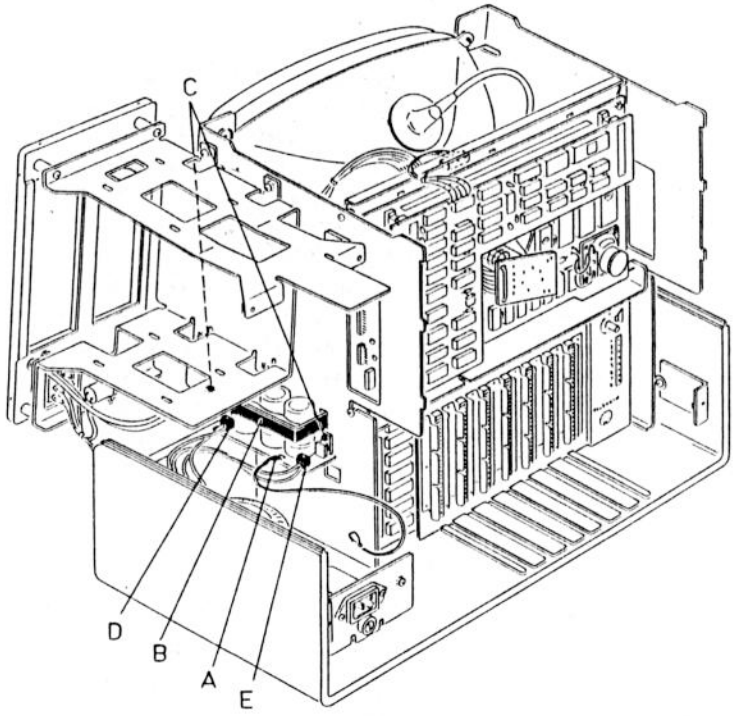


Figure 2.5 Rectifier board removal

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).

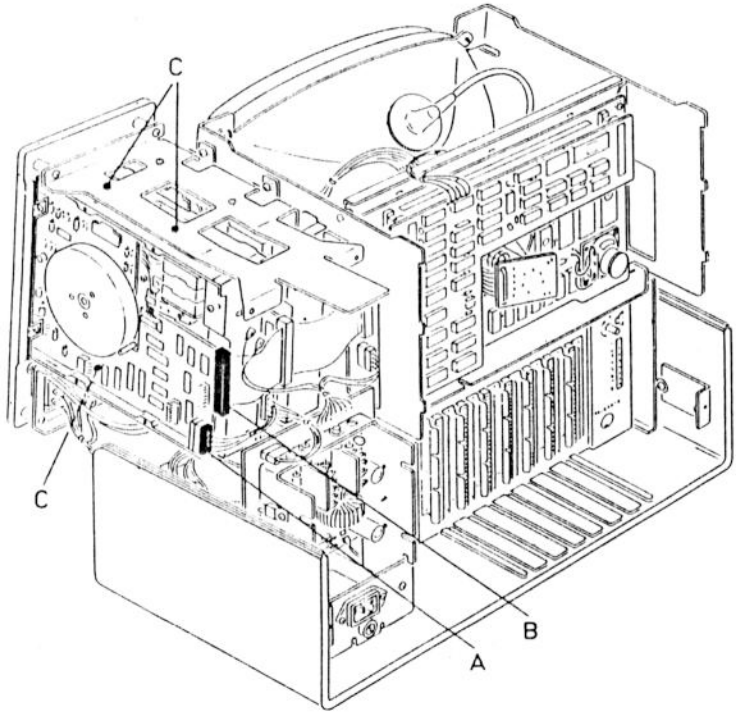


Figure 2.6 Disconnect flexible disk drive

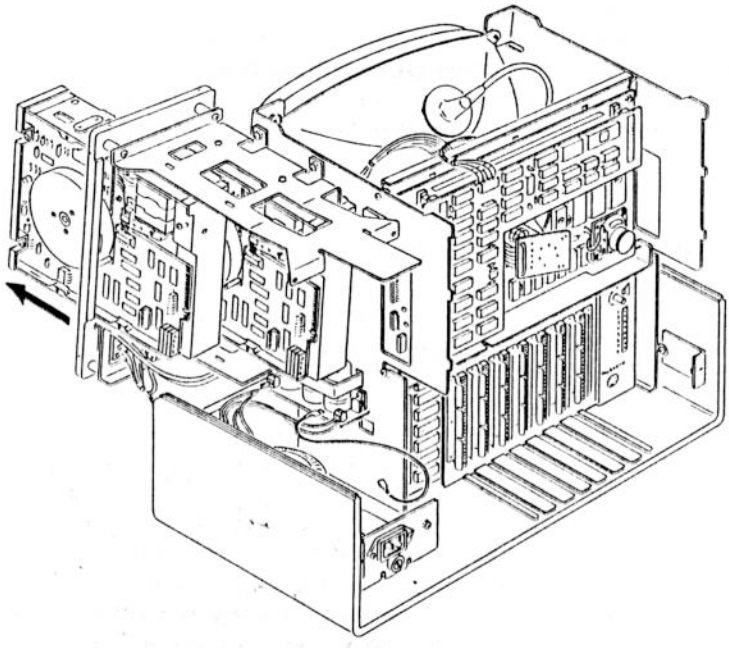


Figure 2.7 Flexible disk drive removal

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:

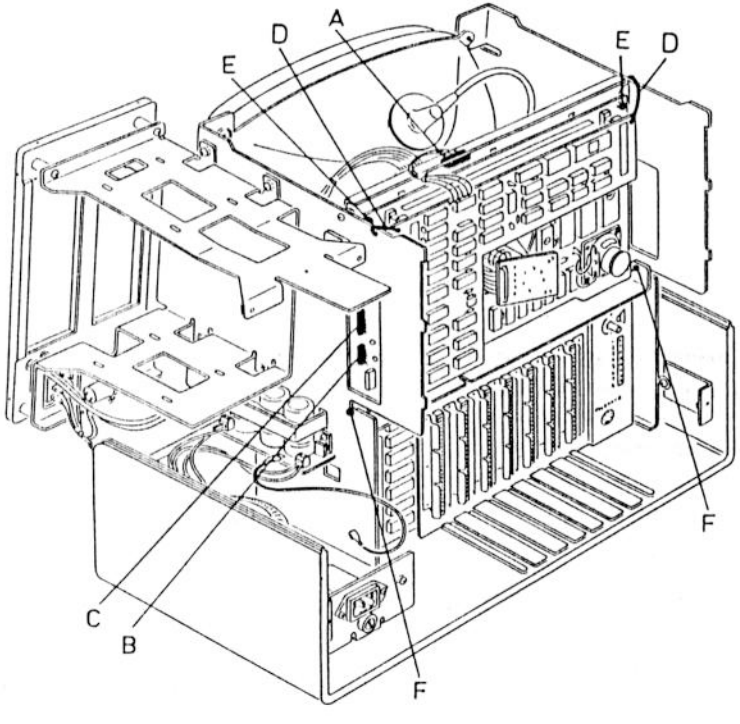


Figure 2.8 Controller module removal

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.

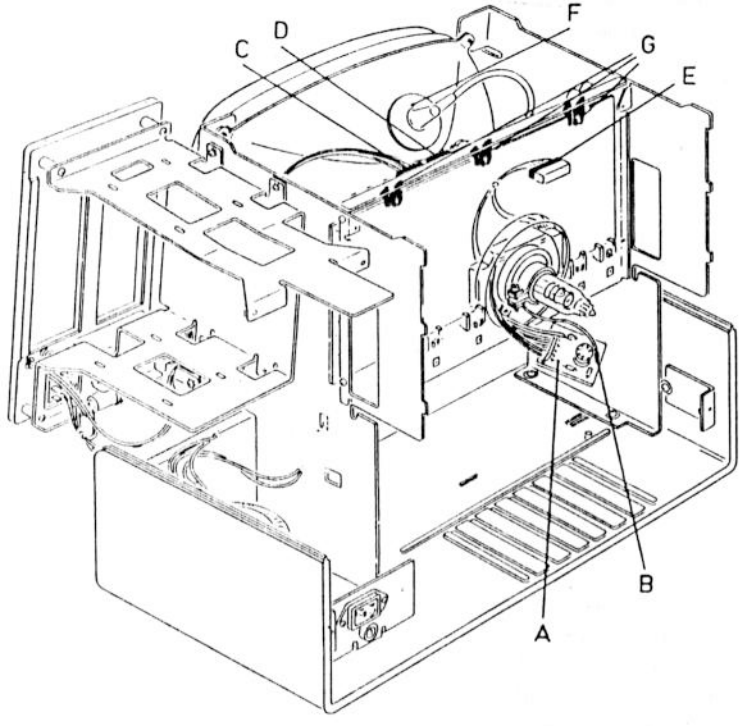


Figure 2.9 CRT deflection board removal

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).

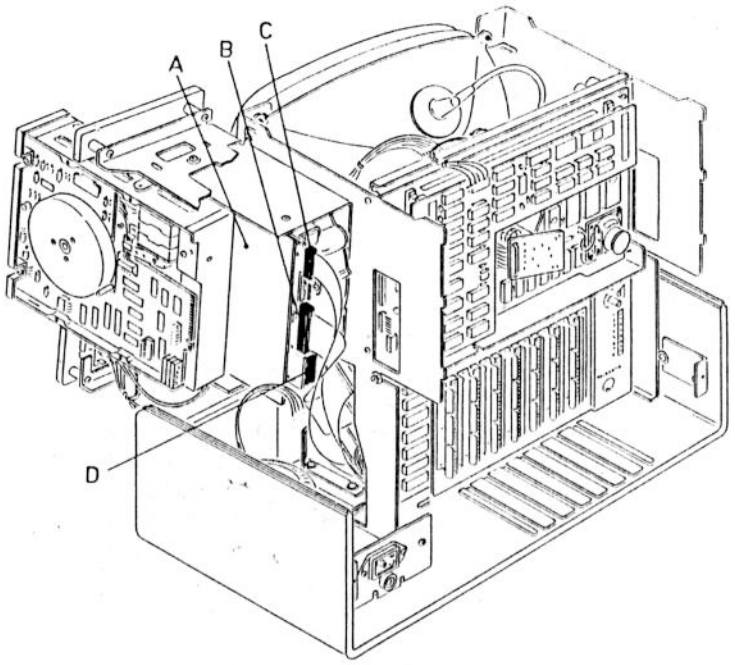


Figure 2.10 Disconnecting fixed disk

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.

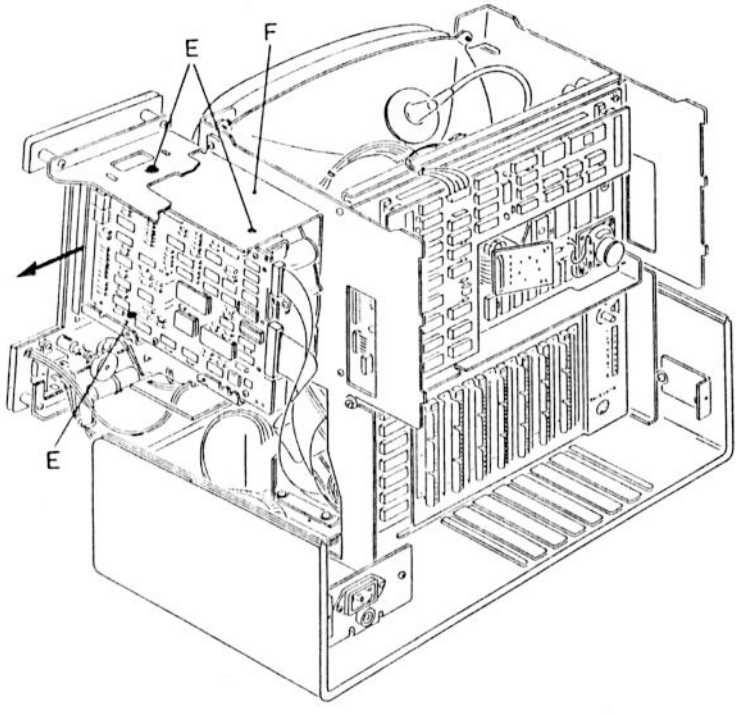


Figure 2.11 Fixed disk removal

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.

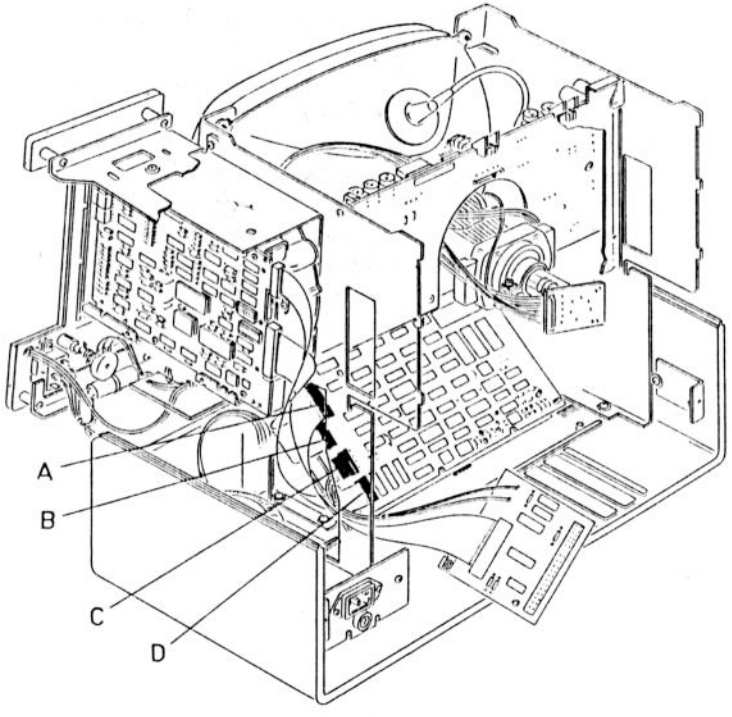


Figure 2.12 Disconnecting fixed disk controller

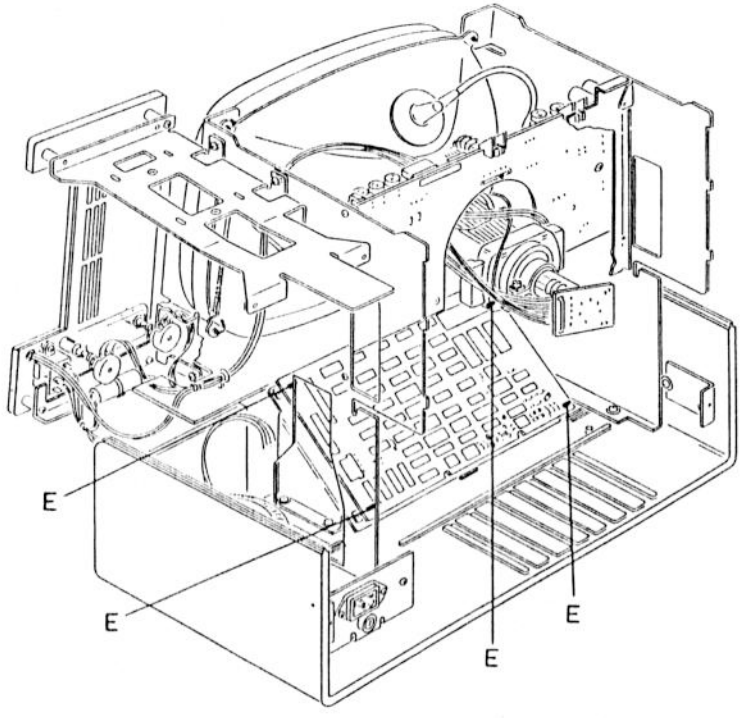


Figure 2.13 Fixed disk controller removal

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.

