Tim Slate

M I C R O D E C I S I O N

S E R V I C E G U I D E

Rev. 20 – Kozhyinska.

THE SERVICE PROCEDURES DESCRIBED IN THIS DOCUMENT ARE TO BE PERFORMED ONLY BY AUTHORIZED MORROW DESIGNS DEALERSHIPS. ONLY QUALIFIED SERVICE PERSONNEL SHALL PERFORM THE REPAIRS. QUALIFICATION MAY BE OBTAINED BY SATISFACTORY COMPLETION OF A MORROW DESIGNS SERVICE SEMINAR OR EQUIVALENT TRAINING AND EXPERIENCE IN PERSONAL COMPUTER SERVICE.

PART I - TECHNICIAN'S REFERENCE: COMPONENT ID AND DISASSEMBLY

PREFACE

The Micro Decision Service Guide is organized in two distinct parts. Part I serves as a technician's reference guide; the modular assembly of the Micro Decision is discussed in detail, and the disassembly procedures for each module is provided. Troubleshooting and parts replacement is also covered in Part I.

Part II, Diagnostics II User's Manual, follows the Customer Service Bulletin Index. This part of the Micro Decision Service Guide details the testing of each major Micro Decision component.

The Morrow Designs Micro Decision computer system is designed for serviceability. A reduced part count and modular assembly approach contribute to reliability and ease of service.

The Central Processing Unit, memory circuits, communications port and all support electronics reside on a single printed circuit board ("motherboard"). One power supply assembly provides all DC operating voltages to the motherboard and the internal disk drives.

The motherboard, power supply, and disk drives are typically replaced as complete units. Thus repairs can usually be performed with a minimum of troubleshooting for you and downtime for the owner. No special tools are required, beyond normal hand tools. A digital voltmeter is needed for power supply troubleshooting and cable continuity tests.

User-selectable options are limited to baud rates, hardware/software printer handshaking, and terminal/modem selection for the RS-232 connectors. These are described in the Micro Decision User's Guide. Refer to the User's Guide for an introduction to the system and operating instructions.

The intent of this manual is to guide you through module replacements. To this end, disassembly procedures, troubleshooting flowcharts, and SuperSoft's Diagnostics II documentation are included. If you attempt to perform repairs at a component level, you do so at your own risk and with the knowledge that doing so voids any remaining factory warranty on the unit.

TABLE OF CONTENTS

L I S T O F F I G U R E S

L I S T O F T A B L E S

1. TOOLS REQUIRED FOR DISASSEMBLY

You will need a Phillips screwdriver, preferably size #2 and magnetic. Keep any magnetized tools away from diskettes that contain valuable files.

To help insure against callbacks, you should wear a grounding wriststrap that is connected to the Micro Decision chassis whenever you handle the mother board.

2. COVER REMOVAL

Before removing the cover, turn off the Micro Decision and unplug the equipment from the ac power source. Failure to do so presents a serious hazard to the equipment and to service personnel. Next, disconnect all cables from the rear of the unit.

At this printing, Morrow has installed three versions of Micro Decision chassis. For clarification, we refer to them as Revision A (original model), Revision B, and Revision C (newest chassis style).

The simplest way to distinguish the three chassis revisions is to view the unit from the rear. Revision A has a cord pan installed, and the AC power cord is hardwired (see Figure 2-1).

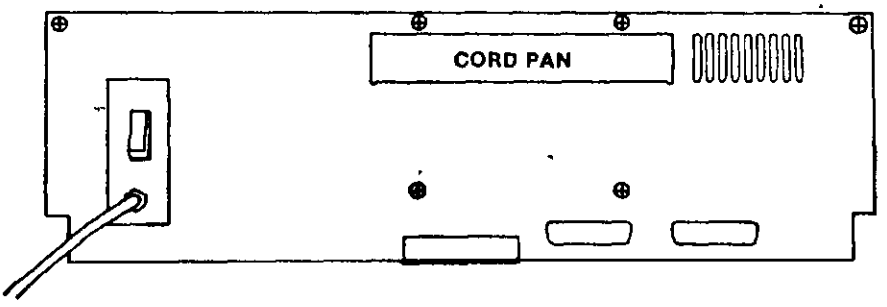


Figure 2-1: Revision A Chassis

The Revision B chassis does not have a cord pan, and the power cord plugs into the back of the unit.

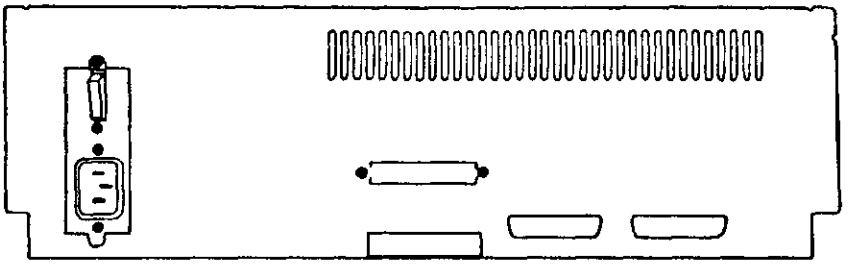


Figure 2-2: Revision B Chassis

The third chassis style (Revision C) is similar to the Revision B chassis, but can be identified by the knockout provided on the rear panel for a fan. The fan is installed in MD XI units only. Another distinguishing characteristic is the location of the drive expansion knockout. It is located in the upper right portion of the Revision C rear panel, rather than at the base. The Revision C chassis also has two screws provided for removal of the Micro Decision motherboard.

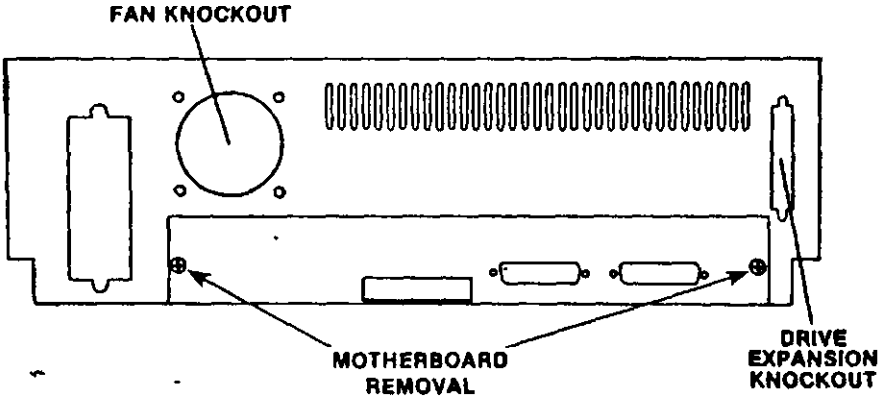


Figure 2-3: Revision C Chassis

2.1. Revision A Chassis

1. Remove the four screws on the bottom that hold the cover to the chassis (see Figure 2-4).

2. Now remove the two screws at the upper corners of the unit's back that hold the cover to the back panel.

3. Carefully remove the cover by sliding it off towards the front.

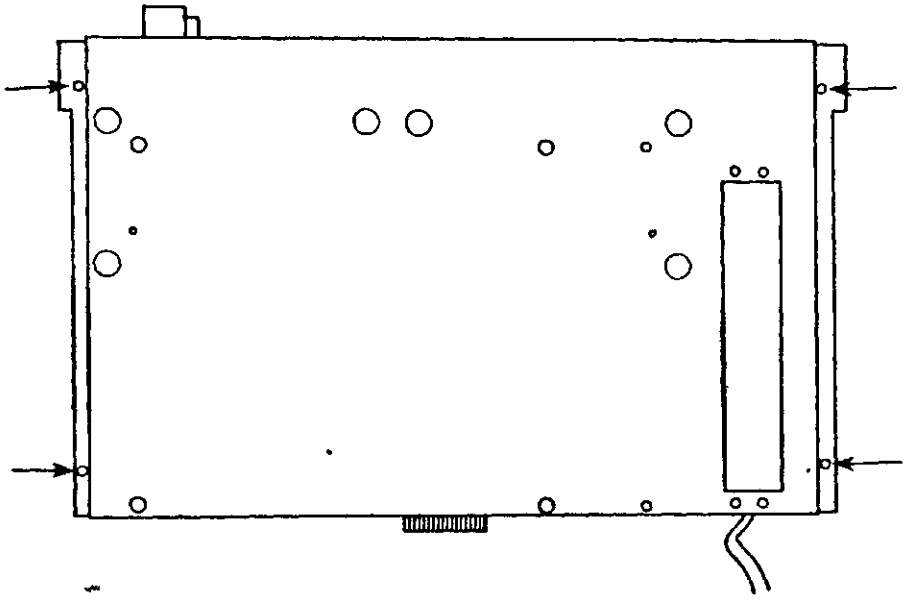


Figure 2-4: Cover Removal - Revision A Chassis

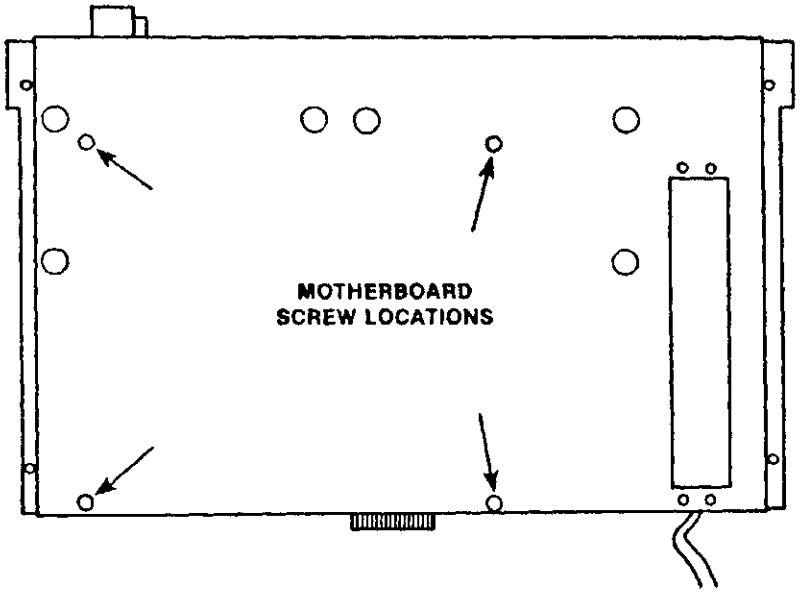


Figure 2-5: Location of Screws - Revision A Chassis

2.2. Revision B and C Chassis

1. Remove the four screws closest to the edge (two on either side).

   NOTE: A magnetized screwdriver is not required when working on Revision B and C chassis.

2. Tip the unit and rest it on the rear panel.

3. Slide the cover up and off.

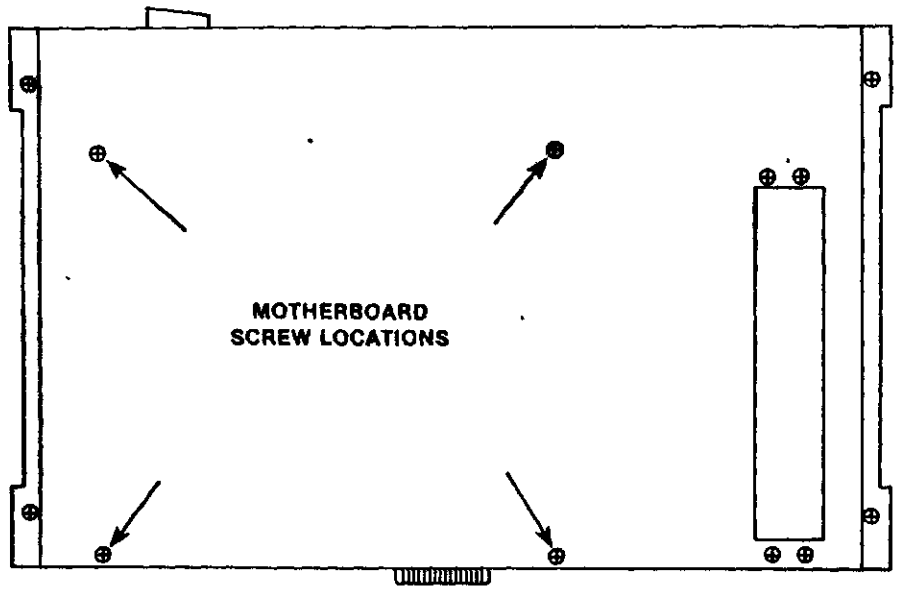


Figure 2-6: Location of Screws - Revision B Chassis

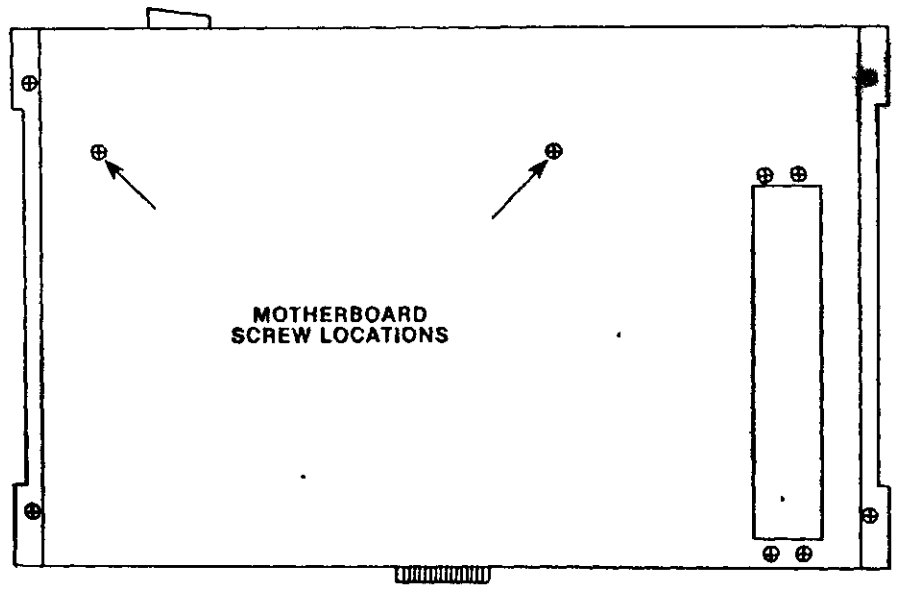


Figure 2-7: Location of Screws - Revision C Chassis

3. DISK DRIVE CONFIGURATION AND REMOVAL

There are three drive configurations for the Micro Decision:

MD I - One 3/4 high, single sided, 5 1/4 inch floppy drive, mounted at the left (as you face the unit)

MD II - Two 3/4 high, single sided, 5 1/4 inch floppy drives, mounted side by side

MD III - Two 1/2 high, double sided floppy drives, stacked (drive B mounted above drive A) in the left half of the unit (as you face the front)

Drive removal depends on the configuration of the drives and the type of chassis in which these drives are installed.

