

MICRO DECISION
MODELS MD-1 / MD-2 / MD-3
SERVICE GUIDE

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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.

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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).

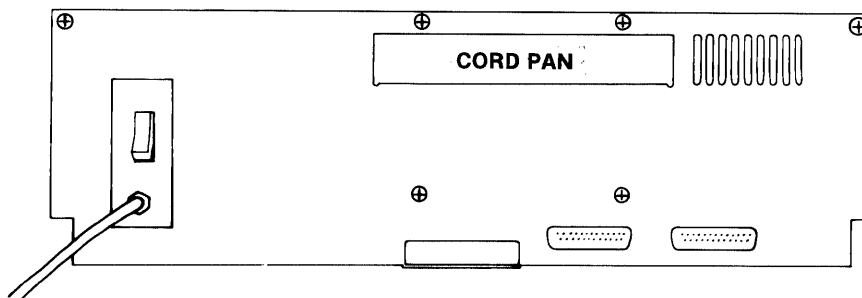


Figure 2-1: Revision A Chassis

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

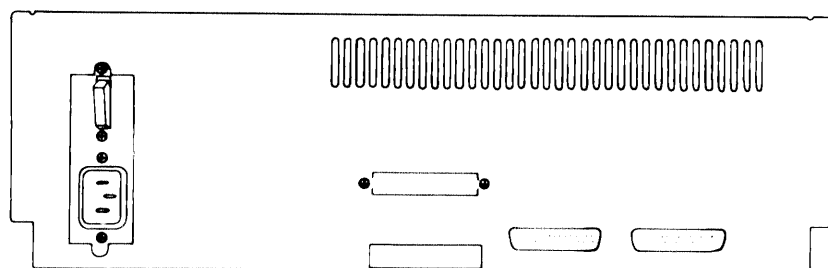


Figure 2-2: Revision B Chassis

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.

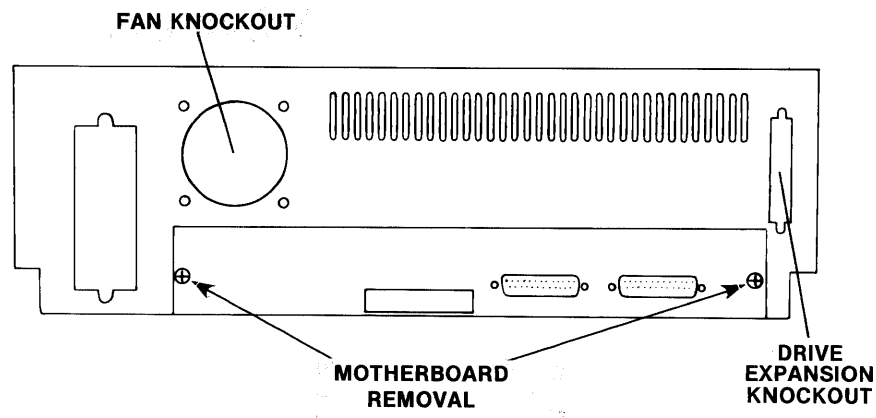


Figure 2-3: Revision C Chassis

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.