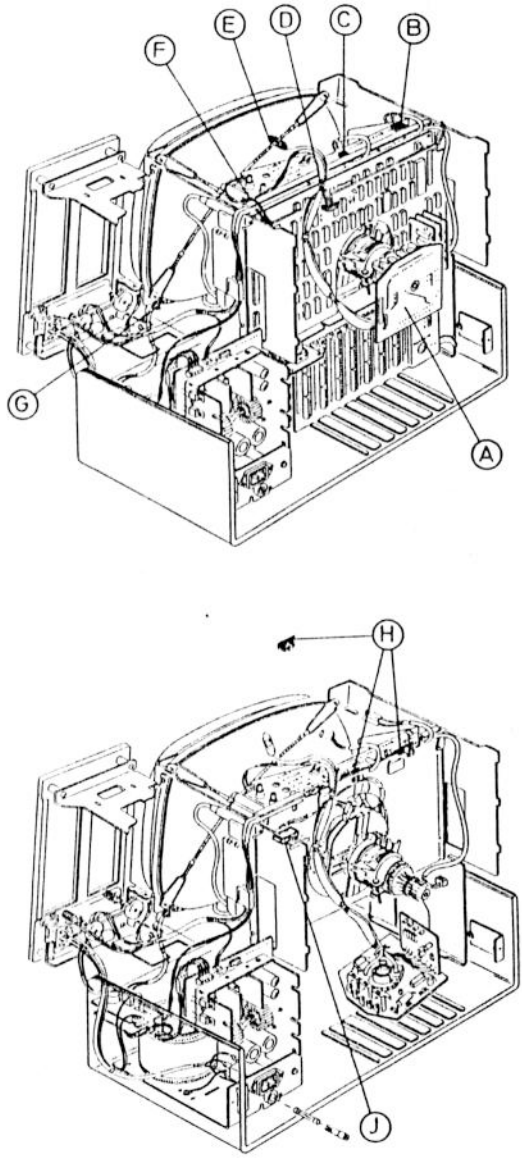


Figure 2.14 Color Deflection Board Removal

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.

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.

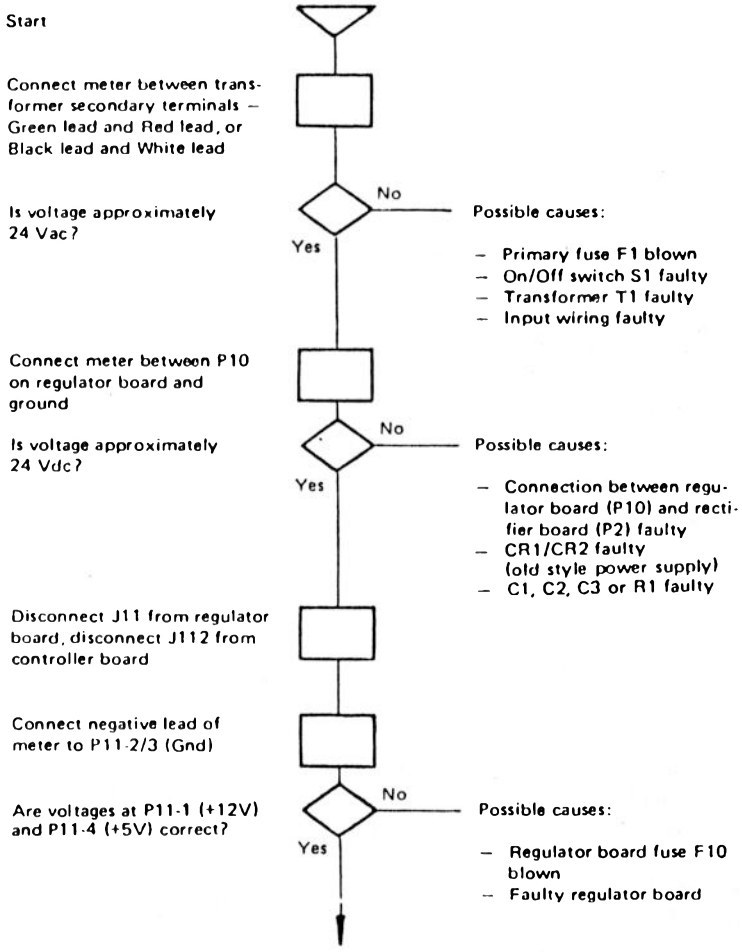


Figure 3.1 Power problem flowchart (1 of 2)

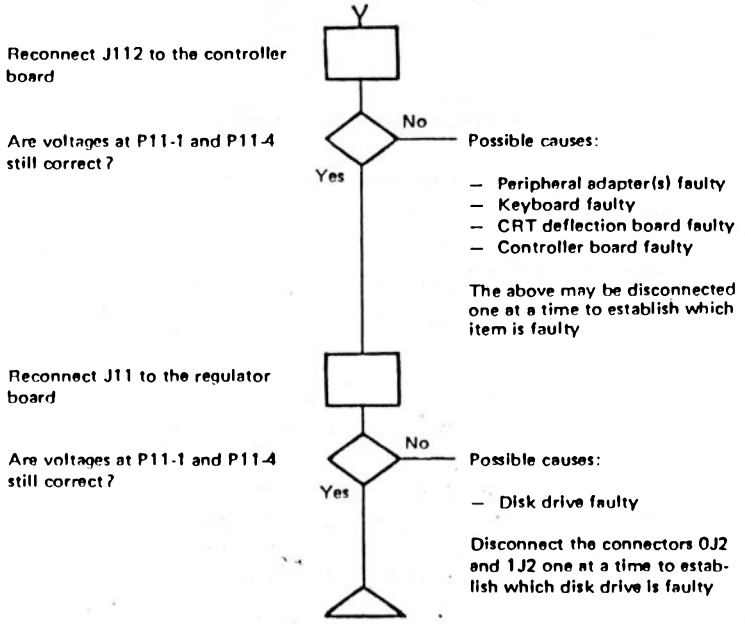


Figure 3.1 Power problem flowchart (2 of 2)

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 T/N 255	Suspected Components From 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.

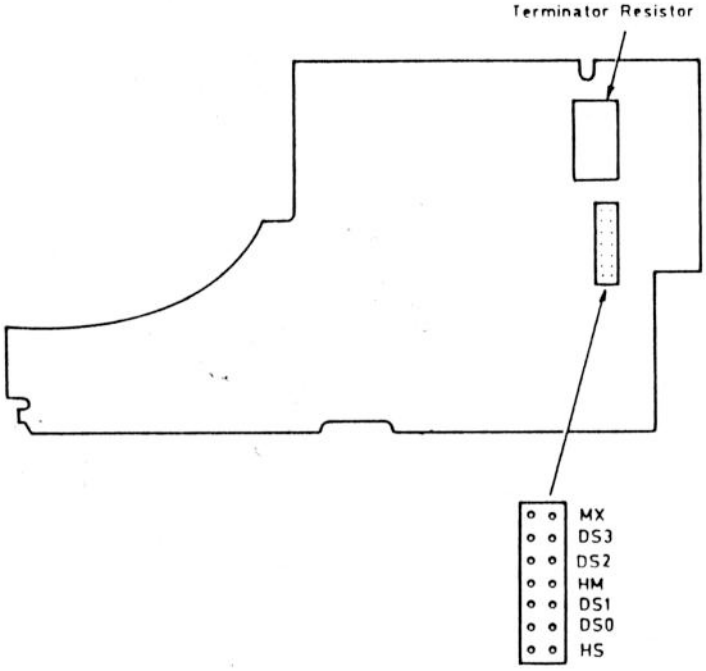


Figure 3.3 Strapping locations

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 (±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.

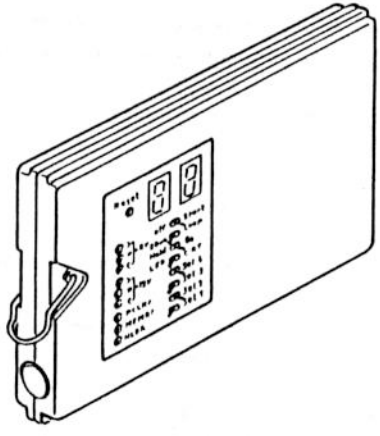


Figure 4.1 Diagnostic module

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 4 3 2 1	Test Name	Mode LED	Mode 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 ±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

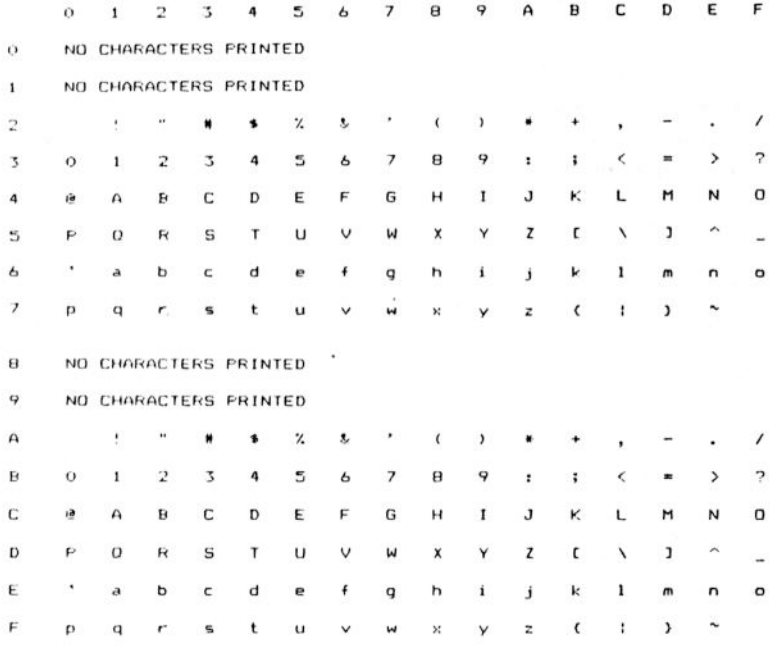


Figure 4.4 Printer test pattern

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 avialable 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 (GDC Graphic Display Controller)
12		GDC RAM bank # 0 error
13		# 1 error
14		# 2 error
15		# 3 error
16		GDC Color plane # 0
17		GDC Color plane # 1
18		GDC Color plane # 2
21	KEYBOARD CONTROLLER ERROR	
31	MEMORY DATA ERROR ADDRESS EXP. OBS. iiii xx xx	iiii = RAM Address from 0 to FFFFH xx = Data
32	MEMORY ADDRESS ERROR EXP. ADDRESS OBS. ADDRESS iiii iiii	
41	DMA CONTROLLER ERROR	DMA controller error
41	DMA CONTROLLER ERROR ON CHANNEL n EXP. OBS. xx xx	DMA controller error n = 0 to 3 xx = Data
51	FLEX DISK CONTROLLER ERROR	
71	MEMORY DATA ERROR ADDRESS EXP. OBS. iiii xx xx	iiii = RAM address from 0to FFFH
72	MEMORY ADDRESS ERROR EXP. ADDRESS OBS. ADDRESS iiii iiii	
73	BANK SWITCHING ERROR EXP. OBS. xx xx	
81	KEYBOARD NOT CONNECTED	This message may also be shown in case of a keyboard controller failure.
82	KEYBOARD PROCESSOR ERROR	

Figure 4.5 LED and CRT messages (1 of 3)

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

Figure 4.5 LED and CRT messages (2 of 3)

LED Code	CRT Message	Explanation
⊆1	WINCHESTER DISK CONTROLLER ERROR EXP. OBS. xx xx	
⊆2	RECALIBRATE ERROR STATUS ERROR xx xx	The special character displayed as first digit on Diagnostic Module stands for Test No. D
⊆3	FORMAT ERROR STATUS ERROR xx xx	
⊆4	WRITE ERROR STATUS ERROR xx xx	
⊆5	READ ERROR STATUS ERROR xx xx	
⊆6	READ DATA COMPARE ERROR EXP. OBS. 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 D7	D6	D5	D4	Hex Code	Data Lines 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

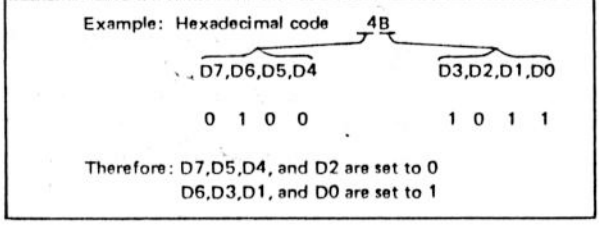


Figure 4.6 Data line codes

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 D7 = 1	INTERRUPT CODE – Abnormal termination because during Command execution the ready signal from the FDD changed state.
D6 = 0 D7 = 1	INTERRUPT CODE – Invalid Command issue, (IC). Command which was issued was never started.
D6 = 1 D7 = 0	INTERRUPT CODE – Abnormal termination of Command (AT). Execution of Command was started, but was not successfully completed.
D6 = 0 D7 = 0	INTERRUPT CODE – Normal termination of Command, (NT). Command was completed and properly executed.

Figure 4.7 Status register 0

D0 = 1	MISSING ADDRESS MARK – If the FDC cannot detect the ID Address Mark after encountering the index hole twice, then this flag is set. D0 Missing Address Mark – 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.
D1 = 1	NOT WRITABLE – 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.
D2 = 1	NO DATA – 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. No Data – During execution of READ ID Command, if the FDC cannot read the ID field without an error, the this flag is set. No Data – During execution of READ A Cylinder Command, if the starting sector cannot be found, then this flag is set.
D3 = 0	Not used – This bit is always 0 (low).
D4 = 1	OVER RUN – If the FDC is not serviced by the main systems during data transfers, within a certain time interval, this flag is set.
D5 = 1	DATA ERROR – When the FDC detects a CRC error in either the ID field or the data field, this flag is set.
D6 = 0	Not used – This bit is always 0 (low).
D7 = 1	END OF CYLINDER – When the FDC tries to access a Sector beyond the final Sector of a Cylinder, this flag is set.

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 Adress 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).

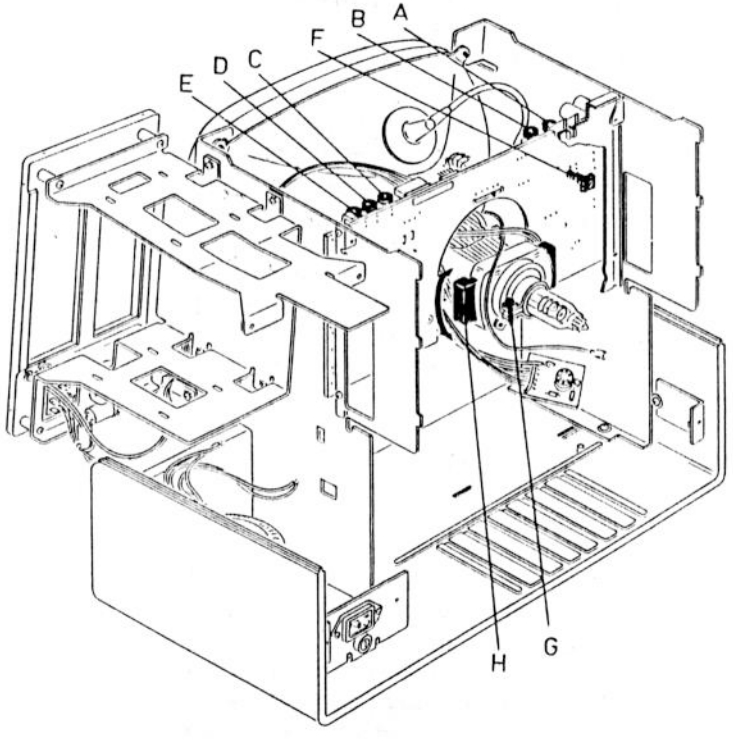
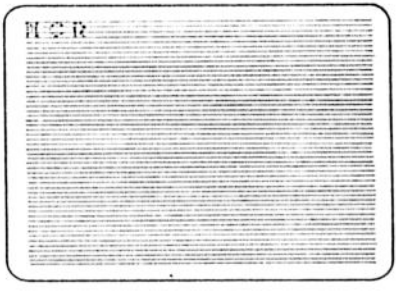


Figure 5.1 Monochrome CRT adjustment points

WARNING

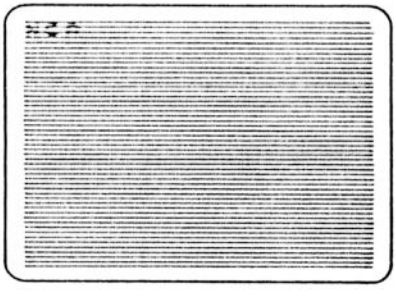
Very high voltages are present when the unit is operating. Although these voltages carry very low current, extreme care should be used when performing adjustments while the unit is operating. All adjustments should be made with plastic adjusting tools. Before removing the CRT High Tension lead, the tube 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



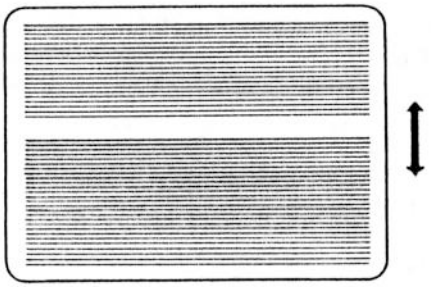
Adjust focus trimmer (A).