NOTE: When removing MD II or MD III drives from a Revision 1.1 motherboard, it is very important that you mark disk drives as A or B, since they must go back in the same positions from which they came. The best method is to place a piece of masking tape on the B drive with a note "next to power supply".

3.1. MD I and MD II - Revision A Chassis

1. Turn the unit upside down and remove the three screws that anchor the drive you wish to remove. Figure 3-1 points out the positions of the screws for both drives.

2. While holding the loosened drive in place, turn the unit right side up. Disconnect the drive cable and carefully pull it backwards out of the chassis.

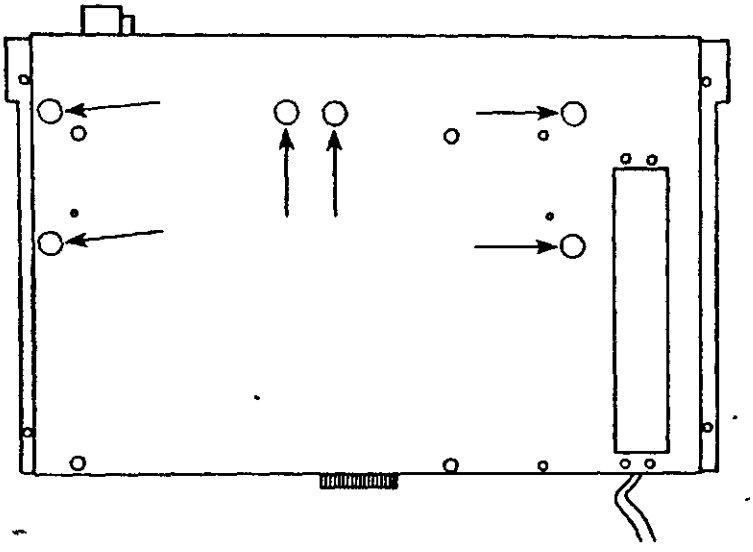


Figure 3-1: MD I/MD II Drive Removal - Revision A Chassis

3.2. MD III - Revision A Chassis

1. Follow the instructions provided for MD I and MD II drive removal (Section 3.1).

2. Remove the strap which holds the two drives together. Remember to mark one or both of the drives; drive B must be reinstalled on top of drive A.

3.3. MD I and MD III - Revision B and C Chassis

1. Disconnect the flat ribbon cable(s) from the connector(s) on the drive(s). Then disconnect the cable(s) to the motherboard. For MD III configurations, we recommend that you mark the cables for drive B to identify them when reinstalling the drive.

2. Remove the two bottom screws from the brackets on the left (see Figure 3-2A).

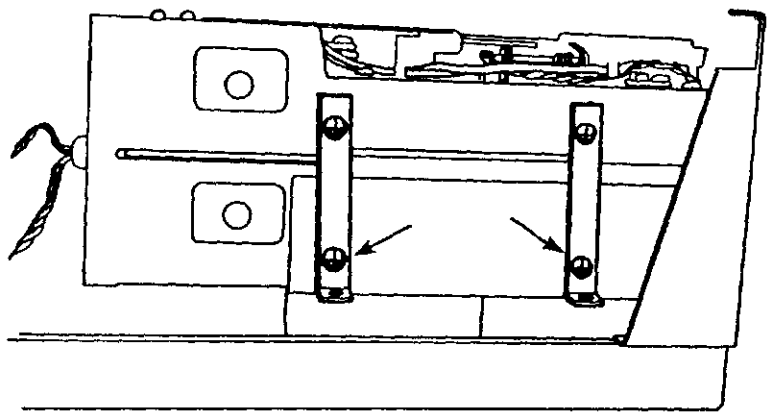


Figure 3-2A: MD I/MD III Drive Removal - Revision B and C Chassis

3. Remove the screw at the base of the "L" bracket on the right side as viewed from the front of the unit (see Figure 3-2B).

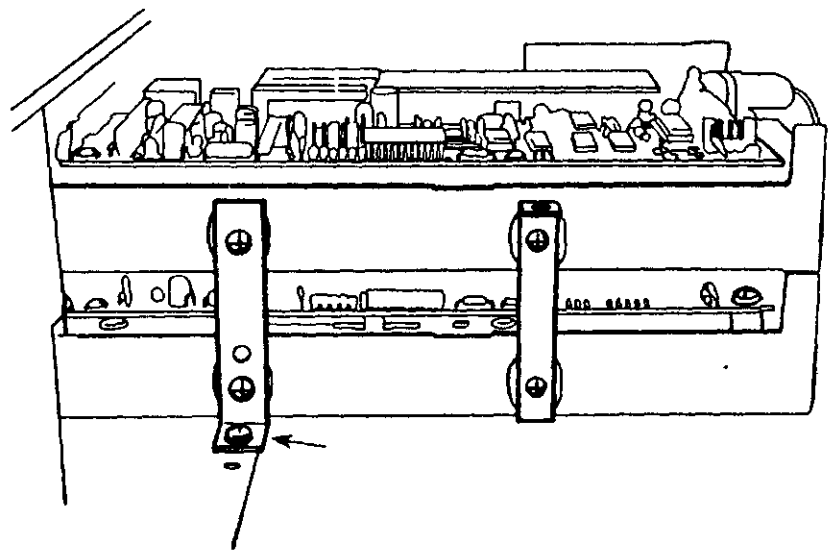


Figure 3-2B: MD I/MD III Drive Removal - Revision B and C Chassis

4. Slide the drive(s) toward the rear and out.

5. To separate and remove individual drives (MD III), remove the two bottom screws from the straps on the right side of the drives.

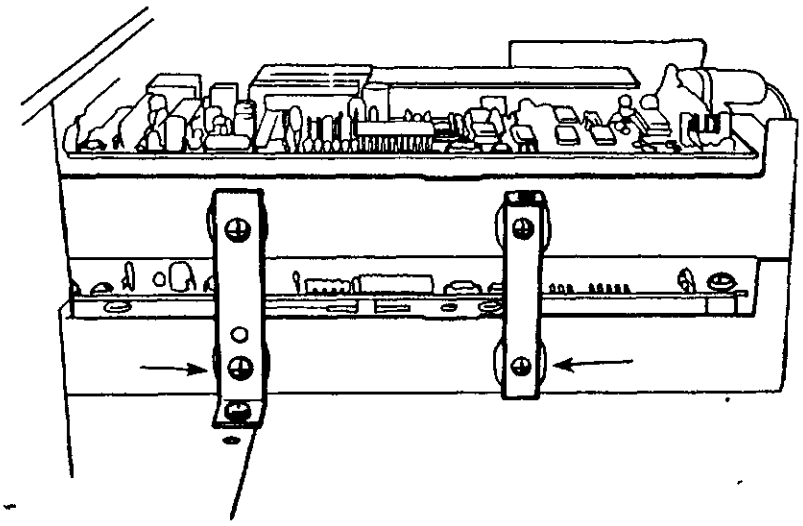


Figure 3-3: Separating MD III Drives - Revision B and C Chassis

3.4. MD II - Revision B and C Chassis

1. Remove the cable connectors from the drive you wish to remove.

2. Remove the screw at the base of the bracket holding the two drives (see Figure 3-4A).

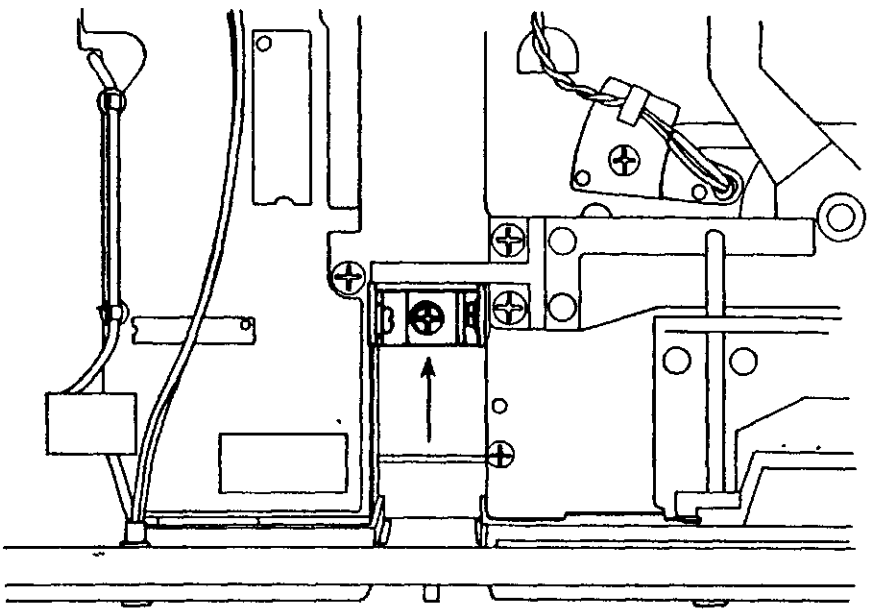


Figure 3-4A: MD II - Revision B and C Chassis - Drive Removal

a. If removing the A drive, remove the two screws on the support bracket (see Figure 3-4B).

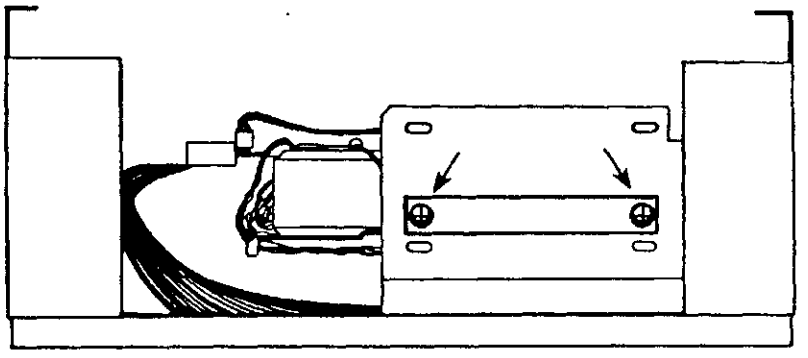


Figure 3-4B: MD II - Revision B and C Chassis - Drive Removal

b. If removing the B drive, you must first remove the power supply (see Section 4), and then unscrew the support bracket.

3. Toggle the "L" bracket connected to the drive as shown in Figure 3-4C.

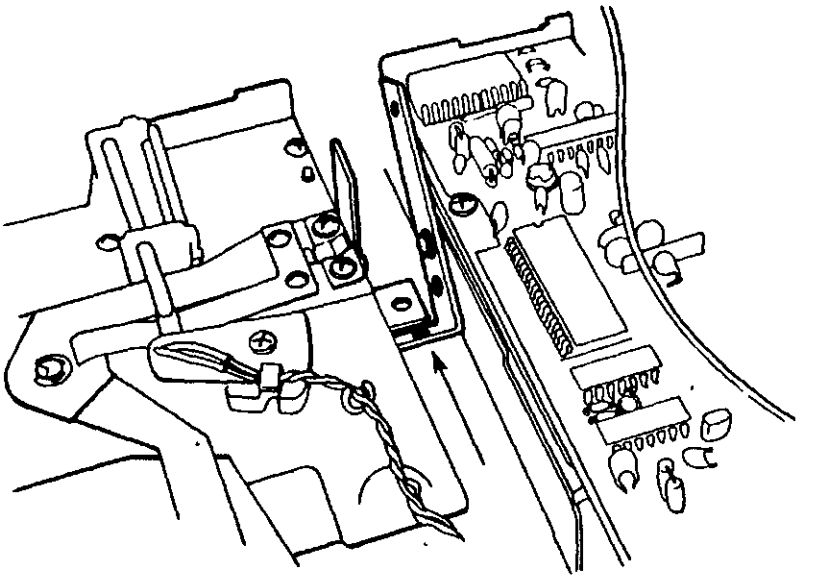


Figure 3-4C: MD II - Revision B and C Chassis - Drive Removal

4. Carefully pull the drive toward the rear of the unit.

4. POWER SUPPLY REMOVAL

The location of screws used to remove the power supply is identical for all chassis revisions. Figure 4-1 shows the Revision B chassis, but can also be used as reference for Revision A and Revision C power supply removal.

Procedures for power supply removal, which are dependent on the type of chassis being serviced, are documented below.

4.1. Revision A Chassis

1. If removing the power supply from an MD II, remove the B drive as described in Section 3.1.

2. Disconnect the power supply harness from the mother board and the cable that powers the LED in the Reset switch.

3. With the unit upside down, remove the four screws on either side of the power supply's ventilation grill (see Figure 4-1). The power supply will drop lightly onto the bench.

4. When installing the new power supply, route its wires as far away from drive B as possible. Make sure you do not pinch any wires between the power supply and the chassis.

4.2. Revision B and C Chassis

1. With the unit upside down, remove the four screws on the either side of the power supply's ventilation grill (see Figure 4-1). The power supply will drop lightly onto the bench.

2. If removing the power supply from an MD II, remove the B drive as described in Section 3.4.

3. Disconnect the power supply harness from the mother board and the cable that powers the LED in the Reset switch.

4. When installing the new power supply, route its wires as far away from drive B as possible. Make sure you do not pinch any wires between the power supply and the chassis.

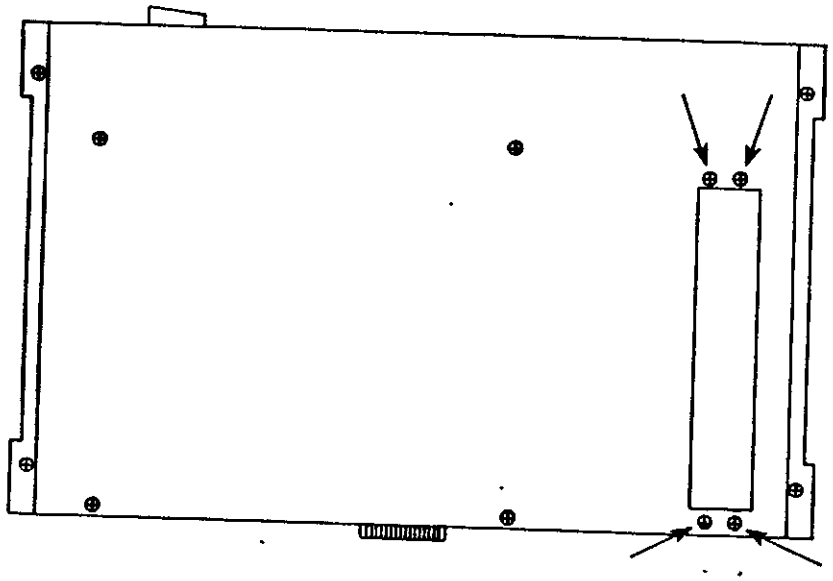


Figure 4-1: Power Supply Removal

5. MOTHERBOARD REVISIONS

Morrow supports two Micro Decision Motherboard revisions: Rev 1.1 and Rev 2.0. The Rev 1.1 boards were phased out May 27, 1983 and are generally found in Revision A chassis. Refer to Figure 5-1 for a layout of this board.

Rev 2.0 boards expand the Micro Decision capabilities. There are two versions of this board; one board is manufactured by Kohjinsha in Japan (see Figure 5-2) and the other is assembled in Korea (see Figure 5-3). These boards are generally mounted in Revision B and Revision C chassis.

5.1. Revision 1.1 Details

Figure 5-1 illustrates the layout of this motherboard. Table 5-1 lists the port addresses, and Table 5-2 provides a bit map for RAM chip replacement.

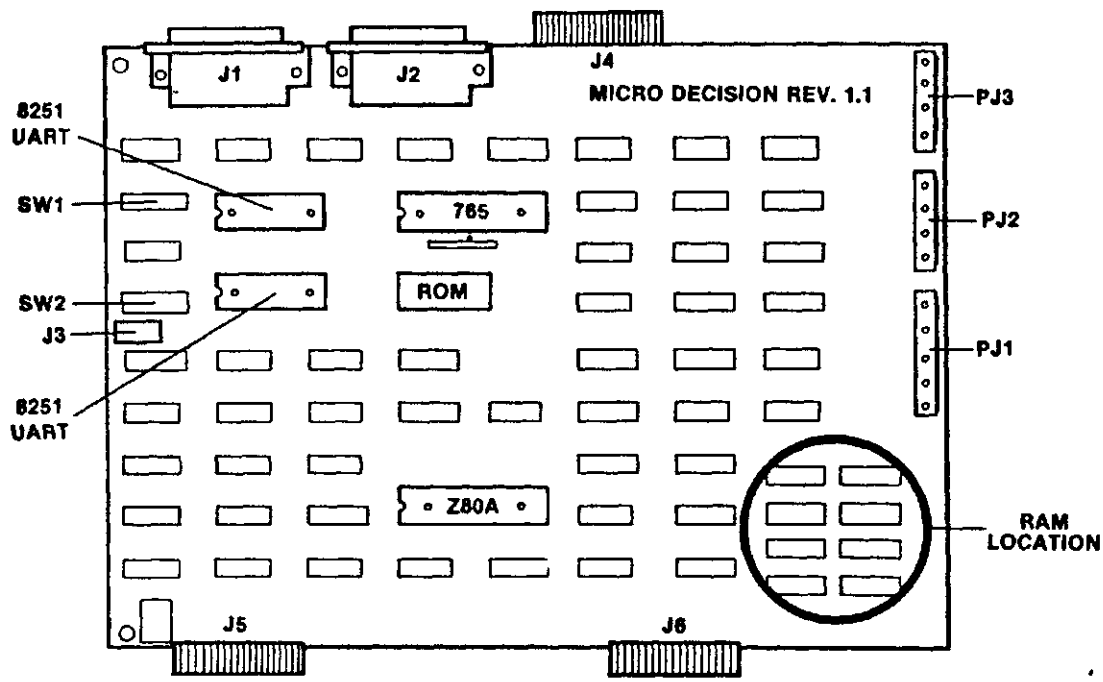


Figure 5-1: Micro Decision Rev 1.1 Motherboard

Table 5-1: Micro Decision Rev 1.1 Port Addresses

PORT	FUNCTION
OF5	MOTOR CHECK PORT
OF6	ROM ENABLE/DISABLE (out=enable/in=disable)
OF7	VFO COUNT SET PORT
OF8	MOTOR & SHIFT CONTROL
OFA	UPD-765 STATUS
OFB	UPD-765 DATA
OFC	1st. SERIAL PORT DATA
OFD	1st. SERIAL PORT STATUS
OFE	2nd. SERIAL PORT DATA
OFF	2nd. SERIAL PORT STATUS

Table 5-2: Rev 1.1 Bit Map (RAM Location)

BIT	LOCATION
0	9G
1	8G
2	9H
3	8H
4	9J
5	8J
6	9K
7	8K

5.2. Motherboard Removal

CAUTION! When handling motherboards, you should take care to avoid damage to them through electrostatic discharge. Ideally you should wear a grounded wriststrap, but we doubt you will; so at least moisten carpets with a spray bottle and discharge yourself by touching the Micro Decision chassis frequently as you work. Handle the board by the edges, and avoid touching IC leads or solder connections.

1. Remove both disk drives as described above.

2. Disconnect all cables from the motherboard. You will not be able to disconnect the ribbon cables leading to the disk drives, as they are glued to the motherboard and are replaced along with the board.

3. If the unit has a cord pan (rectangular box) attached to the inside of the back panel, remove it by removing the four screws that secure it to the back panel.

4. Rest the unit on its side. If disassembling a Revision A or Revision B chassis, remove the four screws on the bottom that hold the motherboard to the chassis (see Figure 2-5 or 2-6). If working with a Revision C chassis, remove the two screws on the bottom and the two screws on the rear panel which secure the motherboard (see Figure 2-3 and Figure 2-7). Support the board with your hand (do NOT push hard against it) when you remove the last screw, to keep it from falling.

5. Put the unit back on its bottom. Slide the motherboard toward the front of the chassis until the peripheral cable connectors are on the inside of their cutouts. Then gently lift the board out by its rear end, sliding it away from the front of the chassis as you go.

5.3. Revision 2.0 Features

The Micro Decision Rev 2.0 board differs with the Rev 1.0 board in several aspects:

1. The addition of a Centronics compatible parallel port.

2. Software selectable baud rate generator (Intel 8253).

3. 40 pin I/O connector (for future enhancements).

4. Internal ROM diagnostics for testing the function of the board.

5. Improved floppy disk data separator.

The new Rev 2.0 board will not effectively run CP/M with a Morrow revision lower than 2.1. The Rev 1.0 board will not run CP/M with a Morrow revision greater than Rev 1.6.

External disk drives (C and D) are now "daisy-chained" from drive "B" since the parallel connector is located where the drive expansion connector was on the Rev 1.1 board. External drives are also configured differently for the Rev 2.0 board.

The Micro Decision uses two different Rev 2.0 board layouts. One board is manufactured by Kohjinsha Inc. It can be identified by the Kohjinsha label located to the right of the board near the power plugs (PJ1-PJ3) on the component side. The jumper for the diagnostics is labeled JP4, and is at location A-5, 6. The 40 pin I/O connector is at location F-1 thru K-1. Refer to Figure 5-2 for a diagram of this board.

The second board can be identified by the "ASSEMBLED IN KOREA" label located to the right of the board near the power supply. Also, the power connectors (PJ1) are located differently, location A, B-8. The jumper for the diagnostics is labeled E5, and is at location A-6, 7. The 40 pin I/O connector is at location A-6, 7 thru D-6, 7. Figure 5-3 illustrates the layout of this board.

The two boards are functionally identical. Port addresses, which apply to both layouts, are listed in Table 5-3.

Table 5-3: Micro Decision Revision 2.0 Port Addresses

PORT	FUNCTION
OF0 OF1 OF2 OF3	8253 BAUD RATE GENERATOR
OF4	CENTRONICS DATA PORT
OF5	CENTRONICS STATUS PORT read bit 3 ACK=1 write bit 7 strobe=0 read bit 4 busy=1

All other ports remain the same as Rev 1.1 (see Table 5-1).

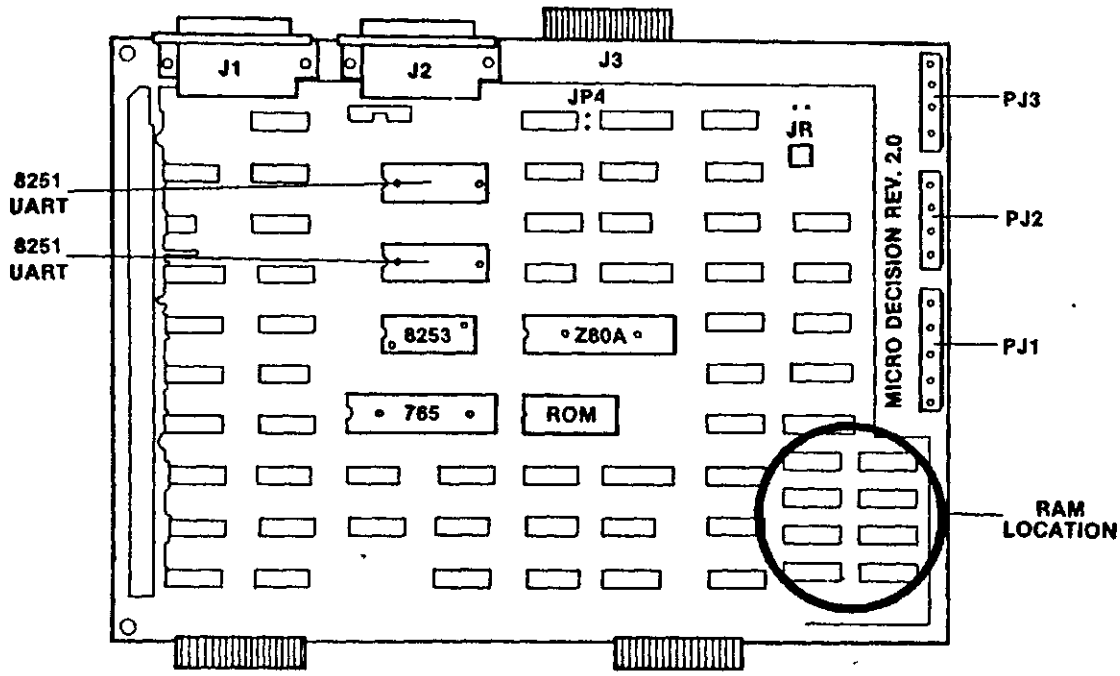


Figure 5-2: Rev 2.0 Motherboard - Kohjinsha

Table 5-4: Rev 2.0/Kohjinsha Bit Map (RAM Location)