DISPLAY TOO DIM



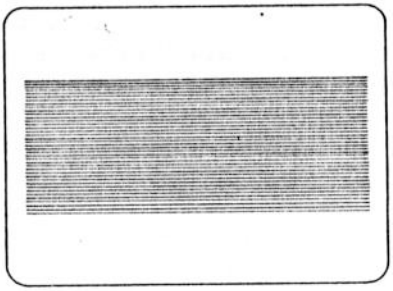
Adjust brightness preset trimmer (B). (Overadjusting this trimmer causes the display to change size when the Brightness control is turned.)

DISPLAY ROLLS



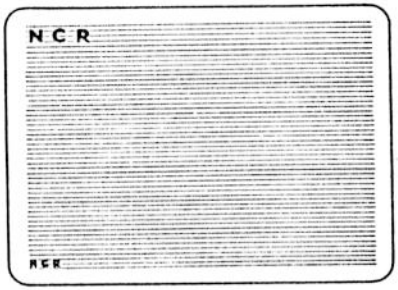
Adjust sync trimmer (C). (Turn trimmer until display stops rolling, turn trimmer in the opposite direction until display just starts to roll in the opposite direction, set the trimmer to the mid-point of these two positions.)

DISPLAY TOO SHORT/LONG



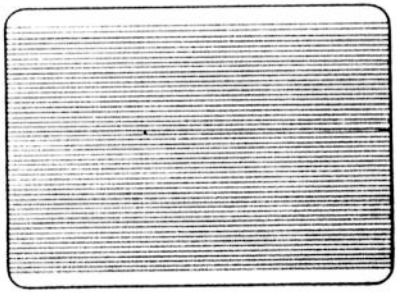
Adjust height trimmer (D), see Character Field Size.

DISPLAY NOT LINEAR



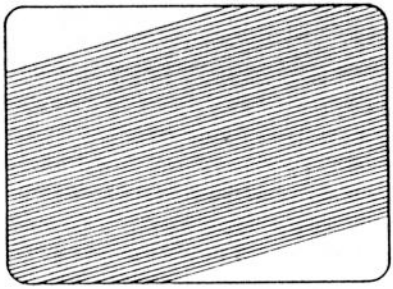
Adjust linearity trimmer (E).

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

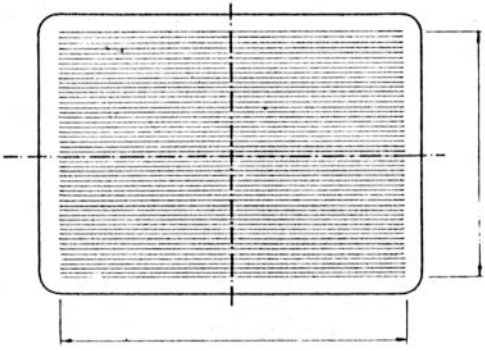


Figure 5.2 Character field size

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 216mm±2mm (8.5in.±0.08in.).

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 (5.5in.).
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 135mm ± 2mm (5.3in. ± 0.08 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 μA.
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.

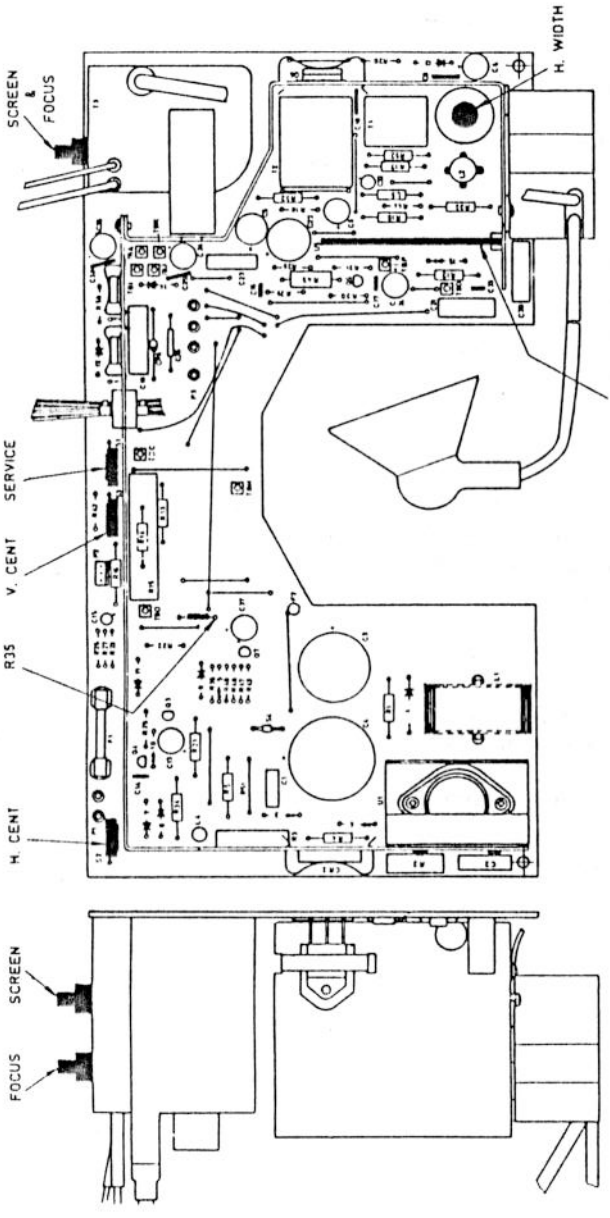


Figure 5.3 Color CRT deflection board

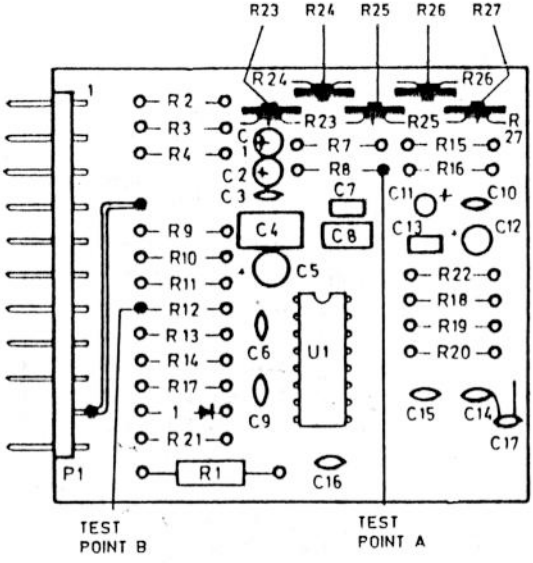


Figure 5.4 Color CRT HV oscillator board

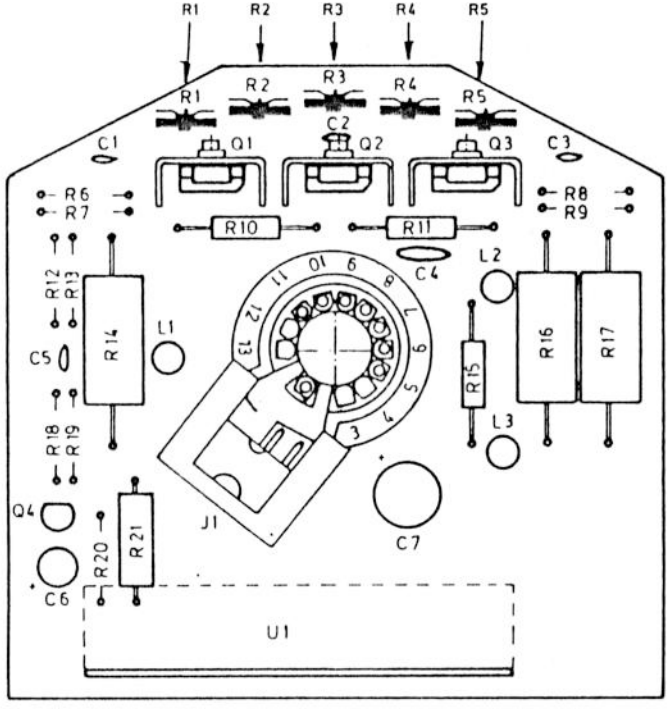


Figure 5.5 Color CRT video amplifier board

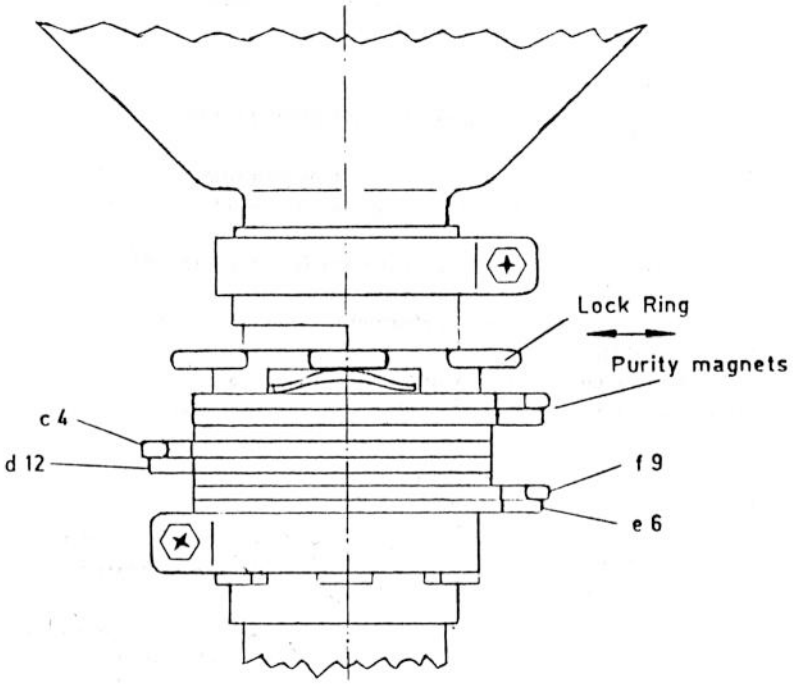


Figure 5.6 Color CRT convergence magnets

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
1. ROTATIONAL SPEED
2. INDEX HEADER TIMING
3. LINEARITY
4. HYSTERESIS
5. AZIMUTH ROTATION
6. ECCENTRICITY TEST (7.0/3.0 mils OFFSET)
7. ECCENTRICITY TEST (8.0/3.5 mils OFFSET)
8. ECCENTRICITY TEST (9.0/4.0 mils OFFSET)
9. HEAD ALIGNMENT
A. TRACK SEEK

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 (±0.2 ms) is displayed together with the expected time (200.0 ms ± 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 ±21' (minutes) in sectors 1 and 2, to ±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 ±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 ± 0.15 mm (0.01 in.±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.