BIT	RAM LOCATION
0	8J
1	8J/K
2	8K
3	8L
4	9J
5	9J/K
6	9K
7	9L

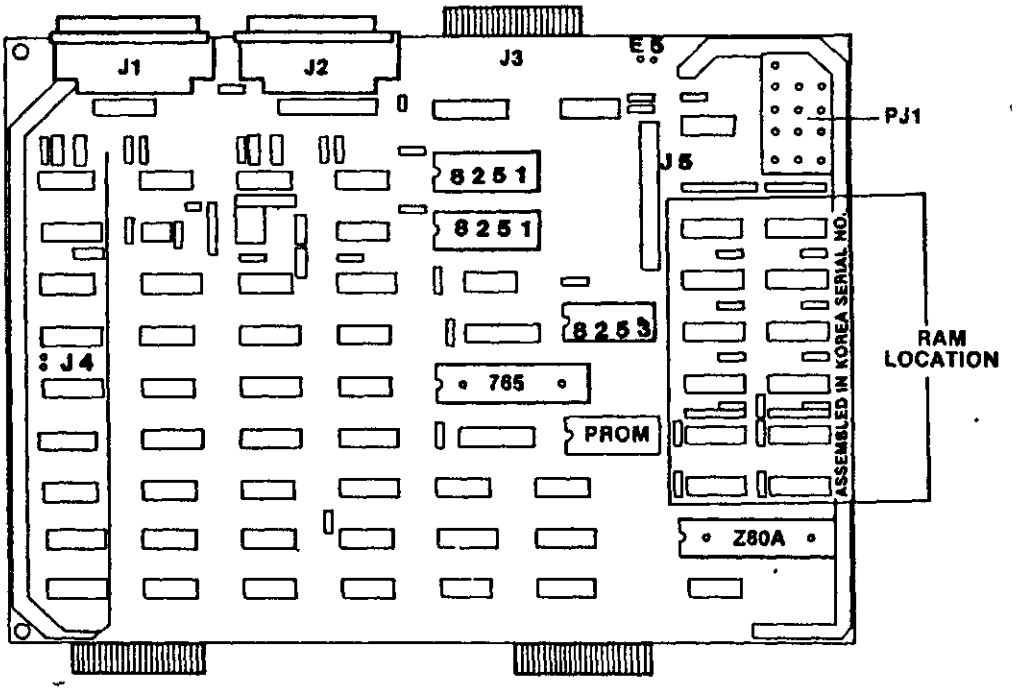


Figure 5-3: Rev 2.0 Motherboard - Korean Assembled

Table 5-5: Rev 2.0/Korean Assembled Bit Map (RAM Location)

BIT	RAM LOCATION
0	8C
1	8D
2	8E
3	8F
4	7C
5	7D
6	7E
7	7F

5.3.1. Parallel Port

The Micro Decision's unidirectional parallel port is a Centronics compatible port employing a 34 pin edge connector for connection to a printer. The data is transferred through a 74LS374 tri-state buffer to the connector. The addresses for the ports are listed in Table 5-6.

Table 5-6: Parallel Port Addresses

F4	Data port
F5	Status port Read: bit 3 = 1=ACK bit 4 = 1=Busy Write: bit 7 = Strobe

The signals for the 34 pin edge connector are listed in Table 5-7 (Rev 2.0 Kohjinsha) and Table 5-8 (Korean-assembled Rev 2.0 board).

Table 5-7: Parallel Port Signals (Kohjinsha Rev 2.0 Board)

PIN	SIGNAL
1	STROBE (neg.)
3	DB0
5	DB1
7	DB2
9	DB3
11	DB4
13	DB5
15	DB6
17	DB7
19	Acknowledge (neg.)
21	Ready/Busy

Even pins 2-24, 34 twisted pair ground; all other pins n/c

Table 5-8: Parallel Port Signals (Korean Assembled Rev 2.0 Board)

PIN	SIGNAL
2	STROBE (neg.)
4	DB0
6	DB1
8	DB2
10	DB3
12	DB4
14	DB5
16	DB6
18	DB7
20	Acknowledge (neg.)
22	Ready/Busy

Odd pins 1 - 23, 33 twisted pair ground; all other pins n/c

The SETUP program on the CP/M diskette must be used to set the CP/M LST device to acknowledge the parallel port instead of the second serial port.

Special Notes:

If the terminal used with the Micro Decision will not operate at 9600 baud, you must run SETUP using the CP/M distribution diskette to create a system diskette first.

When you do this, don't be surprised when "garbage" appears on the screen each time you press the reset button. This is a garbled version of the message that normally tells you to insert the CP/M diskette and press Return. It is sent out at 9600 baud, so the installed terminal misinterprets it. After you press Return, however, the new baud rate takes over and everything proceeds normally from there.

5.3.2. Serial Ports

The serial connectors on the Micro Decision motherboard conform to RS-232 standards, and use DB 25/S connectors. Figure 5-4 shows the layout of the connector, and Table 5-9 identifies the signal associated with each of the pins.

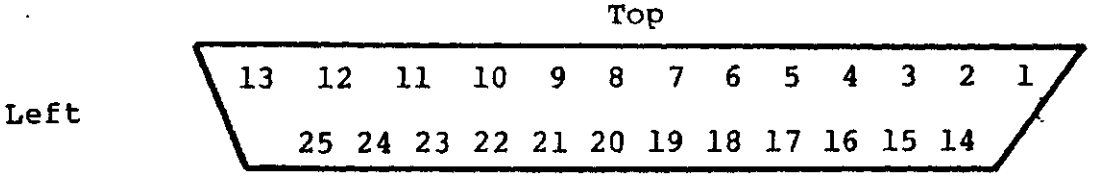


Figure 5-4: Serial Port Pin Arrangement - Rear View

Table 5-9: RS-232 Signal Descriptions

Pin #	Signal
1	Frame Ground
2	Receive Data Input
3	Transmit Data Output
4	Request to Send Input
5	Clear To Send Output
6	Data Set Ready Output
7	Signal Ground
8	Carrier Detect Output
9 *	+12V Output
10 *	-12V Output
11 *	Alternate Handshake Line
14 *	+5V Output
17 *	Receiver Clock Output
20	Data Terminal Ready Input
24 *	Transmitter Clock Input

* These signals are available on the printer/modem connector only.

On the circuit board in front of each serial connector is a set of jumper headers labelled JPA and JPB. JPA has eight pairs of jumpers for defining the terminal port; JPB has 13 pairs that define the printer/modem port. Slip-on connectors are used to make the RS-232 pin assignments. By changing the positions of some connectors, the ports can be configured for use with modems. The jumpers select whether the serial connector is set up to talk to DCE or DTE equipment.

JPA Factory Settings

The terminal port can be configured for DCE. The signal present on each jumper pin in JPA is shown in Table 5-10, along with the factory setting for the feeding of the signals to the RS-232 connector. The reason the pin numbers appear as 1 (1A) is that the board may be silkscreened in either of these two ways.

Table 5-10: JPA Pinouts (Terminal Setup)

JPA Pin #	Signal	RS-232 Pin #
1 (1A)	RxD to UART	2
2 (2A)	RD to terminal	3
3 (3A)	DSR to terminal	6
4 (4A)	DSR/ to UART	4
5 (5A)	DTR from terminal	N/C
6 (6A)	DTR/ from UART	5
7 (7A)	+12V	8
8 (8A)	+12V	8
9 (8B)	CTS/ to UART	8
10 (7B)	CD from terminal	8
11 (6B)	CTS to terminal	5
12 (5B)	CTS/ to UART	8
13 (4B)	RTS from terminal	4
14 (3B)	RTS/ from UART	6
15 (2B)	TxD from UART	3
16 (1B)	TD from terminal	2

This signal configuration is accomplished through circuit board wiring and the factory jumper settings, as shown in Figure 5-5.

When setting up JPA for use with a modem on the terminal port, the jumper modifications depend on whether the modem cable has pin 2 at one end tied to pin 3 at the other, and vice versa. This crisscrossing is frequently, but not always, found in modem cables. If you're not sure which type you have, use an ohmmeter or continuity tester to find out.

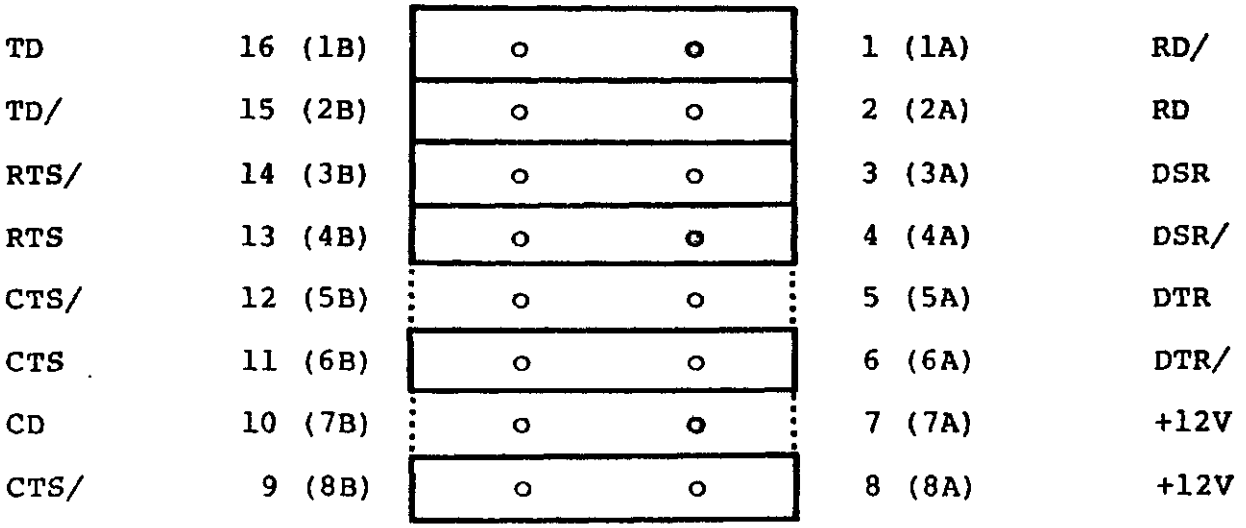


Figure 5-5: Factory Jumper Settings for JPA

JPA Settings for Modems

For cables that crisscross pins 2 and 3, arrange the jumpers as shown below.

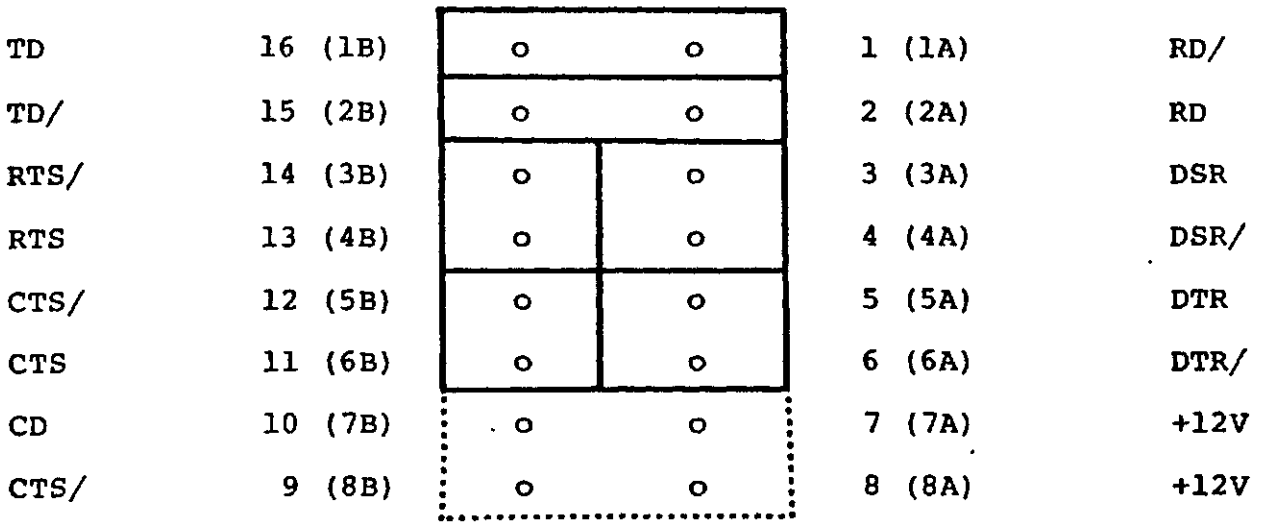


Figure 5-6: JPA Settings for Modems

For cables that connect pin 2 to pin 2 and pin 3 to pin 3, set the jumpers as shown in Figure 5-7 following.