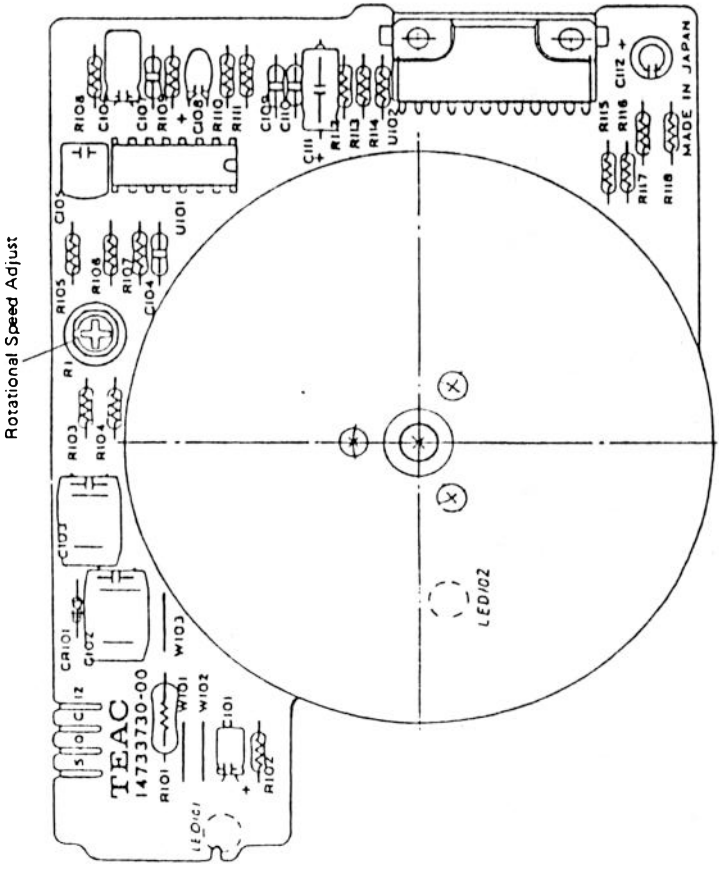


Figure 5.7 PCBA DC motor servo

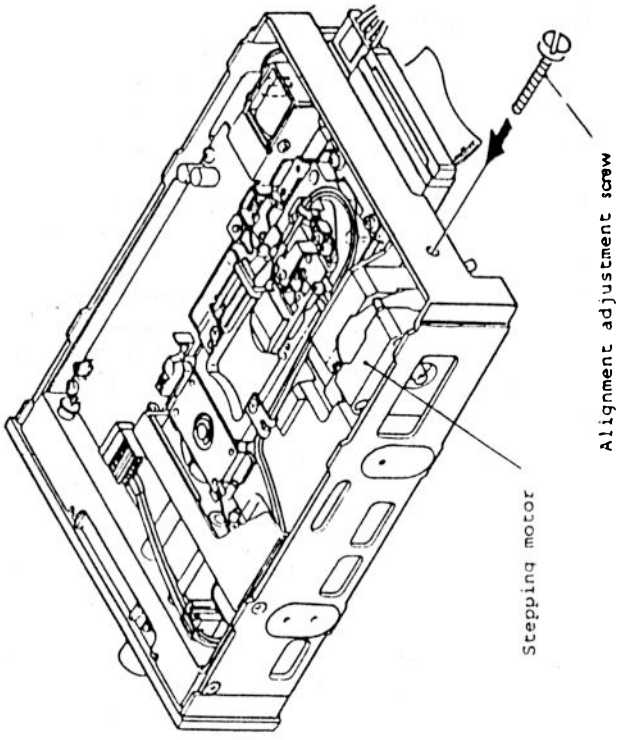


Figure 5.8 Track alignment adjustment

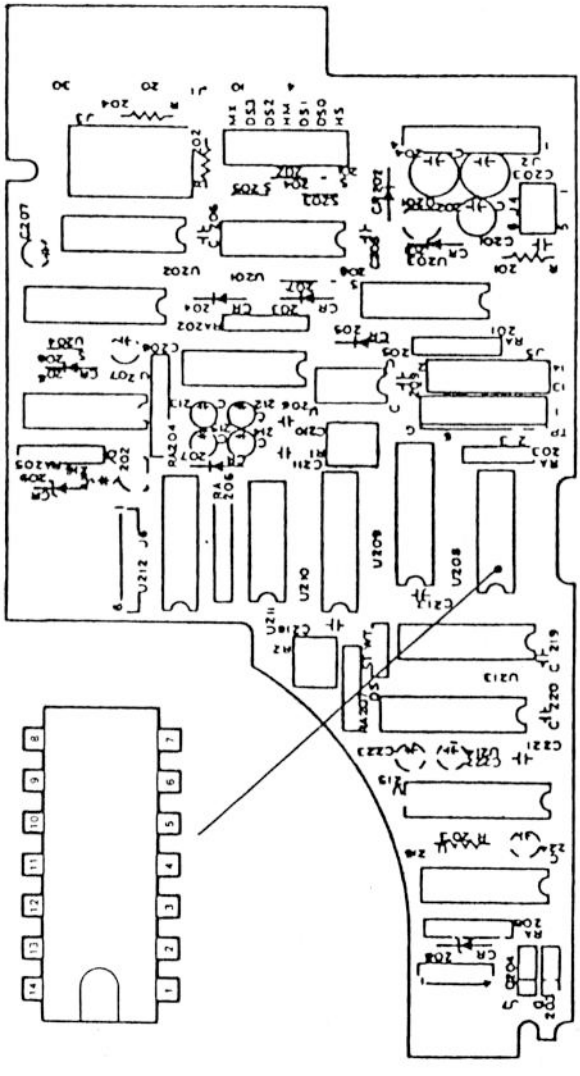


Figure 5.9 PCBA MFD control-track 00 sensor check

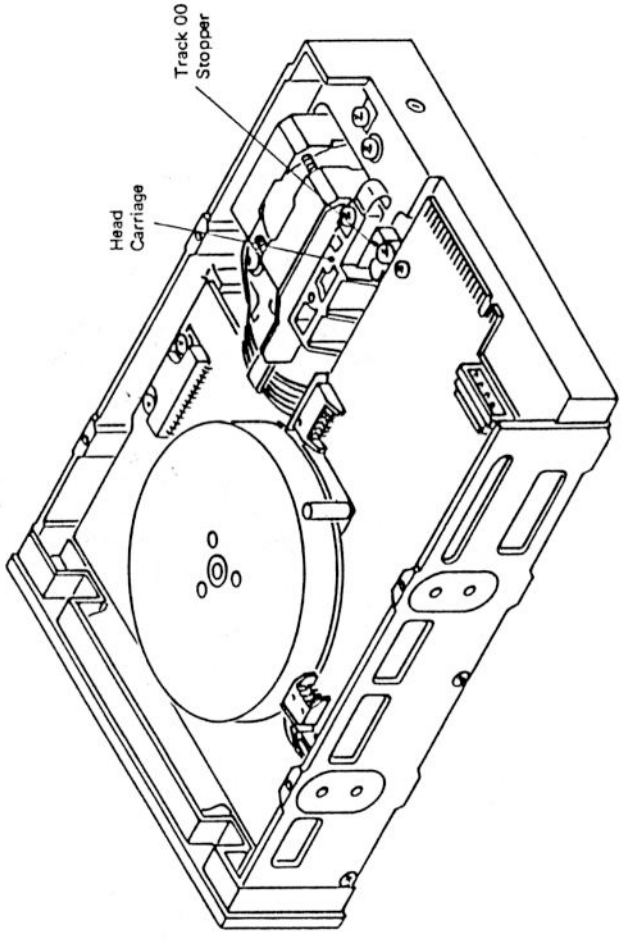


Figure 5.10 Track 00 sensor adjustment (stopper)

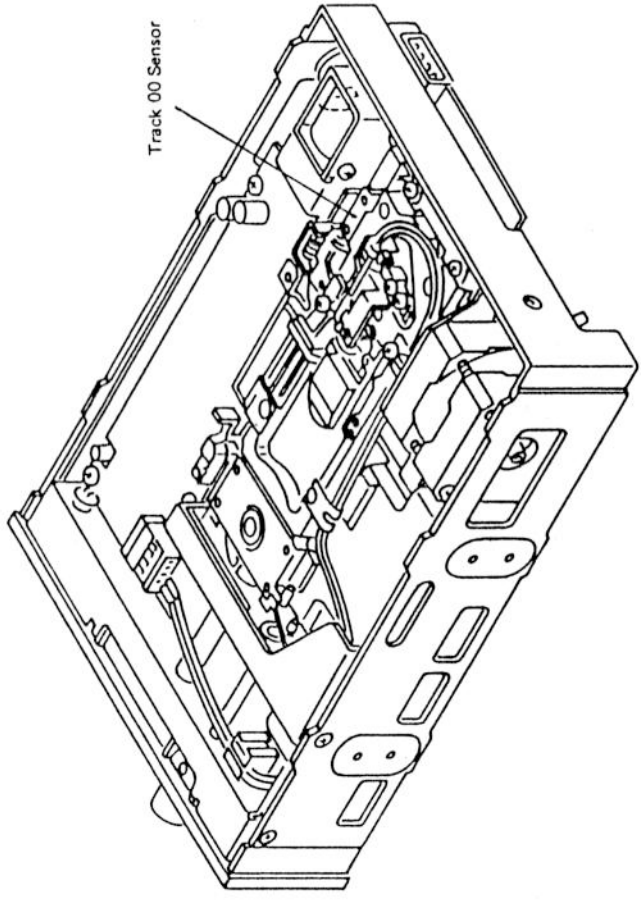


Figure 5.11 Track 00 sensor location

PIN ASSIGNMENTS & STRAPPING

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

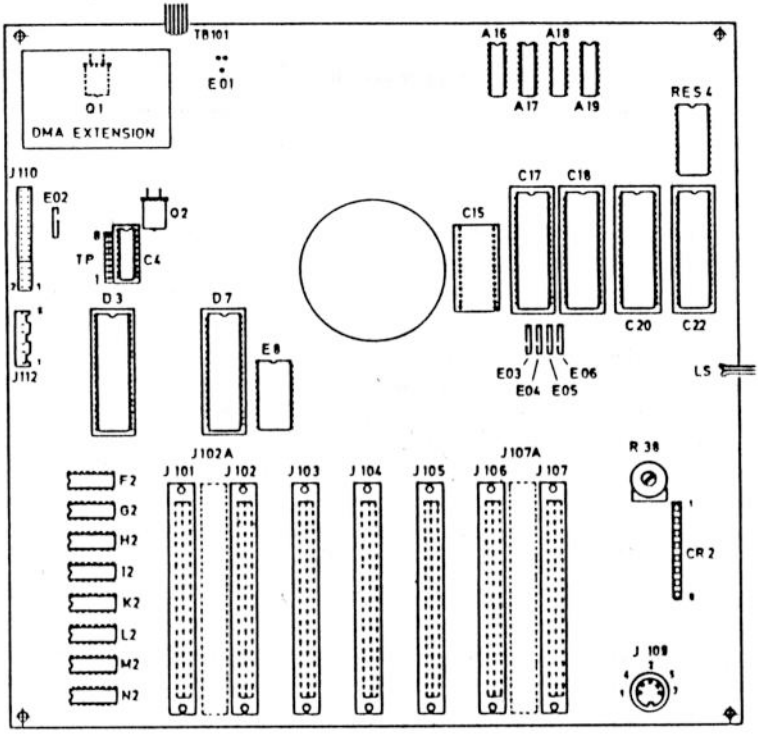
Information is included for the printed circuit boards that are in the NCR DECISION MATE V and for the various options that are available. Schematics are provided in the last part of this manual, Section 8.

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	
017-0032124	16-bit, Flex disk, Monochrome	
017-0032125	8-bit, Fix disk, Monochrome	Replacement for: 017-0031966
017-0032126	16-bit, Fix disk, Monochrome	Common service part for: 017-0032123, 017-0032124, 017-0032125
017-0032452	8-bit, Flex disk, Monochrome	Replacement for: 017-0032123
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 Common service part for: 017-0032452, 017-0032453 017-0032454
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 Common service part for: 017-0032721, 017-0032722, 017-0032723
017-0032725	16-bit, Flex disk, Color, Multi-layer	
017-0032726	16-bit, Fix disk, Color, Multi-layer	Common service part for: 017-0032725

Controller board history

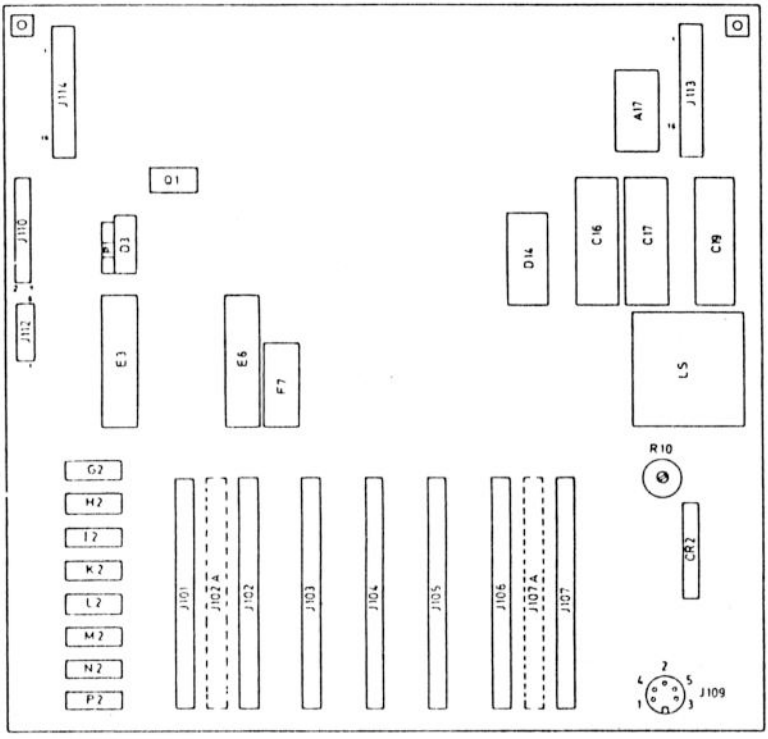
Up To Tracer Number 255



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	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)

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
SIDESEL/	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)

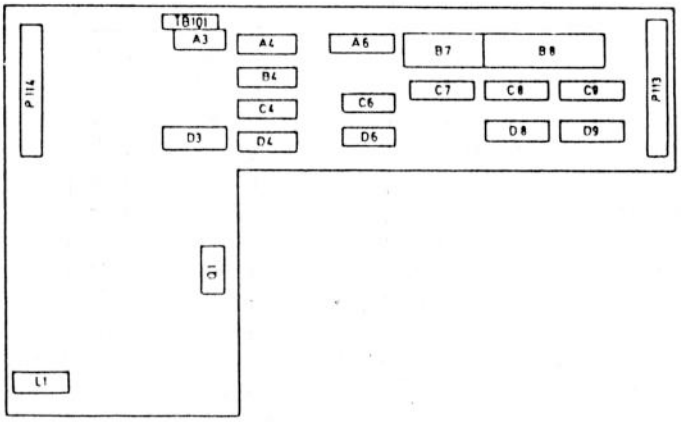
a		c
+5 V	1	+5 V
	2	+12 V
RESET/	3	RESET IN/
IOW/	4	IOR/
MEMW/	5	MEMR/
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
READY DMA	10	ABTRI/
EOP/	11	
INTACK/	12	IFSEL 4/
AUTO/	13	DIR/
THOLD/	14	HLDA
PCLK/	15	CLK1
LGRD	16	TRAMD/
BA19	17	BA18
BA17	18	BA16
BA15	19	BA14
BA13	20	BA12
BA11	21	BA10
BA9	22	BA8
BA7	23	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	Q1	Quartz 22.1184 MHz
C8	Data Bus Transceiver	TB101	Connector, CRT Deflection Board
C9	Address Register		

Major component locations

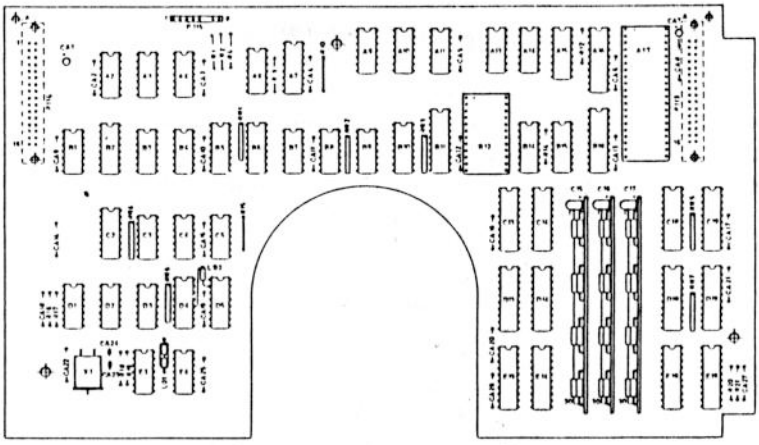
a		c
+5V	1	+5V
	2	
D1	3	D0
D3	4	D2
D5	5	D4
D7	6	D6
	7	
HSYNCX	8	HSYN
VSYNCX	9	LGRD
BA1	10	BA0
	11	
GDCIOW/	12	GDCIOR/
DACK2/	13	GDRQ2
	14	
	15	WCLK
LGRD	16	LGRD

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

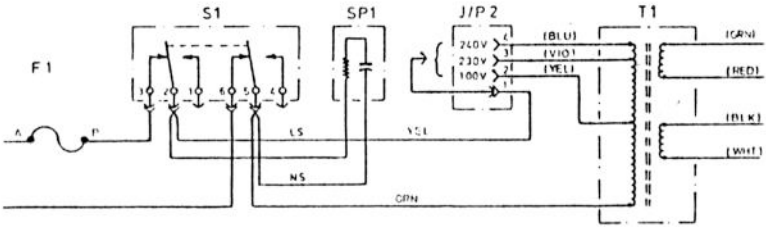
COLOR CRT GRAPHICS BOARD



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

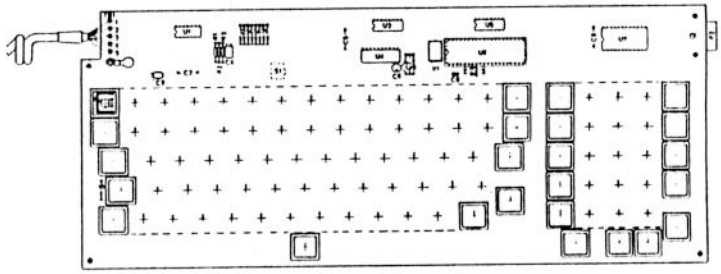


Transformer strapping (models 3273-XX XX-70/74/75)

Voltage	System Flex.	Fix.	Color
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