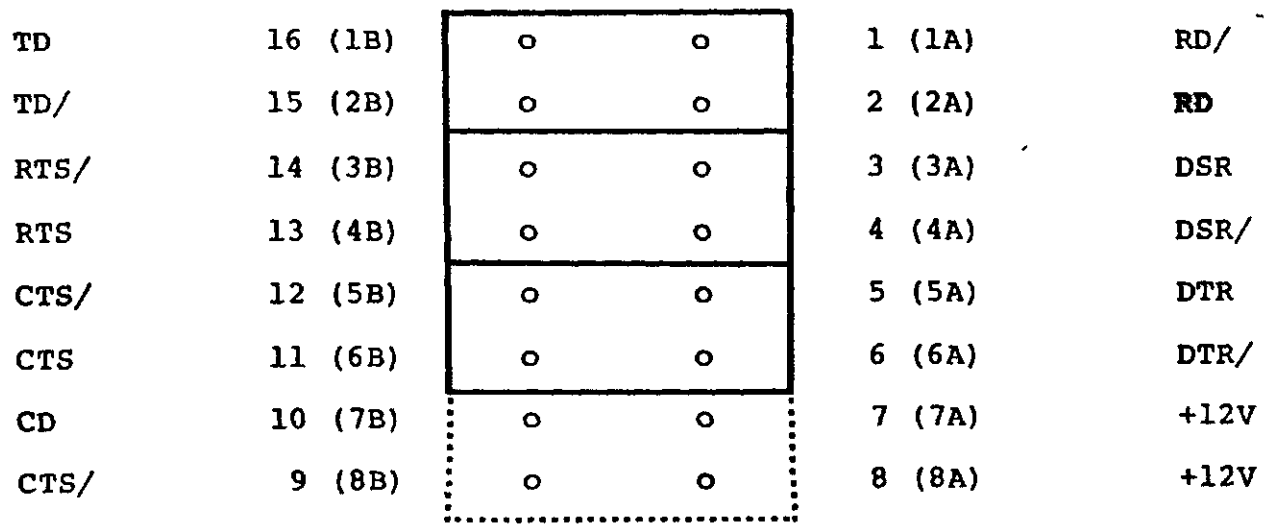


Figure 5-7: Jumper Settings (Pin 2 to Pin 2, Pin 3 to Pin 3)

Factory Settings for JPB

The printer/modem port would be configured for a modem if you want to use the Micro Decision as a host computer contacting remote computers or data bases.

The signal present on each jumper pin in JPB is shown in Table 5-11, along with the factory setting for the feeding of the signals to the RS-232 connector. The reason the pin numbers appear as 1 (1A) is that the board may be silkscreened in either of these two ways.

Table 5-11: JPB Pinouts (Terminal Setup)

JPA Pin #	Signal	RS-232 Pin #
1 (1A)	RxD to UART	2
2 (2A)	RD to terminal	3
3 (3A)	DSR to terminal	6
4 (4A)	DSR/ to UART	20
5 (5A)	DTR from terminal	20
6 (6A)	DTR/ from UART	5
7 (7A)	TTL false (<-3V)	8
8 (8A)	TTL false	8
9 (9A)	TTL false	8
10 (10A)	Receiver Clock to modem	17
11 (11A)	RS-232 Receiver input	N/C
12 (12A)	TTL output of RS-232 rcvr	N/C
13 (13A)	N/C	
14 (13B)	Baud Clock output	N/C
15 (12B)	Baud Clock input to UART	N/C
16 (11B)	TC (External Clock)	24
17 (10B)	RS-232 level clock out	N/C
18 (9B)	DET (alternate handshake)	11
19 (8B)	CTS/ to UART	8
20 (7B)	CD from terminal	8
21 (6B)	CTS to terminal	5
22 (5B)	CTS/ to UART	8
23 (4B)	RTS from terminal	4
24 (3B)	RTS/ from UART	6
25 (2B)	TxD from UART	3
26 (1B)	TD from terminal	2

This signal configuration is accomplished through circuit board wiring and the factory jumper settings as shown in Figure 5-8.

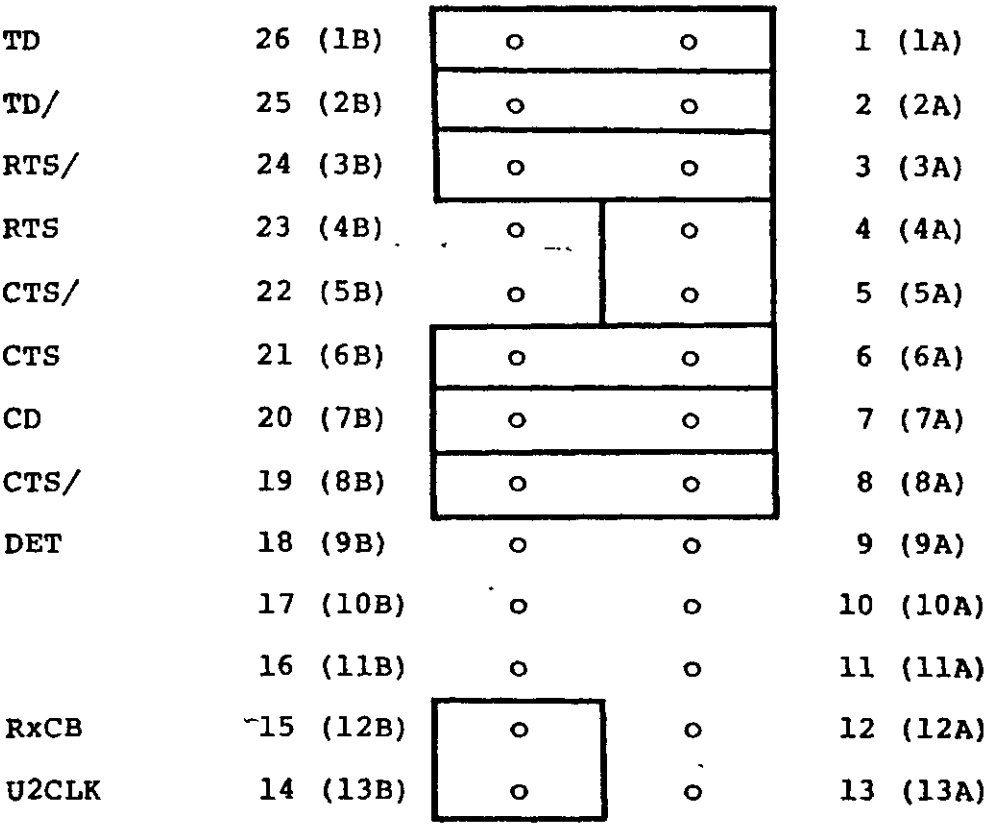


Figure 5-8: Factory Jumper Settings for JPB

JPB Settings for Modems

As was mentioned above for JPA, the jumper setting for JPB depend on the type of modem cable you have. For cables that crisscross pins 2 and 3, arrange the jumpers as shown in Figure 5-9.

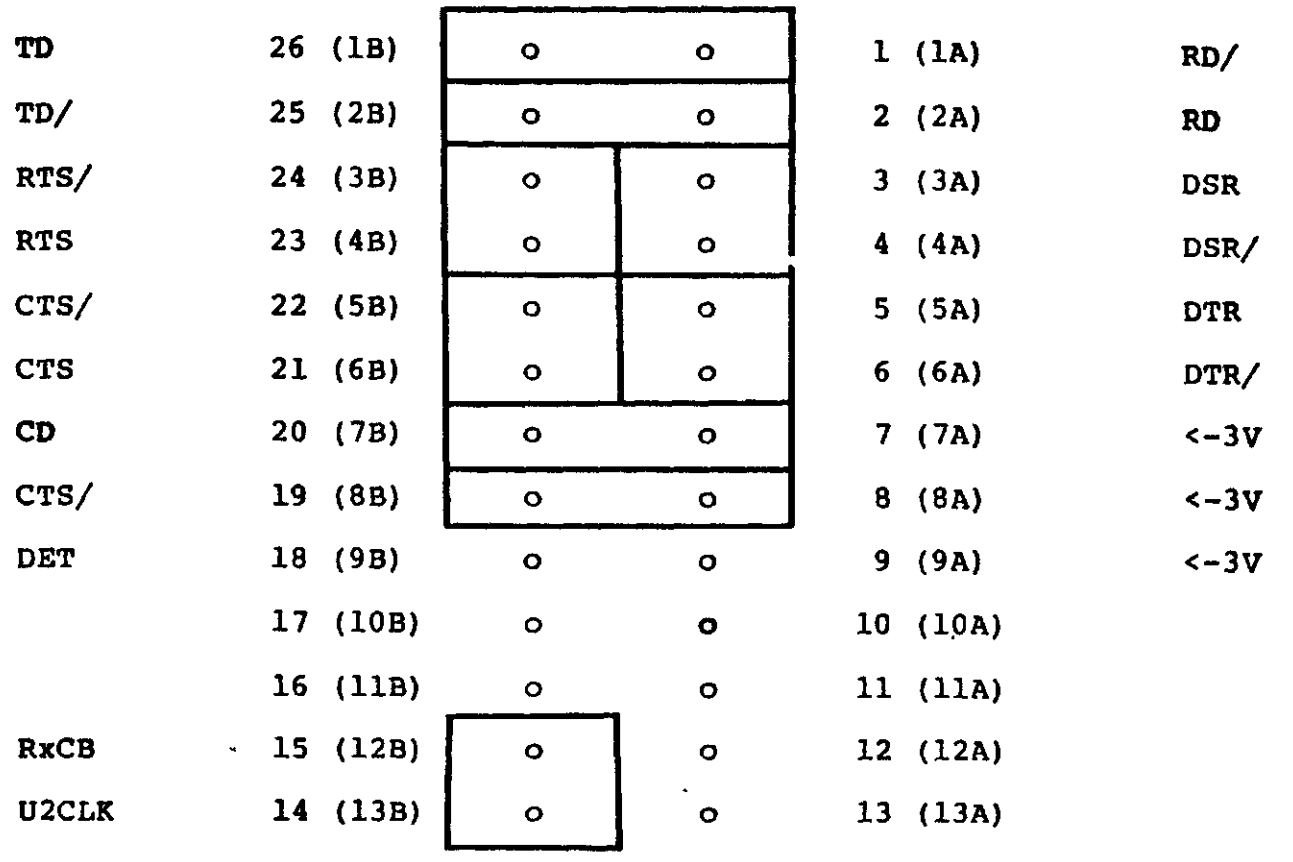


Figure 5-9: JPB Jumper Settings (Crisscross Modem Cable)

When using a modem cable that connects pin 2 to pin 2 and 3 to 3, use of the jumper setup is the same as above except for positions 1 (1A), 2 (2A), 25 (2B), and 26 (1B). See the difference below.

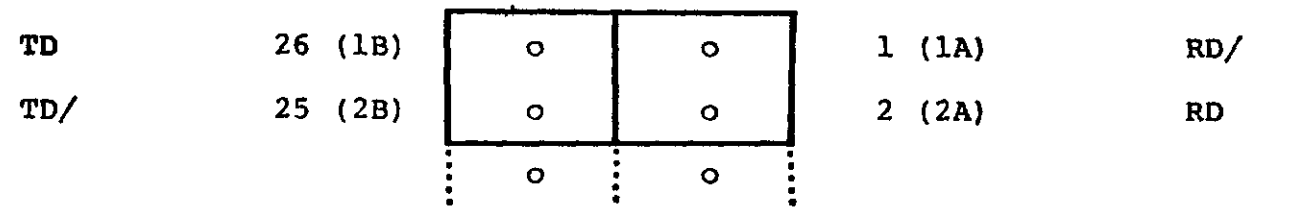


Figure 5-10: Alternate JPB Jumper Settings

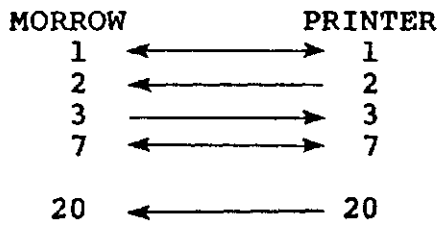
Sample RS-232 cable configurations are provided in Table 5-12 following.

Table 5-12: Sample RS-232 Cable Configurations

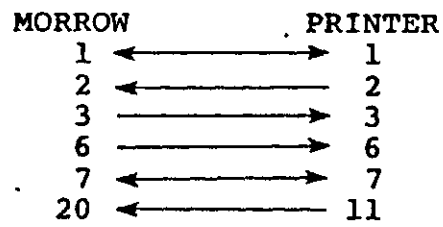
LEGEND for Table 5-9:

#1 MORROW MP 200 EPSON IDS PRISM	#4 SMITH CORONA
#2 OKIDATA	#5 C. ITOH DIABLO QUME NEC (Xon-Xoff)
#3 TI 810 QUME COMREX DAISY WRITER	

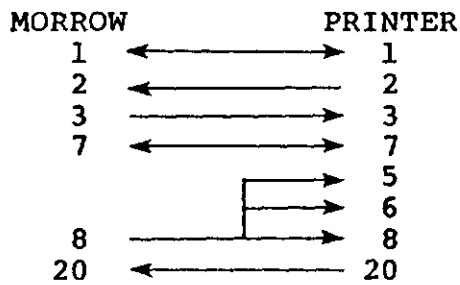
Sample #1



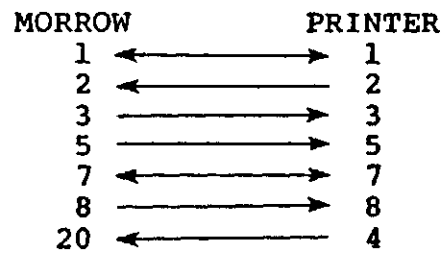
Sample #2



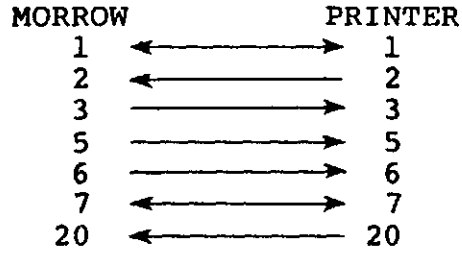
Sample #3



Sample #4



Sample #5



5.3.3. 40 Pin I/O Connector

The 40 pin I/O connector connects the Micro Decision with the outside world. The pin connections for the buss are listed in Table 5-13; unlabeled pins are grounded.