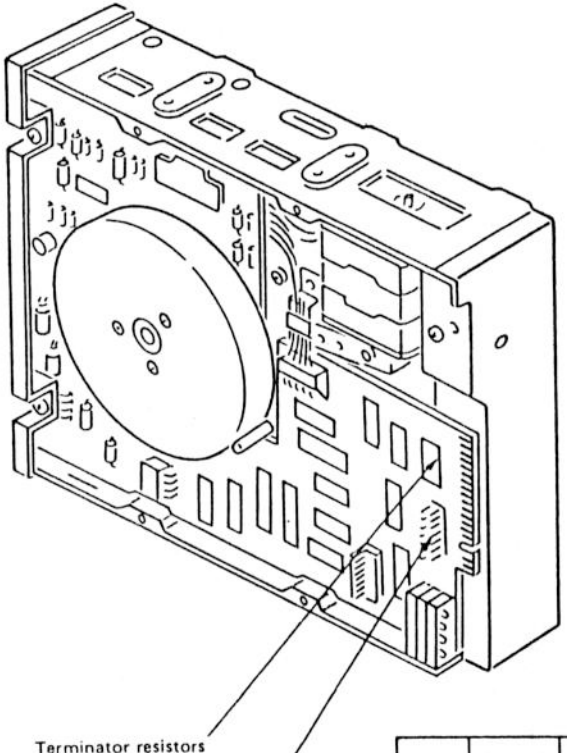


JUMPER	U6=8741/8041 open	U6=8741/8041 closed	U6=8748/8048 open	U6=8748/8048 closed
J1	X		X	
J5	X		X	
J6	X			X
J7		X	X	
J8	X		X	
J9	X		X	
J10		X		X
J11		X	X	
J12		X	X	
J13		X	X	
J2 J3 J4	RESERVED			

Strapping

SWITCH SETTING S1/1	S1/2	S1/3	LANGUAGE CODE
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 S1/1	S1/2	S1/3	LANGUAGE CODE
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

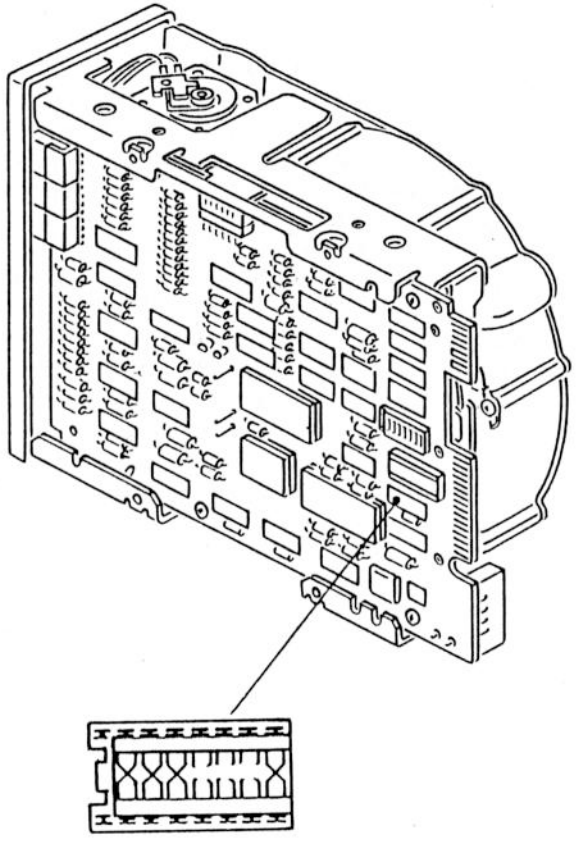


	Drive 0	Drive 1
MX		
DS3		
DS2		
HM	X	X
DS1		X
DS0	X	
HS		
Terminator Resistor Drive 1 only		

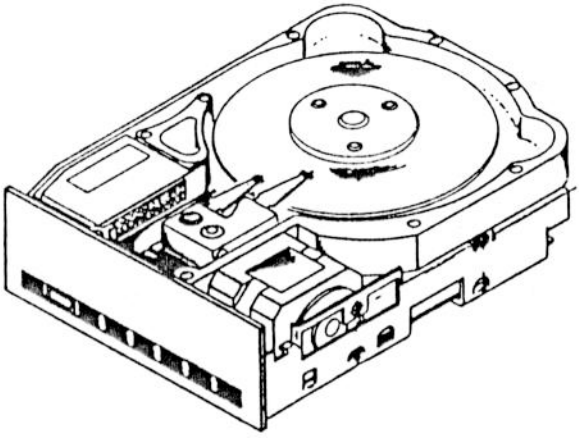
Strapping

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

FIXED WINCHESTER DISK DRIVE
(ST412)



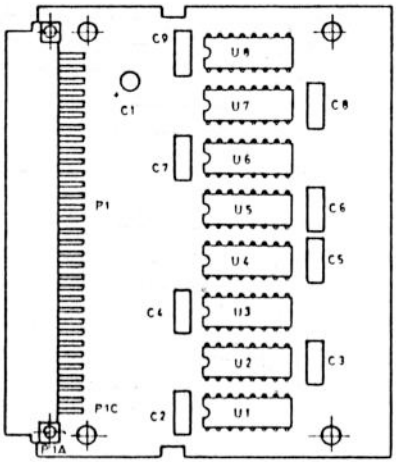
FIXED DISK DRIVE
(ST 212)



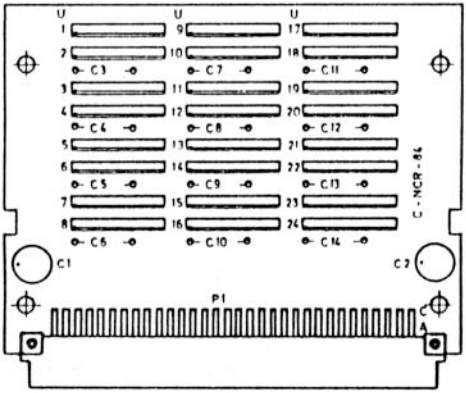
Strapping as for ST 412

MEMORY EXPANSION

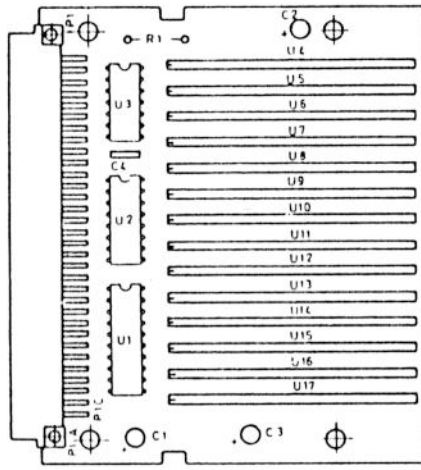
(K200, K202, K208)



64KB PCB



192KB PCB

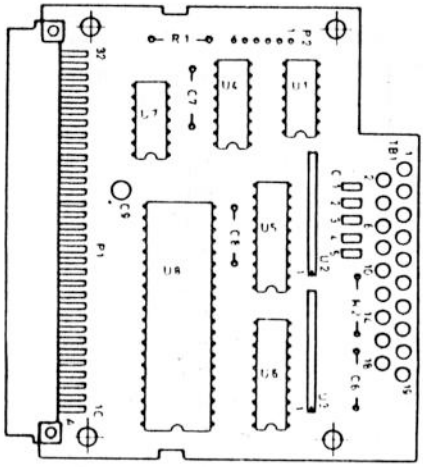


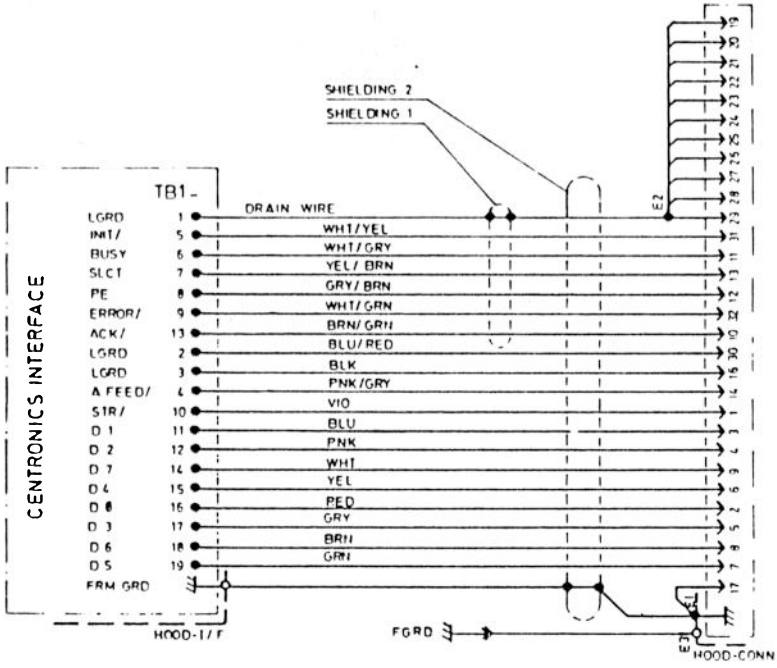
448KB PCB

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)



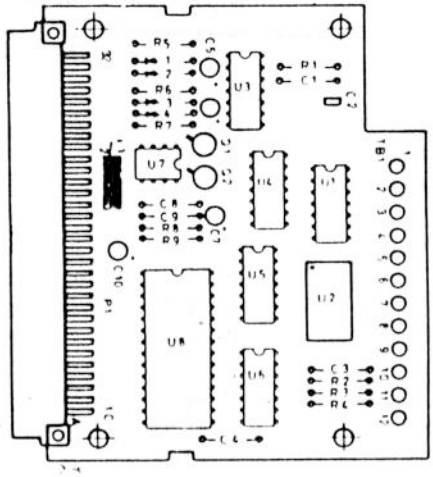


Cable connections

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	
	15	CLK1
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	
BA1	26	BA0
	27	
	28	IFSELO/
	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	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

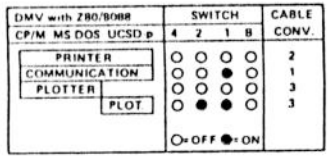
J2	closed	for K 212 (Printer Cable)
J1	closed	for K 211 (Modem Cable)
J2	closed	for K 213 (Plotter Cable)

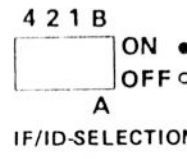
RS-232-C Hardware strapping

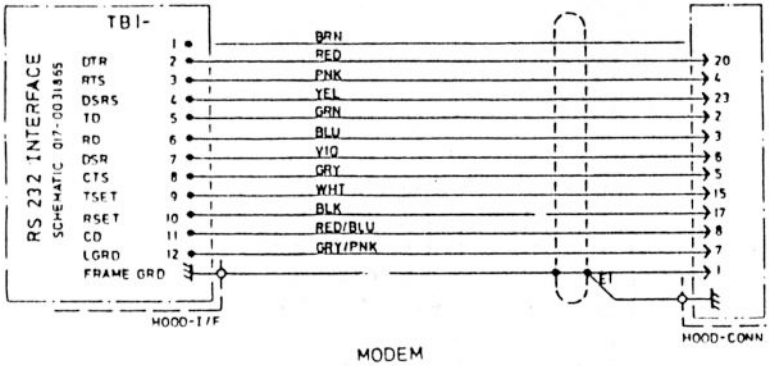
a		c
+5 V	1	+5 V
IRQ	2	+12 V
RESET/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
	11	
	12	
	13	
	14	
	15	
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	BA2
BA1	26	BA0
	27	
IFSEL1/	28	IFSEL0/
	29	
	30	
	31	
LGRD	32	LGRD

RS-232C pin assignments

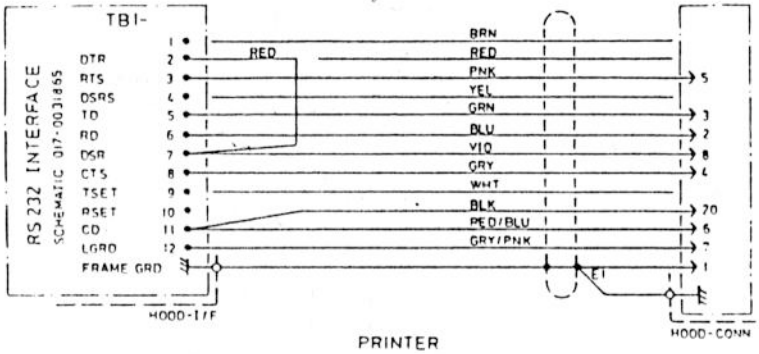
Kit	Port Address	Jumper	IFSEL Switch
K211	70-7F (Hex)	J1	–
K212/213	60-6F (Hex)	J2	–
K801 with MODEM cable converter	70-77 (Hex)	–	1 A
K801 with PRINTER/PLOTTER cable converter	60-67 (Hex)	–	0 A



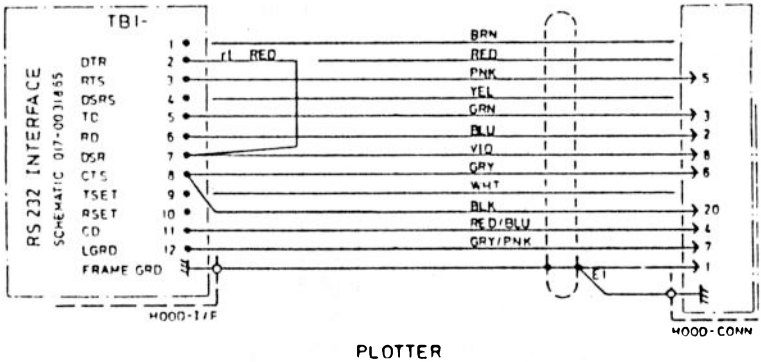




MODEM



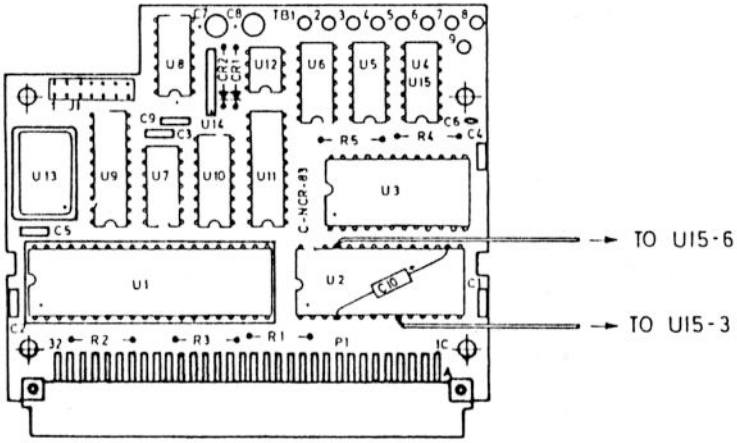
PRINTER



PLOTTER

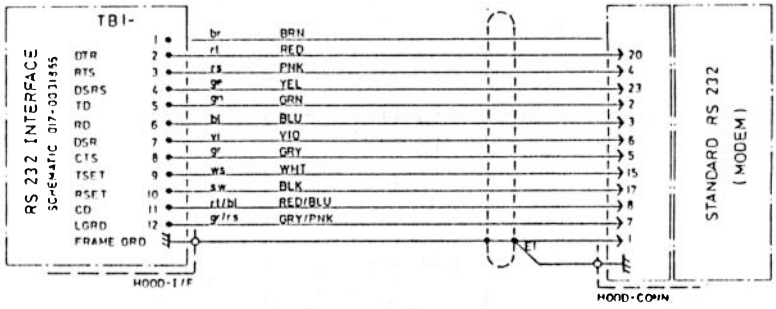
RS-232-C cables

BUFFERED SYNC/ASYNC 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	
	15	
LGRD	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

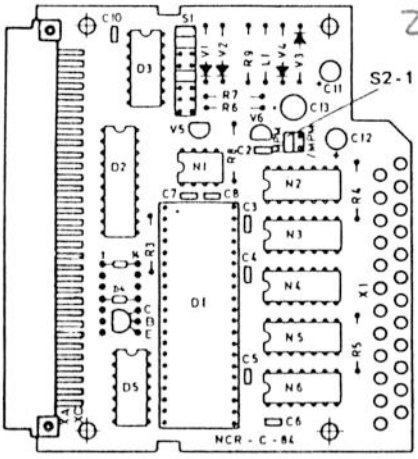


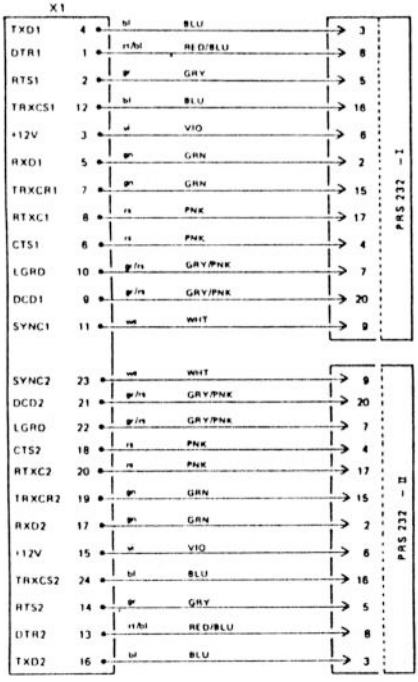
IFSEL	J1	Port Address
0A	11-12 and 9-10	60-67 hex
0B	13-14 and 9-10	68-6F hex
1A	11-12 and 7-8	70-77 hex
1B	13-14 and 7-8	78-7F hex
2A	11-12 and 5-6	30-37 hex
2B	13-14 and 5-6	38-3F hex
3A	11-12 and 3-4	B0-B7 hex
3B	13-14 and 3-4	B8-BF hex
4A	11-12 and 1-2	C0-C7 hex
4B	13-14 and 1-2	C8-CF hex

SCC COMMUNICATION INTERFACE
(K216)

S1-1

D1 = Z8530PS





2 CHANNEL SERIAL CABLE

K216 - V001	MPM	MPM/	S1-3
MPM Operation	•	o	o
Two Channel RS-232	o	•	•

K216 - V002	S2-1	S2-2	S2-3
MPM Operation	•	o	o
Two Channel RS-232	o	•	•

Strapping SCC communication interface

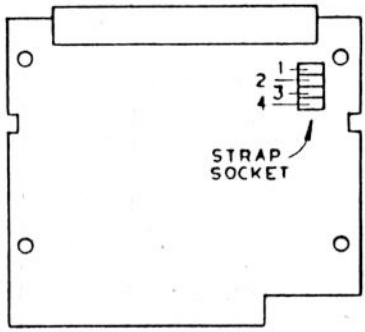
IFSEL		Switch S1 1 2 4 5 6 7 8	Port Address
IFSEL 0	0A1	x x x o o o o	60 - 63 Hex
	0A2	x o x o o o o	64 - 67 Hex
	0B1	o x x o o o o	68 - 6B Hex
	0B2	o o x o o o o	6C - 6F Hex
IFSEL 1	1A1	x x o x o o o	70 - 73 Hex
	1A2	x o o x o o o	74 - 77 Hex
	1B1	o x o x o o o	78 - 7B Hex
	1B2	o o o x o o o	7C - 7F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

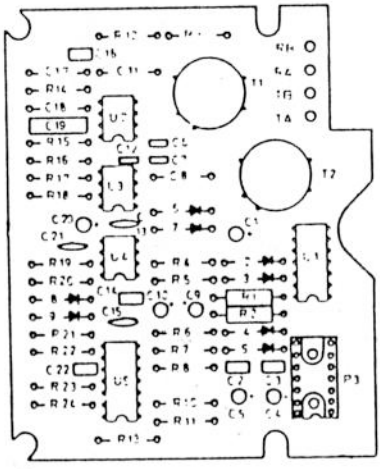
STRAPS				FUNCTION
1	2	3	4	
In				Base address 70 Hex
	In			Base address 78 Hex
		In		NCR 3273
		Out		NCR 3276
			Not used	

- 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

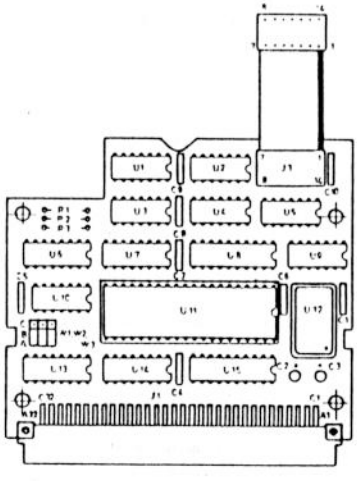
a		c
+5V	1	+5V
GND	2	
RESET/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
	11	IDSEL/
	12	
	13	
	14	
CLK1	15	
	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
BA3	25	BA2
BA1	26	BA0
	27	
IFSEL/	28	
	29	
	30	
	31	INTR/
GND .	32	GND

Pin assignments, integrated modem

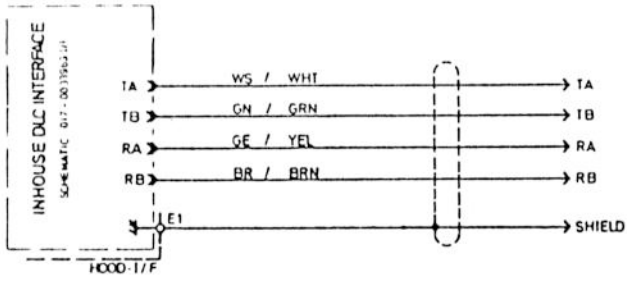
DLC INHOUSE INTERFACE (K223)



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

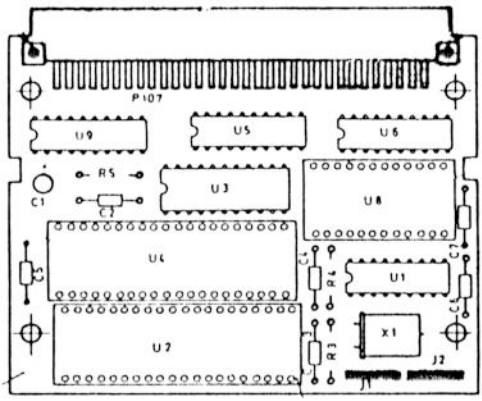
1	+5V
2	TSTART/
3	4MSINT
4	LED
5	GND
6	GND
7	GND
8	RDM
9	4MSSTOP/
10	+12V
11	+12V
12	TDM/
13	TDM
14	+5V

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)

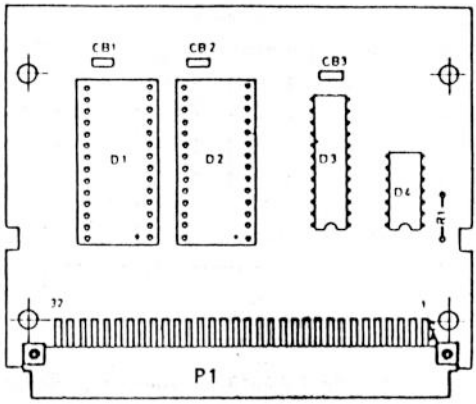


J1	closed
J2	closed

	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)

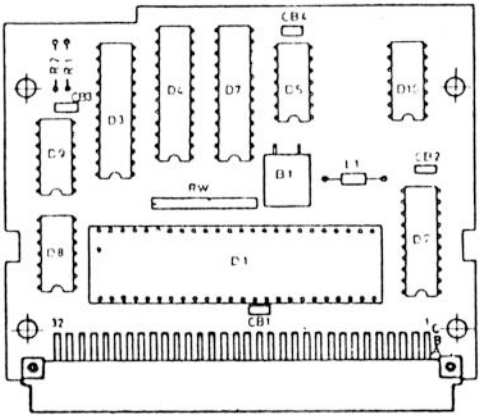
SHARED RAM
(K 233)



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)

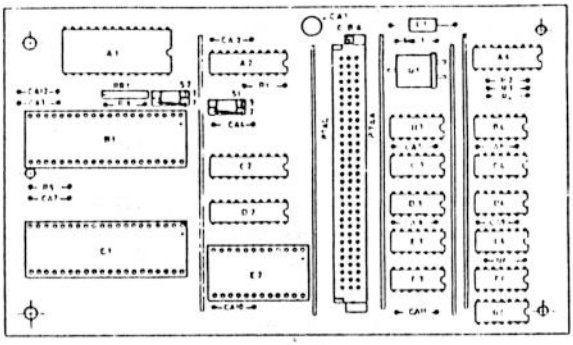
68008 PROCESSOR BOARD
(K234)



	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

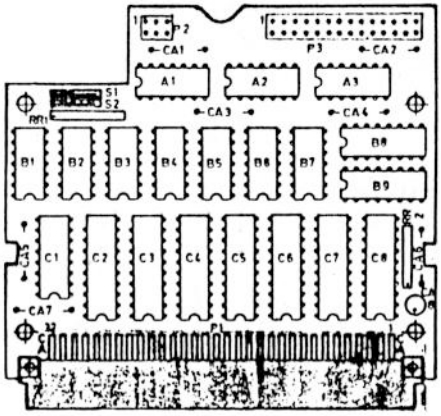
Switches, 16-bit processor with interrupt controller

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)

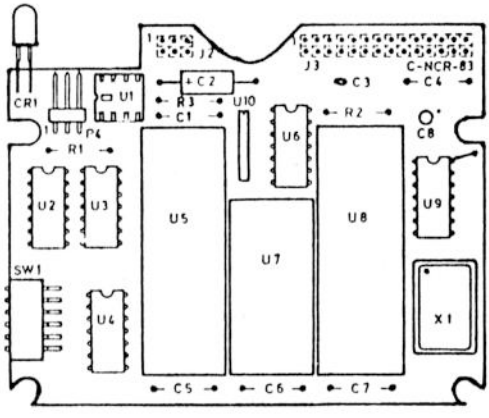
OMNINET ADAPTER
(K 600)



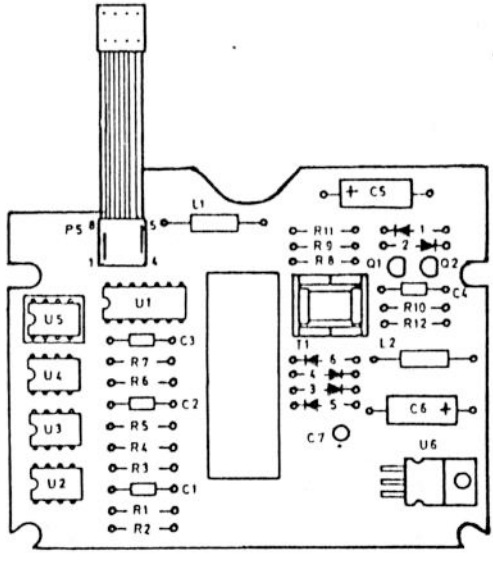
Interface PCB

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



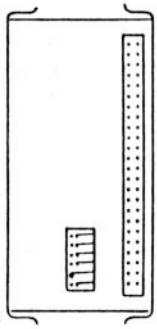
Controller PCB



Isolator PCB

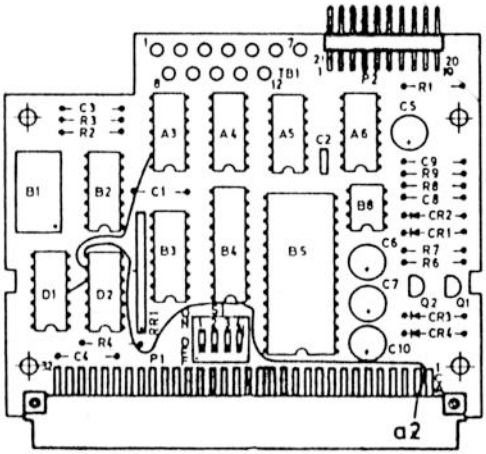
REQUESTER ID		SWITCH SETTING	REQUESTER ID		SWITCH SETTING
HEX	DEC	1 2 3 4 5 6	HEX	DEC	1 2 3 4 5 6
0	0	0 0 0 0 0 0	20	32	0 0 0 0 0 1
1	1	1 0 0 0 0 0	21	33	1 0 0 0 0 1
2	2	0 1 0 0 0 0	22	34	0 1 0 0 0 1
3	3	1 1 0 0 0 0	23	35	1 1 0 0 0 1
4	4	0 0 1 0 0 0	24	36	0 0 1 0 0 1
5	5	1 0 1 0 0 0	25	37	1 0 1 0 0 1
6	6	0 1 1 0 0 0	26	38	0 1 1 0 0 1
7	7	1 1 1 0 0 0	27	39	1 1 1 0 0 1
8	8	0 0 0 1 0 0	28	40	0 0 0 1 0 1
9	9	1 0 0 1 0 0	29	41	1 0 0 1 0 1
A	10	0 1 0 1 0 0	2A	42	0 1 0 1 0 1
B	11	1 1 0 1 0 0	2B	43	1 1 0 1 0 1
C	12	0 0 1 1 0 0	2C	44	0 0 1 1 0 1
D	13	1 0 1 1 0 0	2D	45	1 0 1 1 0 1
E	14	0 1 1 1 0 0	2E	46	0 1 1 1 0 1
F	15	1 1 1 1 0 0	2F	47	1 1 1 1 0 1
10	16	0 0 0 0 1 0	30	48	0 0 0 0 1 1
11	17	1 0 0 0 1 0	31	49	1 0 0 0 1 1
12	18	0 1 0 0 1 0	32	50	0 1 0 0 1 1
13	19	1 1 0 0 1 0	33	51	1 1 0 0 1 1
14	20	0 0 1 0 1 0	34	52	0 0 1 0 1 1
15	21	1 0 1 0 1 0	35	53	1 0 1 0 1 1
16	22	0 1 1 0 1 0	36	54	0 1 1 0 1 1
17	23	1 1 1 0 1 0	37	55	1 1 1 0 1 1
18	24	0 0 0 1 1 0	38	56	0 0 0 1 1 1
19	25	1 0 0 1 1 0	39	57	1 0 0 1 1 1
1A	26	0 1 0 1 1 0	3A	58	0 1 0 1 1 1
1B	27	1 1 0 1 1 0	3B	49	1 1 0 1 1 1
1C	28	0 0 1 1 1 0	3C	60	0 0 1 1 1 1
1D	29	1 0 1 1 1 0	3D	61	1 0 1 1 1 1
1E	30	0 1 1 1 1 0	3E	62	0 1 1 1 1 1
1F	31	1 1 1 1 1 0	3F	63	1 1 1 1 1 1

Requester switch settings

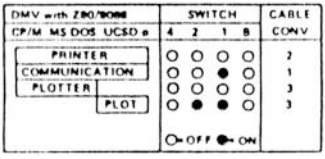


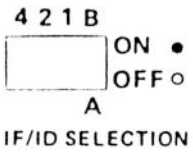
Transporter Switches
(Unit Identification Switches)

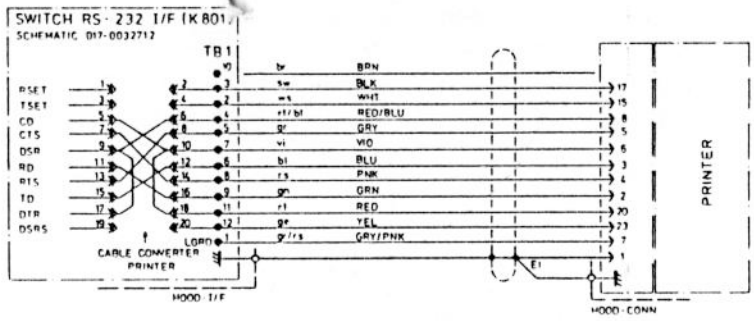
SWITCHABLE RS-232 ADAPTER
(K801)