Table 5-13: 40 Pin I/O Connector - Pin Connections

/BRD	1	Buffered IO Read
/BWR	3	Buffered IO Write
/RESET	5	Z80 Reset Line (Output)
/4M	7	4 MHz Z80 Clock
/IO00	9	Decoded IO Space at Location 00-0Fh
/IO10	11	Decoded IO Space at Location 10-1Fh
/IO20	13	Decoded IO Space at Location 20-Fh
/IO30	15	Decoded IO Space at Location 30-3Fh
AB3	17	Address Line 3
AB2	19	Address Line 2
AB1	21	Address Line 1
AB0	23	Address Line 0
DB7	25	Data Bus 7
DB6	27	Data Bus 6
DB5	29	Data Bus 5
DB4	31	Data Bus 4
DB3	33	Data Bus 3
DB2	35	Data Bus 2
DB1	37	Data Bus 1
DB0	39	Data Bus 0
+5v	38	
+5v	40	
+12v	36	
-12v	34	

5.3.4. ROM Diagnostics

The Micro Decision Rev 2.0 board has diagnostic routines built into the 4K ROM. To access the diagnostics, locate the jumper labeled JP4 or E5. Install a jumper block at that location and turn on the computer. If the power-on memory test passes, the following should appear on the screen:

```
1.   PORT 1              \
2.   PORT 2               >  BARBER-POLE TEST PATTERN
3.   CENTRONICS PORT     /
4.   LOOP BACK ON PORT 2
5.   RAM TEST
6.   FDC R/W
7.   FDC SEEKTEST
8.   VFO TEST
9.   BOOT

Enter #:
```

Description of Test:

NOTE: To end a test, press any key and wait for the Diagnostics Menu to reappear.

1. Port 1 test:

   This test transmits a "barber-pole" character pattern to the CRT.

2. Port 2 test:

   This test transmits a "barber-pole" character pattern to the device connected to serial port 2.

3. Centronics port test:

   This test transmits a "barber-pole" character pattern to a printer via the Centronics parallel port.

4. Loop back on port 2 test:

   This test verifies proper operation of the 8251 USART on port 2. A wrap plug with pins 2 and 3 jumpered and pins 5 and 20 jumpered must be used. This test will immediately show pass or fail.

5. Ram Test:

   This test runs a continuous ram test. The test will show any address which is found to be bad, the value expected and the value read from the bad address.

6. FDC (Floppy Disk Controller) Read/Write test:

   This test performs a "worst case" read/write test on the inner most track of a diskette, reporting errors to the screen. A freshly formatted diskette should be used.

7. FDC Seektest:

   This test will perform a butterfly seektest (outermost track to innermost track, working inward to center, and then back out again) on a selected disk drive.

8. VFO (Variable Frequency Oscillator) test:

   This test is used for verifying the proper operation of the PLL data separators. A frequency counter and a known good Shugart SA200 disk drive is required to perform this test. The SA200 disk drive must be installed as drive "A". Connect the lead of the frequency counter to the test point labeled VCOTP, at location E-1 on the Kohjinsha board, or the test point location labeled TP1 on the Korean assembled board. Insert a formatted diskette in drive "A", close the door and select the VFO Test from the menu. Open the disk drive door and read the frequency. The frequency should read 480Khz ±30Khz on the Kohjinsha board, or 500 Khz ±30Khz on the Korean assembled board. Ignore intermittent fluctuations in frequency of greater than 10 Khz.

9. Boot:

   Selecting item 9 will cause the system to boot a diskette in drive "A".

Remember to remove jumper block after completing diagnostics.

5.3.5. Drive Expansion

External disk drives (C and D) are "daisy-chained" from drive "B". When external drives are added to an MD II or MD III, the current 34 pin ribbon data cable must be removed and a new ribbon cable must be installed in its place (see Figure 5-11). This new cable consists of two edge connectors and one 2 X 16 header plug. One of the edge connectors is connected to drive B, and the other is connected to the motherboard (see Section 5.3.6, Disk Drive Connector). The header plug must be installed in the rear of the chassis where the "knockout" plug is located (directly above the parallel port). The cable supplied with the external drive is an identical mating cable.

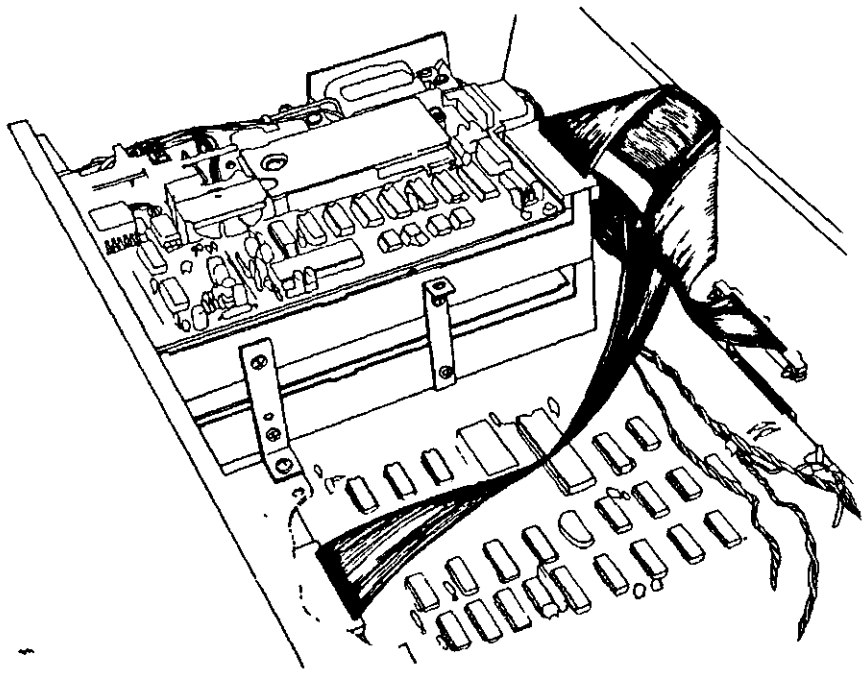


Figure 5-11: Drive Expansion

Once the new cable is installed, the termination block should be removed from drive "B". Drive "D" should be terminated if it is to be the last drive on the chain. Drive "C" is to be selected as the second drive (DS2) and drive "D" as the third drive (DS3). Drive "C" is not terminated unless it is the last drive on the chain, then the terminator block is not removed. Drive "A" is to be left unchanged.

The CP/M distribution diskette must be booted to make a new CP/M working diskette with the change in the number of drives installed on the system.

5.3.6. Disk Drive Connector

The disk drives are connected to the motherboard through two 34 pin edge connectors labeled JD0 for drive A, and JD1 for drives B through D. Drives C and D are daisy-chained from drive B (see Drive Expansion, Section 5.3.5). The pinouts for the connectors are listed in Table 5-14.

Table 5-14: Disk Drive Connectors - Pin Connections

JD0		JD1	
8	/INDEX	8	/INDEX
10	/DS0	10	/DS0
16	/MOTOR	12	/DS1
18	/DIRECTION	14	/DS2
20	/STEP	16	/MOTOR
22	/WRITE DATA	18	/DIRECTION
24	/WRITE GATE	20	/STEP
26	/TRACK 0	22	/WRITE DATA
28	/WRITE PROTECT	24	/WRITE GATE
30	/READ DATA	26	/TRACK 0
32	/SIDE SELECT	28	/WRITE PROTECT
		30	/READ DATA
		32	/SIDE SELECT

All odd numbered pins on JD0 and JD1 are grounded.

6. TROUBLESHOOTING PROCEDURES

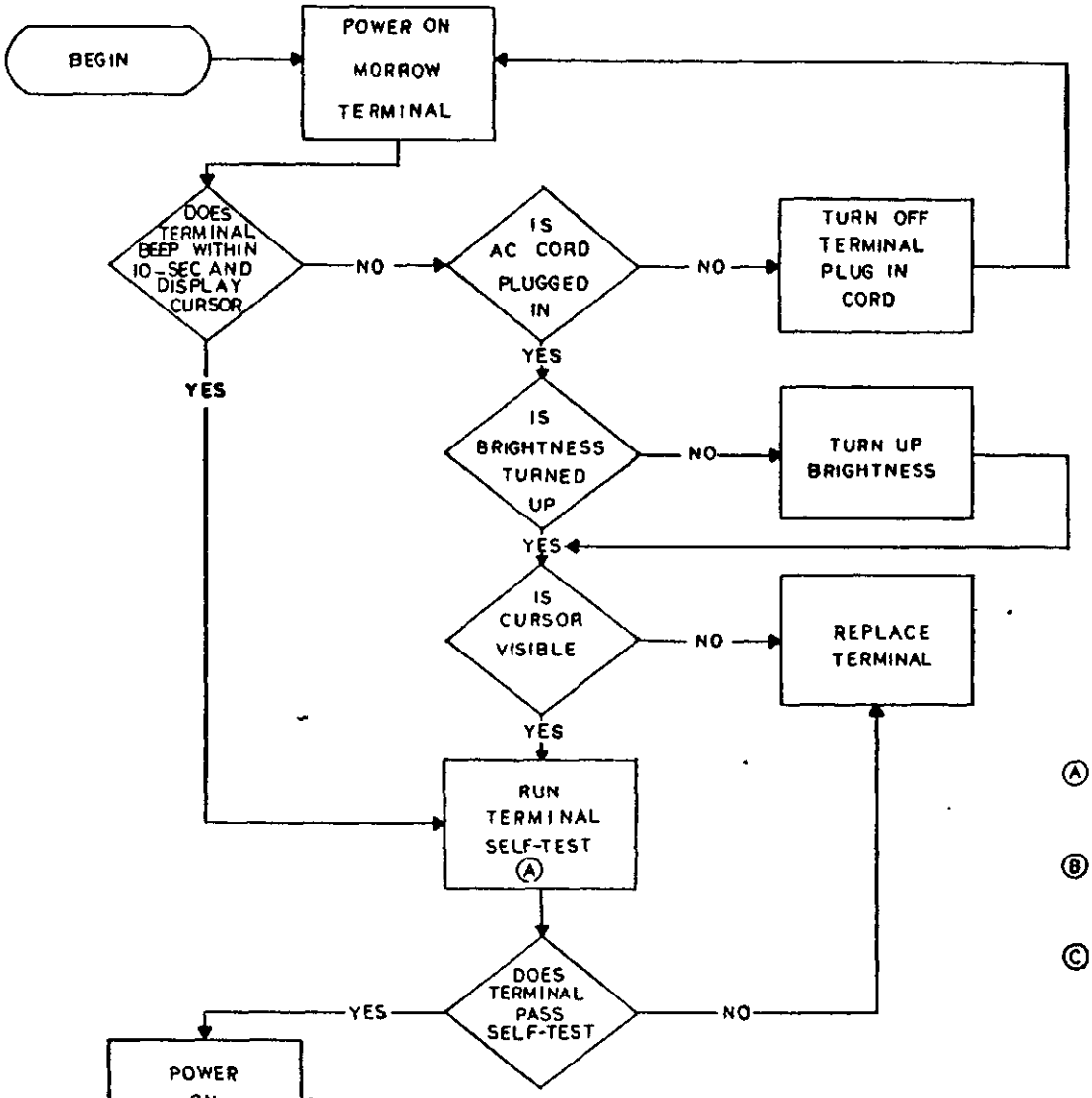
6.1. Tools Required

You will need the Phillips screwdriver, the Diagnostic II diskette, and a digital voltmeter. The meter (Kiethley model 132 or equivalent) is needed when the power supply is suspect, and is also useful for checking the continuity of cables. Another helpful device is a floppy diskette head cleaning kit.

6.2. Troubleshooting Flowchart

Use the troubleshooting flowchart (see Table 6-1) for isolating a defective assembly within the Micro Decision, as well as for determining whether the trouble lies outside the computer (in cables or peripherals, for example). Follow the procedure as described in the figure.

If you find that the problem lies somewhere in the Micro Decision, you will be instructed to run the diskette diagnostic programs. You will need the Diagnostics II diskette and a terminal known to be working properly.



(A) PUT TERMINAL IN LOCAL TYPE ESC, @

(B) REVERSE RESET SWITCH PI IF IT STILL DOES NOT LI REPLACE SWITCH.