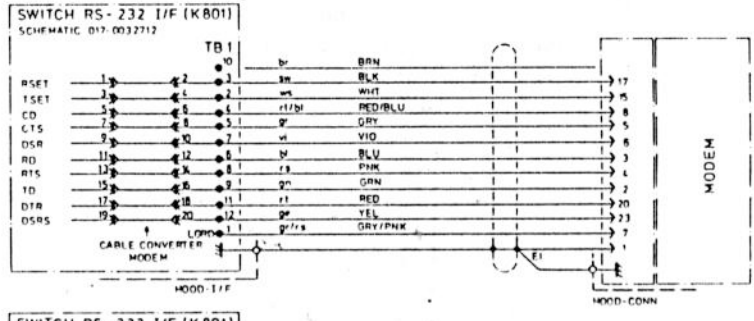


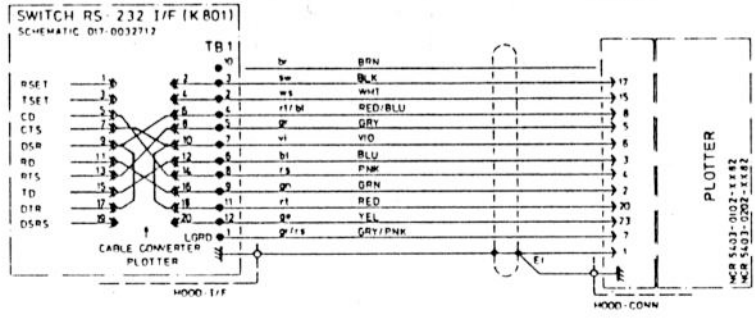
IFSEL	SWITCH 4 2 1 B	PORT-ADDR.
0 A	o o o o	60H – 67H
0 B	o o o •	68H – 6FH
1 A	o o • o	70H – 77H
1 B	o o • •	78H – 7FH
2 A	o • o o	30H – 37H
2 B	o • o •	38H – 3FH
3 A	o • • o	B0H – B7H
3 B	o • • •	B8H – BFH
4 A	• o o o	C0H – C7H
4 B	• o o •	C8H – CFH

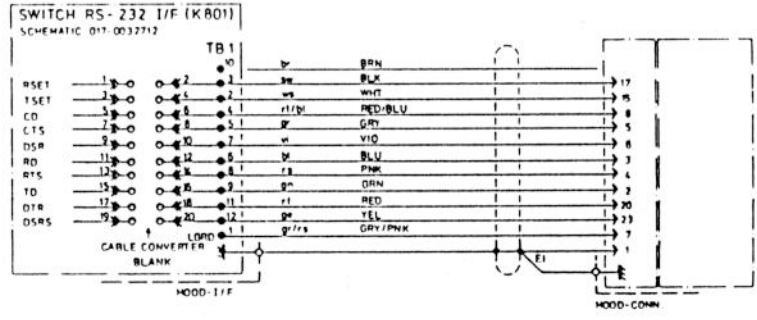





SWITCH RS-232 I/F (K801)
SCHEMATIC 017-0032712
TB1
RSET
TSET
CD
CTS
DSR
RD
RTS
TD
DTR
DSRS
CABLE CONVERTER
PRINTER
HOOD I/F
br BRN
bk BLK
wh WHT
rd/bl RED/BLU
gr GRY
vi VIO
bl BLU
pk PNK
grn GRN
rd RED
ye YEL
gr/rs GRY/PNK
E1
HOOD-CONN
PRINTER


SWITCH RS-232 I/F (K801)
SCHEMATIC 017-0032712
TB1
RSET
TSET
CD
CTS
DSR
RD
RTS
TD
DTR
DSRS
CABLE CONVERTER
MODEM
HOOD I/F
br BRN
bk BLK
wh WHT
rd/bl RED/BLU
gr GRY
vi VIO
bl BLU
pk PNK
grn GRN
rd RED
ye YEL
gr/rs GRY/PNK
E1
HOOD-CONN
MODEM

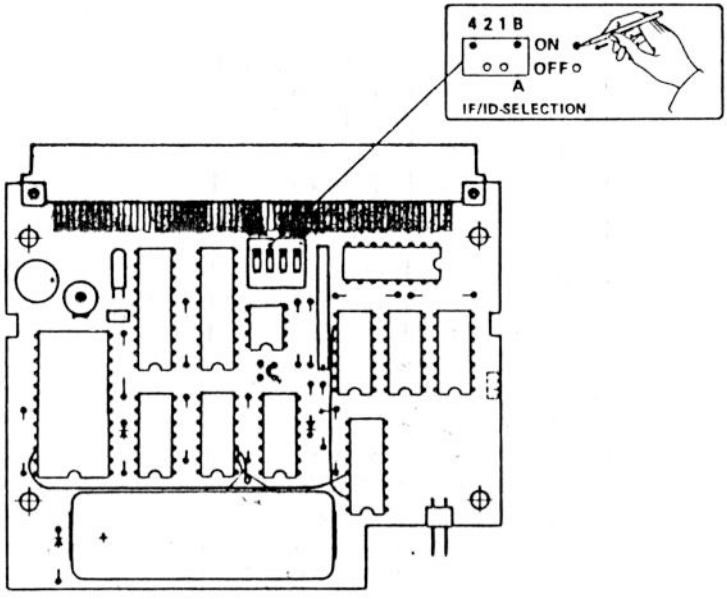

SWITCH RS-232 I/F (K801)
SCHEMATIC 017-0032712
TB1
RSET
TSET
CD
CTS
DSR
RD
RTS
TD
DTR
DSRS
CABLE CONVERTER
PLOTTER
HOOD I/F
br BRN
bk BLK
wh WHT
rd/bl RED/BLU
gr GRY
vi VIO
bl BLU
pk PNK
grn GRN
rd RED
ye YEL
gr/rs GRY/PNK
E1
HOOD-CONN
PLOTTER
MCR 5403-0102-XX82
MCR 5403-0202-XX82
(PRINTER MCR 5442)


SWITCH RS-232 I/F (K801)
SCHEMATIC 017-0032712
TB1
RSET
TSET
CD
CTS
DSR
RD
RTS
TD
DTR
DSRS
CABLE CONVERTER
BLANK
HOOD I/F
br BRN
bk BLK
wh WHT
rd/bl RED/BLU
gr GRY
vi VIO
bl BLU
pk PNK
grn GRN
rd RED
ye YEL
gr/rs GRY/PNK
E1
HOOD-CONN

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 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	○ ● ● ○	B0-B7H	176-183
3B	○ ● ● ●	B8-BFH	184-191
4A	● ○ ○ ○	C0-C7H	192-199
4B	● ○ ○ ●	C8-CFH	200-207

IFSEL switch settings

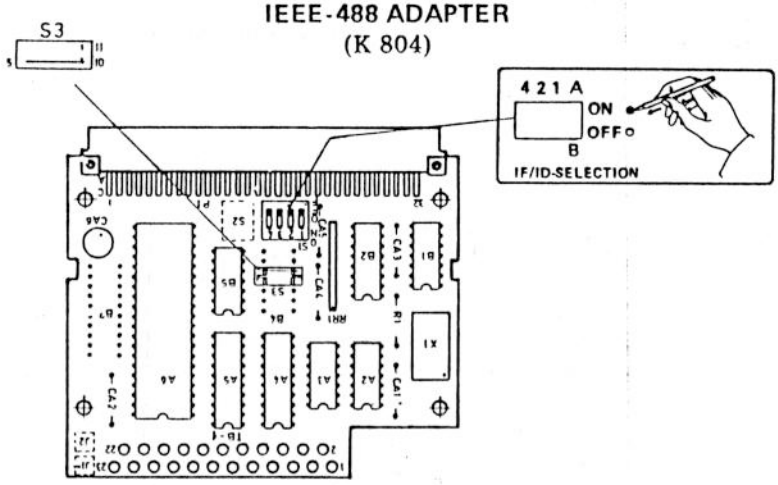
a		c
+5V	1	+5V
IRQ	2	+12V
RESET/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
	11	IDSEL/
	12	IFSEL 4
AUTO/	13	
	14	
	15	
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
BA3	25	BA2
BA1	26	BA0
IFSEL3	27	IFSEL2
IFSEL1	28	IFSEL0
	29	
	30	
WAIT/	31	INT/
LGRD	32	LGRD

Pin assignments P1

P2-1	STBY-INT/
-2	LGRD

Standby interrupt connector

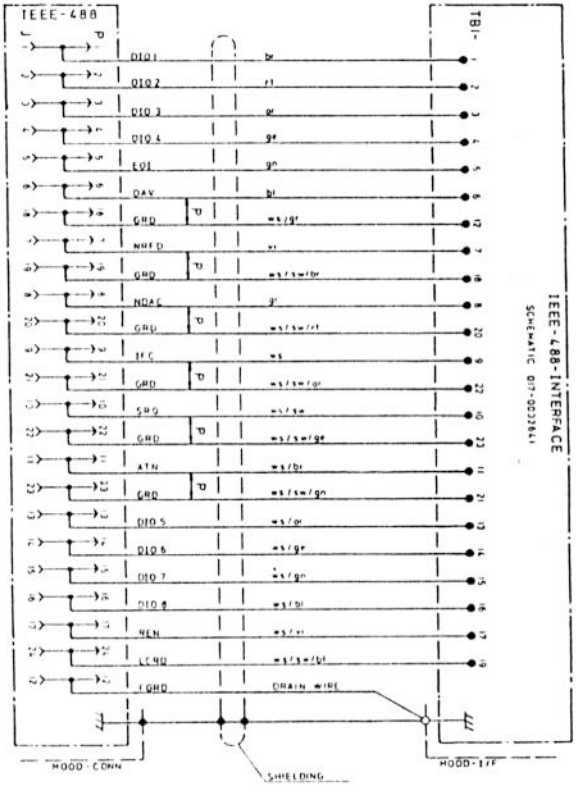
IEEE-488 ADAPTER
(K 804)



a		c
+5V	1	+5V
IRQ	2	
Reset/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
EOP/	11	
	12	ISEL4/
	13	DIR/
	14	
	15	
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
BA3	25	BA2
BA1	26	BA0
ISEL3/	27	ISEL2/
ISEL1/	28	ISEL0/
DRQ1	29	DRQ0
DACK1/	30	DACK0/
	31	INT/
LGRD	32	LGRD

Pin assignments P1

IEEE Cable



IEEE Cable

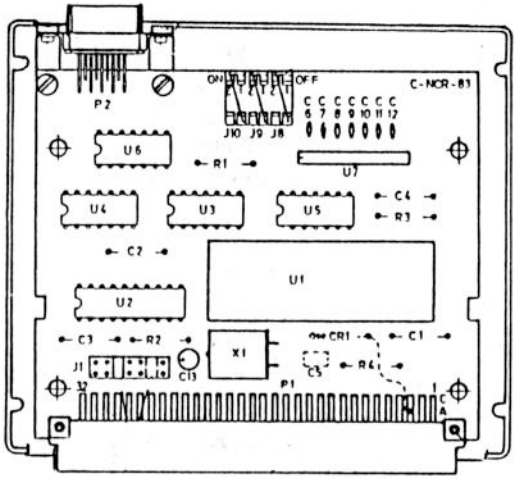
Follow instructions inside adapter cover: ignore any markings on switch assembly.

IFSEL	Switch 4	2	1	4	Port Addresses
0A	o	o	o	•	60-67 Hex
0B	o	o	o	o	68-6F Hex
1A	o	o	•	•	70-77 Hex
1B	o	o	•	o	78-7F Hex
2A	o	•	o	•	30-37 Hex
2B	o	•	o	o	38-3F Hex
3A	o	•	•	•	B0-B7 Hex
3B	o	•	•	o	B8-BF Hex
4A	•	o	o	•	C0-C7 Hex
4B	•	o	o	o	C8-CF Hex

o = Open • = Closed

IFSEL Switch settings

MOUSE INTERFACE
(K 806)



a	.	
+5V	1	+5V
	2	
RESET/	3	
IOW/	4	IOR/
	5	
D1	6	D0
D3	7	D2
D5	8	D4
D7	9	D6
	10	
	11	IDSEL/
	12	IFSEL4/
AUTO/	13	
	14	
	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
BA3	25	
	26	A0
IFSEL3/	27	IFSEL2/
IFSEL1/	28	IFSEL0/
	29	
	30	
	31	INT/
GND	32	GND

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	J8, J9, J10 Off
Depraz Mouse	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.

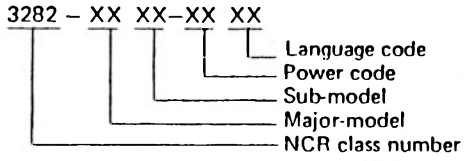
A secondary unit, this unit does not have a disk controller or interface. It is designed to connect to a master unit. A maximum of two secondary units may be connected to the daisy-chain.

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

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.

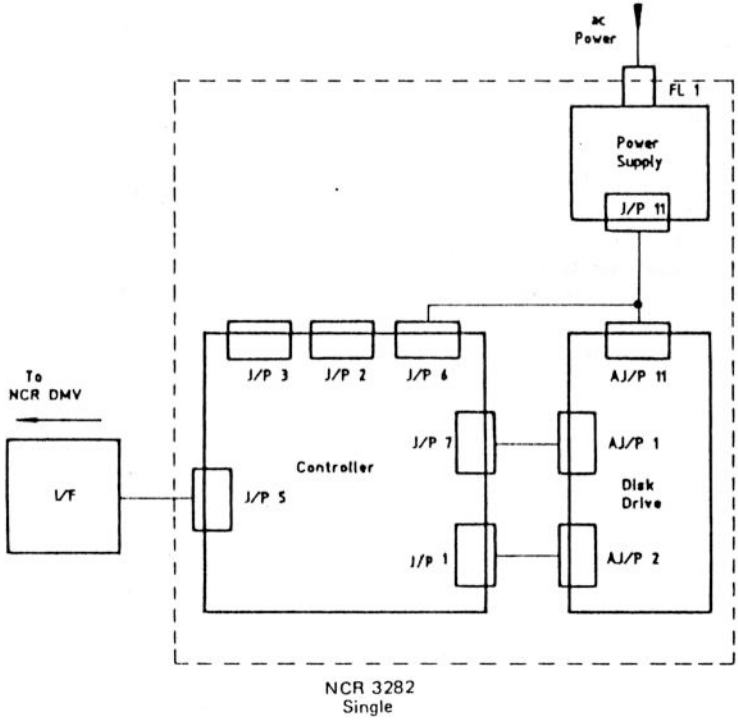


Figure 7.4 Single unit configuration

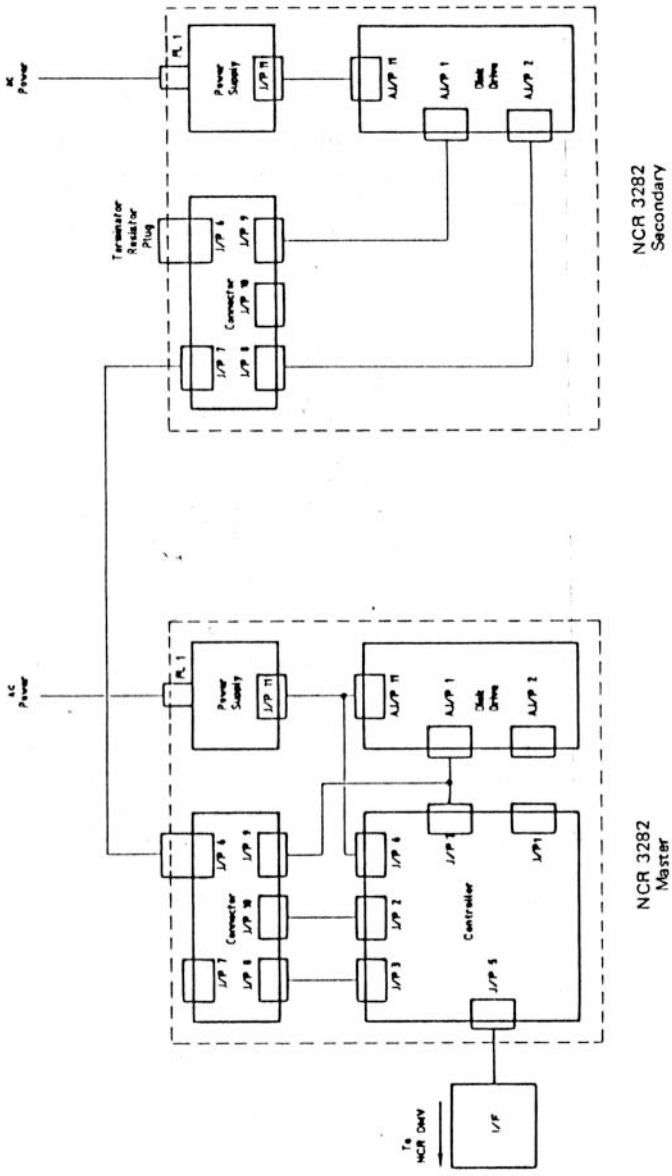


Figure 7.5 Typical Master/Secondary configuration

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.