(C) VERIFY SWITCH SETTINGS TERMINAL AND COMPUTEF

Table 6-1, Continued
Troubleshooting Flowchart

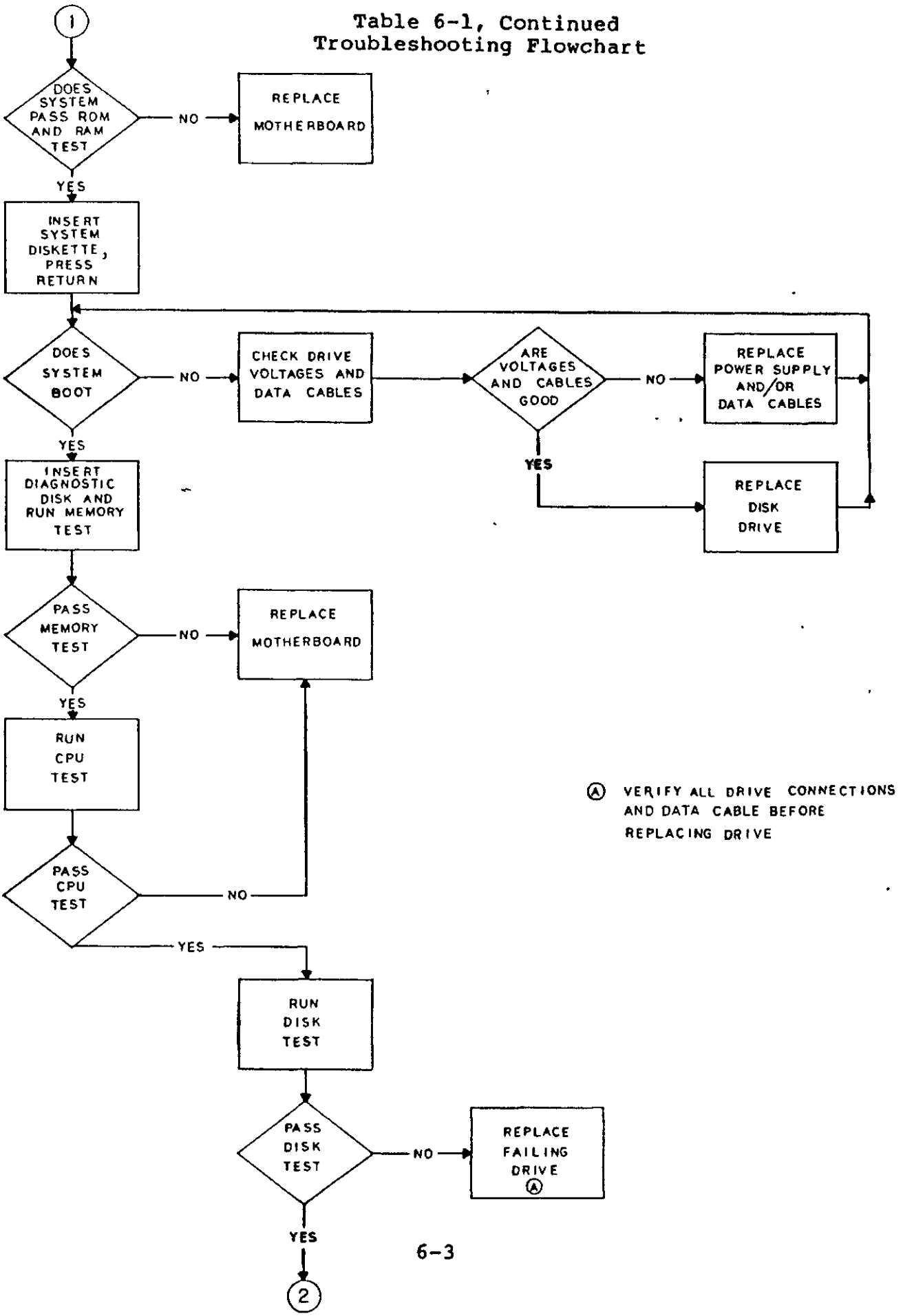
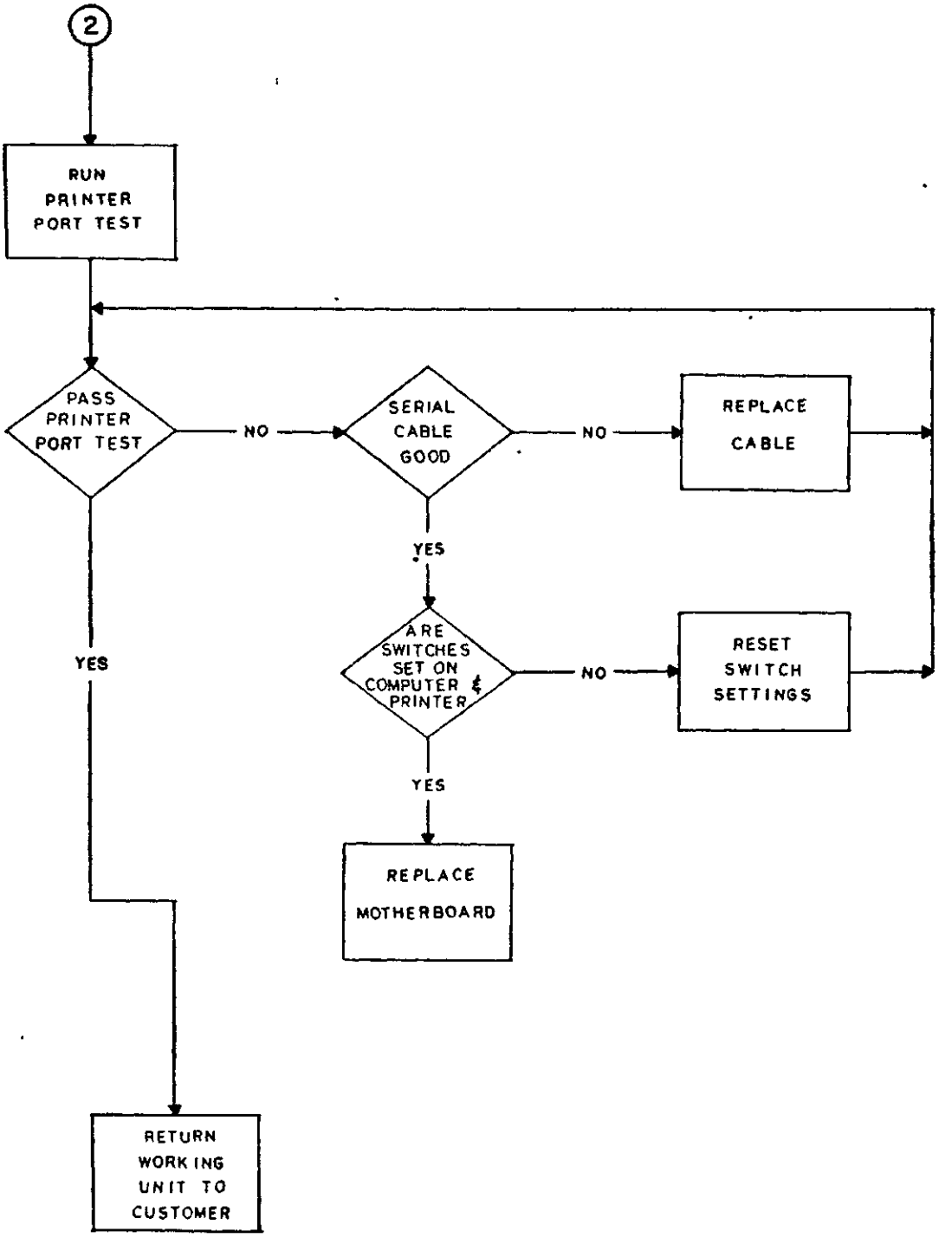


Table 6-1, Continued
Troubleshooting Flowchart



6.3. Measuring Power Supply Voltages

If you reach the point in the troubleshooting flowchart that tells you to "check power supply voltages", here is what you do:

1. With the power cord unplugged, remove the cover as described in Section 2. Then reconnect the power cord and turn the power switch ON.

2. Connect the ground lead (probably black) from the voltmeter to an exposed metal part of the chassis (preferably a drive). Use an alligator clip for best results.

3. Locate connector PJ3 on the motherboard, next to the power supply. Make sure your meter is set up to measure volts on the other meter probe into pin 1 (the red cable lead). You should measure +5 volts.

4. At pin 4 (the blue lead), the +12 volts that powers the disk drive motors should be present.

5. To check the + and -12 volts to Rev 2.0 motherboard circuitry, use the 40 pin I/O connector on the board:

+5v	Pins 38 and 40
+12v	Pin 36
-12v	Pin 34

   Voltage (+5v and +12v) to the Rev 1.1 boards can be checked from the disk drives. -12 volts can be checked from the 1488 serial buffer at location A-1.

6. If any or all of the voltages are missing, or if they vary from the specified voltage by more than 10%, the power supply should be replaced. Refer to Section 4, "Power Supply Removal" for instructions. However, this may not fix the problem (see Tips below).

7. Recheck the voltages even if the problem is cleared up; this is to be sure that nothing is putting too much of a load on the power supply.

6.4. Tips on Troubleshooting Power Supply Problems

A voltage that is lower than it should be could be caused by leakage or shorts outside of the power supply itself. Assuming that you have already substituted the power supply, try disconnecting the disk drives one at a time and rechecking the voltages as you go. If you get down to just the power supply and motherboard being connected and the voltage is still low, then replace the motherboard.

7. REPLACEMENT PARTS

Table 7-1: Replacement Parts List

PART NO.	DESCRIPTION
020-SA455	SA455
020-F5200	SA200 A. INSERT BRKT
125-MHLED	B. LED HARNESS
028-LED3105	1. LED (3 PC)
080-MFP	B. FRONT PANEL
500-PCBM-Rev 1.1 or Rev 2.0	ASSM PCB (REPRO ROM)
060-34122C	A. CABLE 34S 12"
102-SPM	B. STAND-OFF
125-MHDC	C. DC POWER CABLES
500-SWPSM	POWER SUPPLY
125-MHRESET	RESET HARNESS
096-06X14PST	SCREW (632 TYP "F")
096-3X6M-PP	SCREW 3X6MM PAN PHIL

The Dealer Service Kit follows in Table 7-2.

Table 7-2: Dealer Service Kit
(Effective Date: October 1, 1983)

PART #	950-0005-00	950-0006-00	950-0007-00
KIT	(A)	(B)	(C)
SYSTEM	MD I, MD II	MD III	Decision 1
PRICE	$650.00	$900.00	$2,870.00
INCLUDES:	1-Disk Drive 1S 1-Micro PCB 1-Micro SPS 1-LED Panel 1-Reset Harness 1-Connector 4P 1-Connector LED 1-Connector F1 2-Cable 34 S 4-Rubber Ft 1-Front Panel 6-Stand-offs	2-Disk Drive 2S 1-Micro PCB 1-Micro SPS 1-LED Panel 1-Reset Harness 1-Connector 4P 1-Connector LED 1-Connector F1 2-Cable 34 S 4-Rubber Ft 1-Front Panel 6-Stand-offs	1-HDDCA 1-MPZ80 1-DM256 1-Multi I/O 1-DJDMA 1-HDDMA 2-Sw Pwr Supply 1-DEC Buss 14 s 1-Reset switch 1-Complete set of manuals for each bd.

Notes:

Service Guide for Micro Decision	$225.00
Set of Manuals for Micro Decision	$ 54.00
Set of Manuals for Decision 1	$ 60.00

Above prices are NOT discountable.

All parts carry Morrow's factory warranty of 30 days from date of purchase. Remedy is limited to repair or replacement of the defective part at the option of Morrow. Parts supplied are reconditioned and are not to be resold as new. In any case, Morrow will not be liable for consequential damages arising from the use of its products.

Prices supersede those published June 1, 1983 in Dealer Information Bulletin #5. Prices are subject to chang without notice.

To order kits, please contact Customer Service. A maximum of one (1) service kit may be purchased for each 10 systems.

8. CUSTOMER SERVICE BULLETIN INDEX

BULL. #	DATE	SUBJECT	ISSUED BY
1	Nov. 82	Micro Decision 1.3 PROM/Software	T. Fruehan
2	Nov. 82	Micro Decision Power Supply Upgrade	T. Fruehan
3	Dec. 82	Micro Decision Software Remake	T. Fruehan
4		OBSOLETE	
5		OBSOLETE	
6	Feb. 83	MDT20 Terminal Terminal PROMs	T. Fruehan
7	Mar. 83	MDT50 Terminal Terminal Service	J. Patel
8	Mar. 83	Micro Decision Printer Port Info	T. Fruehan
9	Mar. 83	MDT20 Terminal Terminal Service	J. Patel
10	Apr. 83	MDT20 Terminal Terminal Mod.	T. Fruehan
11	Apr. 83	Micro Decision Terminal Configuration	T. Fruehan
12		Cancelled	
12-A	May 83	MP100, MP200, MP300 Printer Service	M. Dean
13	May 83	Micro Decision Rev 2.0 Board Release	T. Fruehan
14	May 83	DJDMA Board S-100 Bus Standards	N. Tilbury
15		Cancelled	
16	Jun. 83	Quest Software Software Support	T. Fruehan

17	Jun. 83	Micro Decision Software Upgrade	T. Frueh
18		Cancelled	
19	Jul. 83	Micro Decision PROM/Software Upgrade	R. Rowe
20		Cancelled	
21	Aug. 83	MDT 20 Terminal Terminal Service	M. Dean
22	Aug. 83	Micro Decision Printer Patch	L. Hamel
23	Sep. 83	Decision One Software Upgrade	W. Bingh
24	Sep. 83	Decision One Micronix	W. Bingh

MORROW
600 McCormick Street ☐ San Leandro ☐ California ☐ 94577

Morrow Micro Decision Board

Revision 2.0 Technical Information

Supplement

MICRO DECISION

Technical Support Services

D-USR

PARALLEL PORT

The Micro Decision's parallel port is a Centronics compatible port employing a 34 pin edge connector for connection to a printer. The data is transferred through a 74LS374 tri-state buffer to the connector. The addresses for the ports are:

```
F4          Data port
F5          Status port
             Read:  bit 3 = 1=ACK
                    bit 4 = 1=Busy

             Write: bit 7 = Strobe
```

The signals for the 34 pin edge connector are:

```
Odd pins 1 - 23, 33 twisted pair ground
     2              STROBE        (neg.)
     4              DB0
     6              DB1
     8              DB2
     10             DB3
     12             DB4
     14             DB5
     16             DB6
     18             DB7
     20             Acknowledge   (neg.)
     22             Ready/Busy
All other pins n/c.
```

The SETUP program on the CP/M diskette must be used to set the CP/M LST device to acknowledge the parallel port instead of the second serial port.