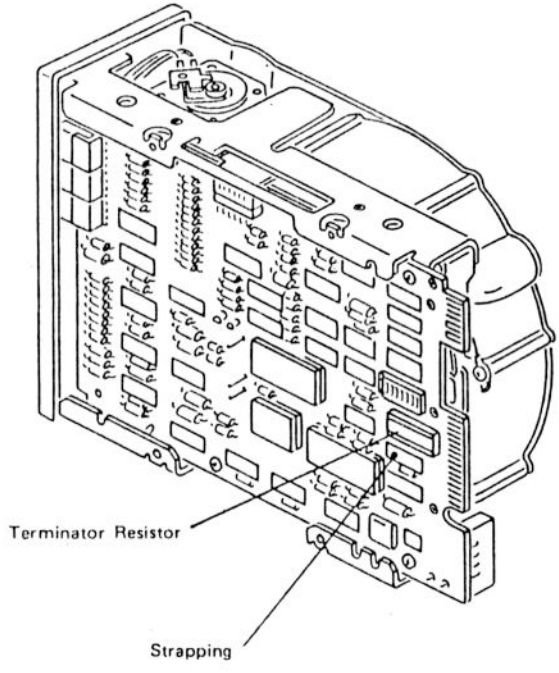


Figure 7.6 Strapping locations

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.

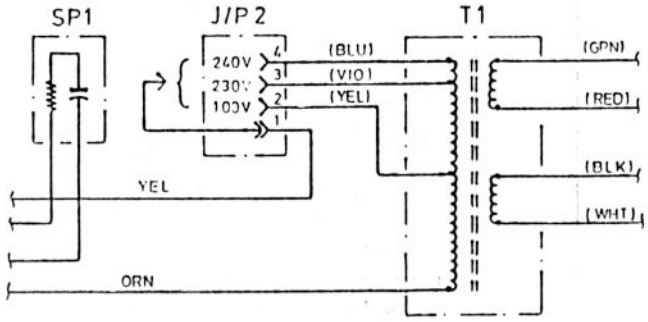


Figure 7.8 Power supply strapping

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.

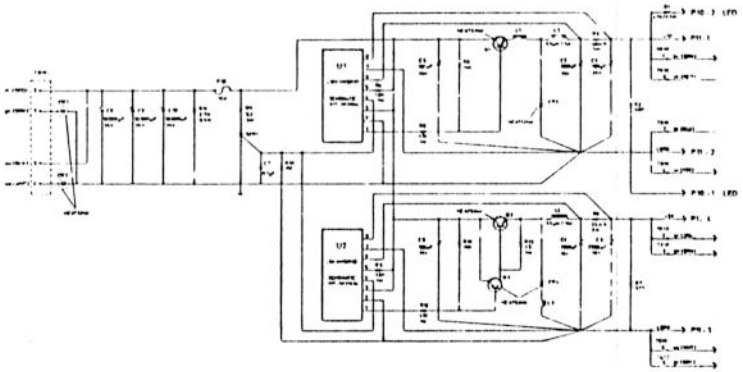


Figure 7.9 Power supply schematic

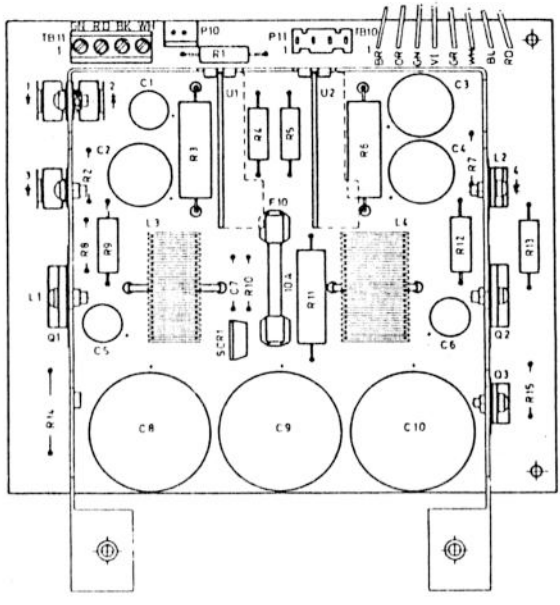


Figure 7.10 Component locations

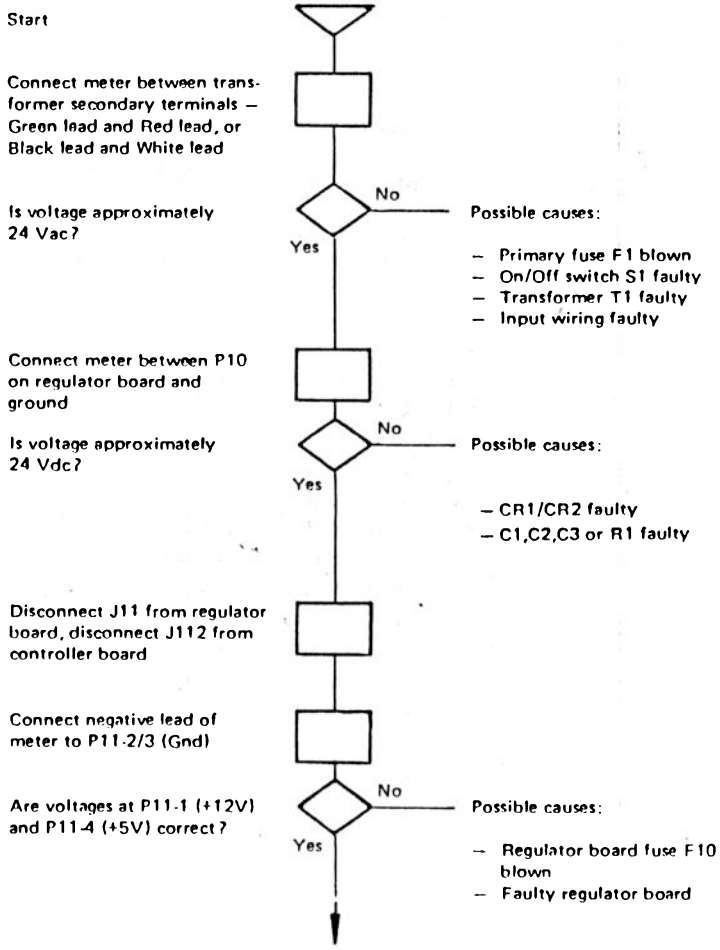
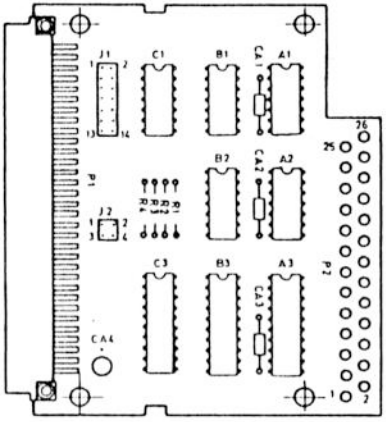


Figure 7.11 Fault finding flow-chart

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 Pin		J2 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

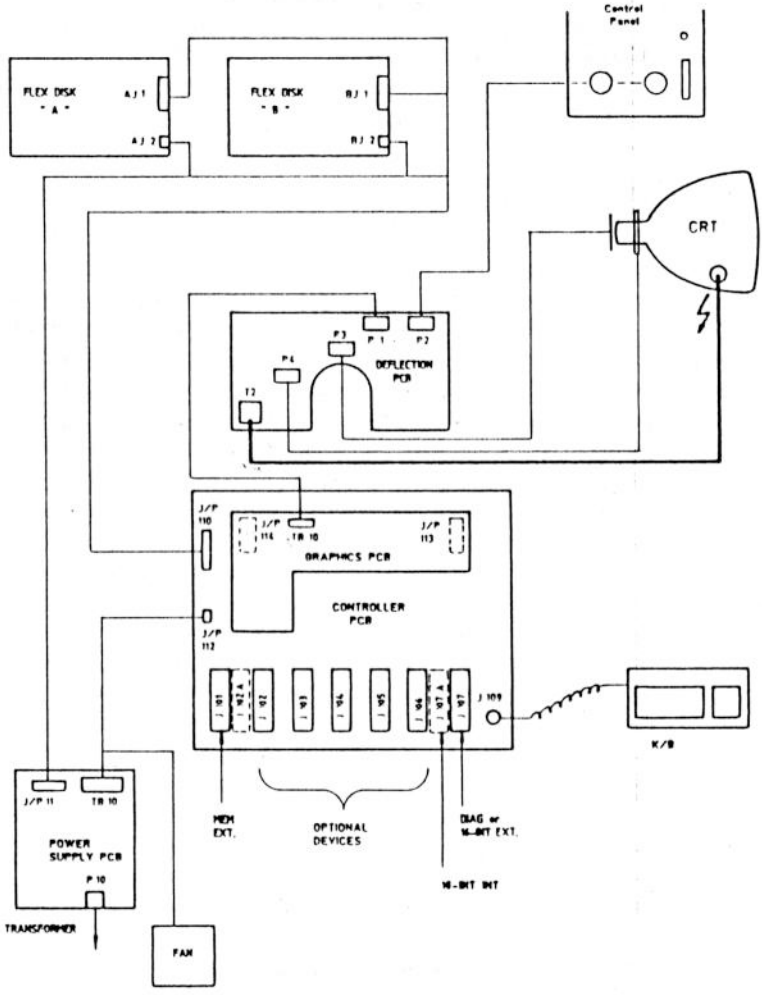
LEVEL 1 DIAGNOSTICS

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

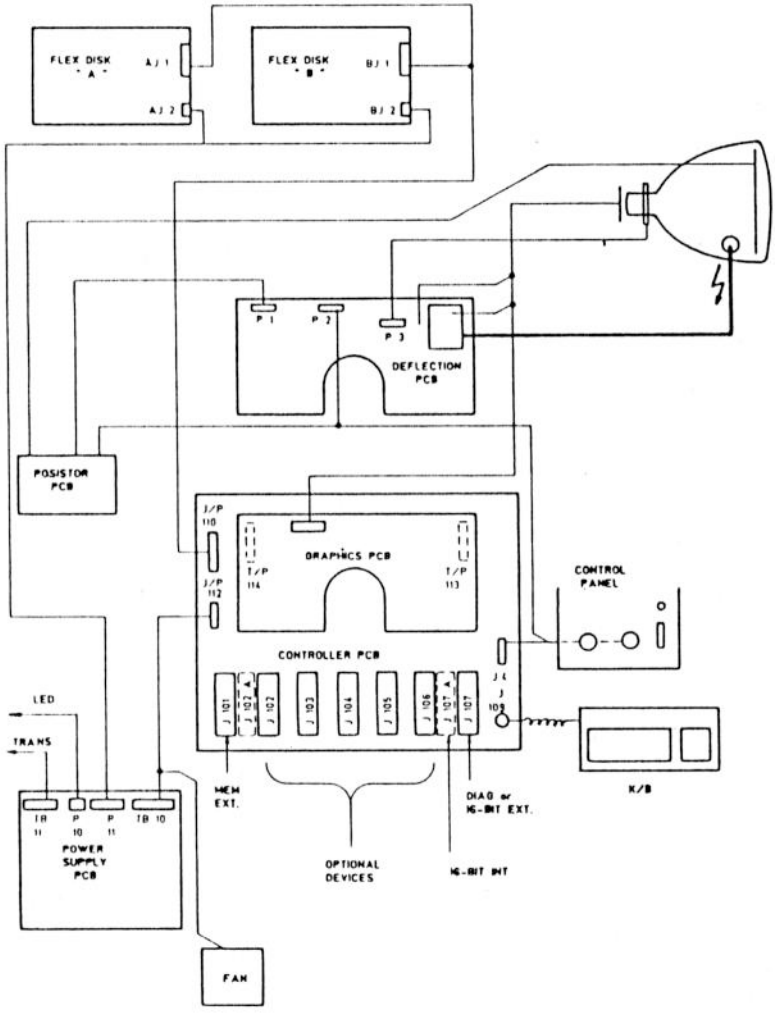
The first unit (Single or Master) contains platters C and D
The second unit (first Secondary) contains platters E and F
The third unit (second Secondary) contains platters G and H

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

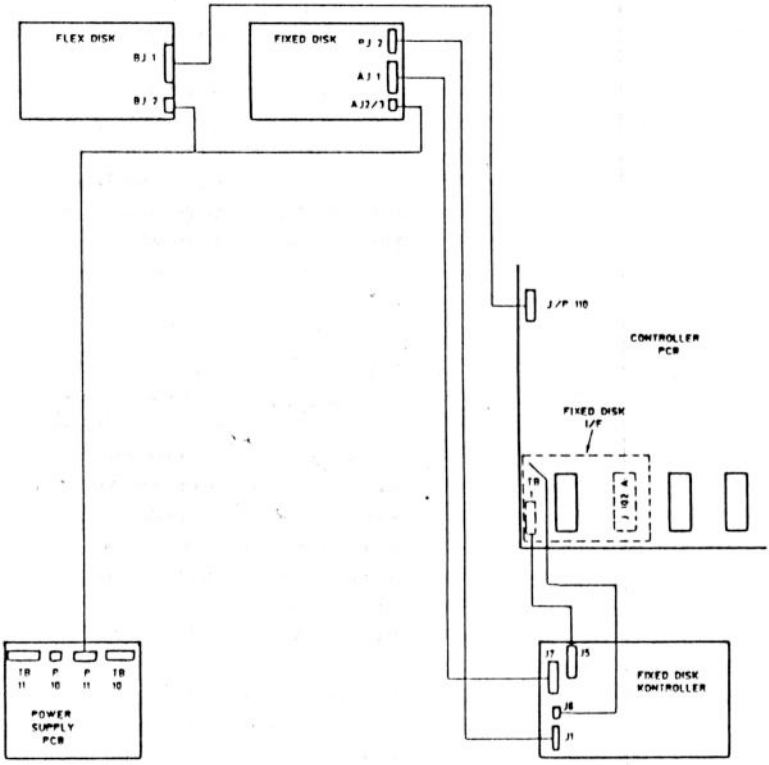
WIRING BLOCK DIAGRAM
MONOCHROME DUAL FLEXIBLE DISK SYSTEM



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
(Convt. Mod/Ptr)	017-0033008 A	017-0033007 A
(Convt. 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