MICRO DECISION REVISION 1.0 PORT ADDRESSES

PORT	FUNCTION
0F5	MOTOR CHECK PORT
0F6	ROM ENABLE/DISABLE (out=enable/in=disable)
0F7	VFO COUNT SET PORT
0F8	MOTOR & SHIFT CONTROL
0FA	UPD-765 STATUS
0FB	UPD-765 DATA
0FC	1st. SERIAL PORT DATA
0FD	1st. SERIAL PORT STATUS
0FE	2nd. SERIAL PORT DATA
0FF	2nd. SERIAL PORT STATUS

MICRO DECISION REVISION 2.0 PORT ADDRESSES

0F0 0F1 0F2 0F3	8253 BAUD RATE GENERATOR
0F4	CENTRONICS DATA PORT
0F5	CENTRONICS STATUS PORT read bit 3 ACK=1 write bit 7 stobe=0 read bit 4 busy=1

All other ports remain the same.

40 PIN I/O CONNECTOR

The 40 pin I/O connector connects the Micro Decision with the outside world.

The pin connections for the buss are:

/BRD	1
/BWR	3
/RESET	5
/4M	7
/IO00	9
/IO10	11
/IO20	13
/IO30	15
AB3	17
AB2	19
AB1	21
AB0	23
DB7	25
DB6	27
DB5	29
DB4	31
DB3	33
DB2	35
DB1	37
DB0	39
+5v	38
+5v	40
+12v	36
-12v	34

unlabeled pins are grounded

The 40 pin I/O connector is at location F-1 through K-1, or locations A-6,7 through D-6,7, depending on the board lay-out. Either board may be supplied with a 2X20 header block or solder holes only.

BAUD RATE GENERATOR

The baud rates for the Micro Decision are software selectable through the SETUP program. The baud rate generator is an Intel 8253 counter timer chip which is accessed through ports 0F0-0F3h. Channel 0 is used for Floppy Drive Timing and should not be written to; Channel 1 is serial port 1 baud; Channel 2 is serial port 2 baud.

The seven most popular baud rates (110, 300, 600, 1200, 2400, 4800 and 9600) can be chosen through the SETUP program for both serial ports. The SETUP program also enables you to choose between software handshaking, (XON-XOFF) or hardware handshaking (DTR pin 20) on the second serial port.

DISK DRIVE CONNECTOR

The disk drives are connected to the motherboard through two 34 pin edge connectors labeled JD0 for drive "A", and JD1 for drives "B" through "D". Drives "C" and "D" are daisy-chained from drive "B". The pin-outs for the connectors are listed below.

JD0		JD1	
8	/INDEX	8	/INDEX
10	/DS0	10	/DS0
16	/MOTOR	12	/DS1
18	/DIRECTION	14	/DS2
20	/STEP	16	/MOTOR
22	/WRITE DATA	18	/DIRECTION
24	/WRITE GATE	20	/STEP
26	/TRACK 0	22	/WRITE DATA
28	/WRITE PROTECT	24	/WRITE GATE
30	/READ DATA	26	/TRACK 0
32	/SIDE SELECT	28	/WRITE PROTECT
		30	/READ DATA
		32	/SIDE SELECT

All odd numbered pins on JD0 and JD1 are grounded.

Micro-Decision Diskette Format Specifications.

Introduction:

This document provides details of the Micro-Decision's native diskette format. Micro-Decision diskettes use a soft-sectored, double-density, IBM like format. Both single and double sided versions of this format are supported. This format is compatible with both Western Digital 179X and NEC 765 type controllers.

Format Characteristics:

All Micro-Decision diskettes have 40 cylinders. Single sided diskettes have one track per cylinder (i.e. 40 tracks), while double sided diskettes have two tracks per cylinder (i.e. 80 tracks). Each track has five 1k byte sectors. This gives a total formatted capacity of either 200k bytes (single sided) or 400k bytes (double sided).

Two tracks (10k bytes) are allocated for the bootable image of the CP/M operating system. And either 4k bytes (single sided) or 6k bytes (double sided) are allocated for the diskette directory. This gives a total usable capacity of 186k bytes (single sided) or 384k bytes (double sided), with up to 136 files (single density) or 192 files (double density).

Track Format:

All tracks are formated the same way, only the cylinder number (and head number for double sided diskettes) are different from one track to another.

Number of Bytes (Decimal)	Value (Hex)		
80	4E		
12	0		
3	C2*		
1	FC	Index Address Mark	
50	4E		
12	0		
3	A1**		
1	FE	I.D. Address Mark	
1	0 - 27	Cylinder	
1	0 - 1	Side	
1	1 - 5	Sector	Repeat
1	3	Sector Size Code	5 Times
2	C.R.C.		
22	4E		
12	0		
3	A1**		
1	FB	Data Address Mark	
1024	E5	Default Data	
2	C.R.C.		
85	4E		
~250	4E	Continue to end of track	

* Missing clock between bits 4 & 5.
** Missing clock between bits 3 & 4.

No physical skew is used, that is the sectors are written in order on each track.

On the Micro-Decision, double sided diskettes are handled as 80 track diskettes, with the even numbered tracks on side 0, and the odd numbered tracks on side 1. The relationship between track, cylinder, and side is :

Track = (2 x Cylinder) + side

or conversly

Cylinder = Integer (Track / 2)
Side = Least-Significant-Bit (Track)

CP/M Parameters:
The parameters for the DISKDEF macro are:

	Single Sided	Double Sided
FSC	1	1
LSC	40	40
SKF	*	*
BLS	2048	2048
DKS	95	195
DIR	128	192
CKS	128	192
OFS	2	2

These parameters produce a DPB with the folowing values:

	Single Sided		Double Sided	
SPT	DW	40	DW	40
BSH	DB	4	DB	4
BLM	DB	15	DB	15
EXM	DB	1	DB	1
DSM	DW	94	DW	194
DRM	DW	127	DW	191
AL0	DB	192	DB	224
AL1	DB	0	DB	0
CKS	DW	32	DW	48
OFF	DW	2	DW	2

* A hand coded translation table must be provided ad shown below:

```
XLT:    DB 1,2,3,4,5,6,7,8
        DB 25,26,27,28,29,30,31,32
        DB 9,10,11,12,13,14,15,16
        DB 33,34,35,36,37,38,39,40
        DB 17,18,19,20,21,22,23,24
```

Track Ø Data:
In order for the Micro-Decision to correctly access the diskette, the following data MUST be on sectors 1 and 2 of track Ø:

Data for track Ø sector 1 of single sided diskettes:

```
ØØØD                    CR      EQU ØDH
ØØØA                    LF      EQU ØAH
ØØ18                    BTERR   EQU 18H
ØØØ3                    MESG    EQU 3
                        ;
                                ORG ØFEØØH

FEØØ    ØØ                      NOP
FEØ1    ØØ                      NOP
FEØ2    ØØ                      NOP
FEØ3    3E C9                   LD A,ØC9H
FEØ5    32 FDFF                 LD (ØFDFFH),A
FEØ8    CD FDFF                 CALL ØFDFFH
FEØB    21 FFFE         RADD:   LD HL,-2
FEØE    39                      ADD HL,SP
FEØF    5E                      LD E, (HL)
FE1Ø    23                      INC HL
FE11    56                      LD D, (HL)
FE12    21 ØØ17                 LD HL,EMSG-RADD
FE15    19                      ADD HL,DE
FE16    EB                      EX DE,HL
FE17    31 FFØØ                 LD SP,ØFFØØH
FE1A    D3 F6                   OUT (ØF6H),A
FE1C    CD ØØØ3                 CALL MESG
FE1F    C3 ØØ18                 JP BTERR        ;JMP TO ROM


FE22    ØD ØA 4E 6F     EMSG:   DB CR,LF,'Not a SYSTEM Diskette.'
FE26    74 2Ø 61 2Ø
FE2A    53 59 53 54
FE2E    45 4D 2Ø 44
FE32    69 73 6B 65
FE36    74 74 65 2E
FE3A    ØD ØA ØØ                DB CR,LF,Ø

FE3D                            DS (ØFE8ØH-$),Ø

FE8Ø    ØØØØ                    DW Ø
FE82    ØØØØ                    DW Ø
FE84    ØØØØ                    DW Ø
FE86    ØØØØ                    DW Ø
FE88    ØØ                      DB Ø
FE89    ØØ28                    DW 4Ø
FE8B    Ø4                      DB 4
FE8C    ØF                      DB 15
FE8D    Ø1                      DB 1
FE8E    ØØ5E                    DW 94
FE9Ø    ØØ7F                    DW 127
FE92    CØ                      DB ØCØH
FE93    ØØ                      DB Ø
```

```
FE94    0020                    DW 32
FE96    0002                    DW 2
FE98    E1                      DB 0E1H
FE99                            DS 103,0

Data for track 0 sector 1 of double sided diskettes:
000D                            EQU 0DH
000A                            EQU 0AH
0018                            EQU 18H
0003                            EQU 3

                                ORG 0FE00H
                        ;
FE00    00                      NOP
FE01    00                      NOP
FE02    00                      NOP
FE03    3E C9                   LD A,0C9H
FE05    32 FDFF                 LD (0FEFFH),A
FE08    CD FDFF                 CALL 0FDFFH
FE0B    21 FFFE                 LD HL,-2
FE0E    39                      ADD HL,SP
FE0F    5E                      LD E,(HL)
FE10    23                      INC HL
FE11    56                      LD D,(HL)
FE12    21 0017                 LD HL,EMSG-RADD
FE15    19                      ADD HL,DE
FE16    EB                      EX DE,HL
FE17    31 FF00                 LD SP,0FF00H
FE1A    D3 F6                   OUT (0F6H),A
FE1C    CD 0003                 CALL MESG
FE1F    C3 0018                 JP BTERR        ;JMP TO ROM


FE22    0D 0A 4E 6F     EMSG:   DB CR,LF,'Not a SYSTEM Diskette.'
FE26    74 20 61 20
FE2A    53 59 53 54
FE2E    45 4D 20 44
FE32    69 73 6B 65
FE36    74 74 65 2E
FE3A    0D 0A 00                DB CR,LF,0

FE3D                            DS (0FE80H-$),0

FE80    00                      DB 0
FE81    04                      DB 4
FE82    0000                    DW 0
FE84    0000                    DW 0
FE86    0000                    DW 0
FE88    00                      DB 0
FE89    0028                    DW 40
FE8B    04                      DB 4
FE8C    0F                      DB 15
FE8D    01                      DB 01
FE8E    00C2                    DW 194
FE90    00BF                    DW 191
```

```
FE92    E0                      DB 0E0H
FE93    00                      DB 0
FE94    0030                    DW 48
FE96    0002                    DW 2
FE98    89                      DB 89H
FE99                            DS 103,0

Data for track 0 sector 2 of single and double sided diskettes:
000D                    CR      EQU 0DH
000A                    LF      EQU 0AH
0018                    BTERR   EQU 18H
0003                    MESG    EQU 3
                        ;
                                ORG 0FE00H
                        ;
FE00    00                      NOP
FE01    00                      NOP
FE02    00                      NOP
FE03    3E C9                   LD A,0C9H
FE05    32 FDFF                 LD (0FDFFH),A
FE08    CD FDFF                 CALL 0FDFFH
FE0B    21 FFFE         RADD:   LD HL,-2
FE0E    39                      ADD HL,SP
FE0F    5E                      LD E,(HL)
FE10    23                      INC HL
FE11    56                      LD D,(HL)
FE12    21 0017                 LD HL,EMSG-RADD
FE15    19                      ADD HL,DE
FE16    EB                      EX DE,HL
FE17    31 FF00                 LD SP,0FF00H
FE1A    D3 F6                   OUT (0F6H),A
FE1C    CD 0003                 CALL MESG
FE1F    C3 0018                 JP BTERR        ;JMP TO ROM

FE22    0D 0A 4E 6F     EMSG:   DB CR,LF,'Not a SYSTEM Diskette.'
FE26    74 20 61 20
FE2A    53 59 53 54
FE2E    45 4D 20 44
FE32    69 73 6B 65
FE36    74 74 65 2E
FE3A    0D 0A 00                DB CR,LF,0

FE3D                            DS (0FE80H-$),0
```