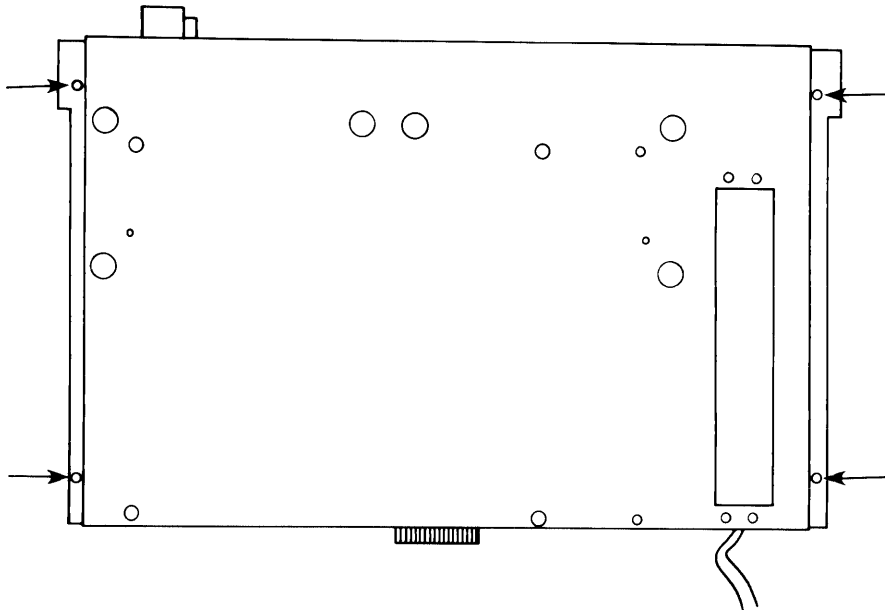


Figure 2-4: Cover Removal - Revision A Chassis

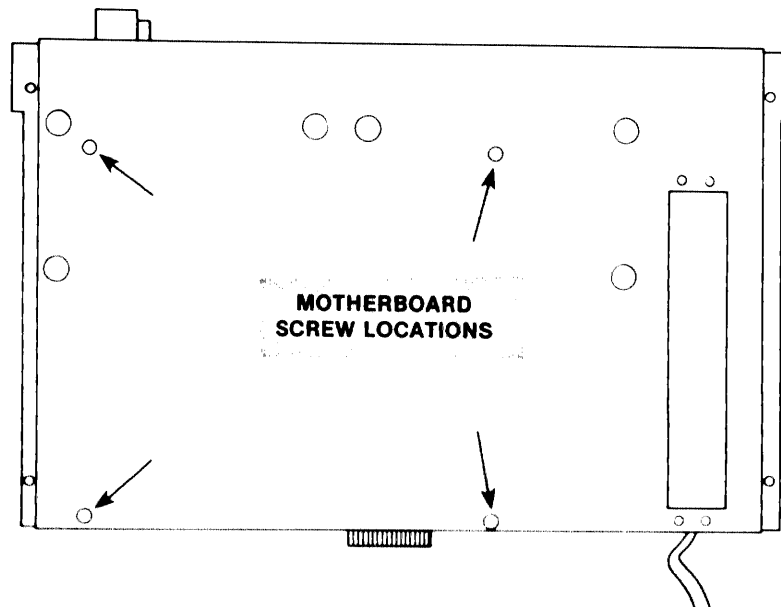


Figure 2-5: Location of Screws - Revision A Chassis

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.

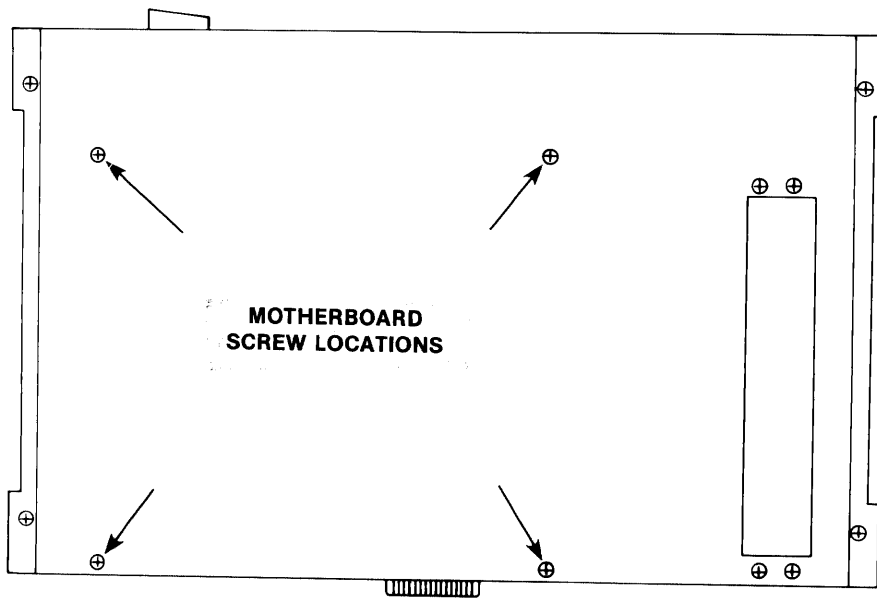


Figure 2-6: Location of Screws - Revision B Chassis

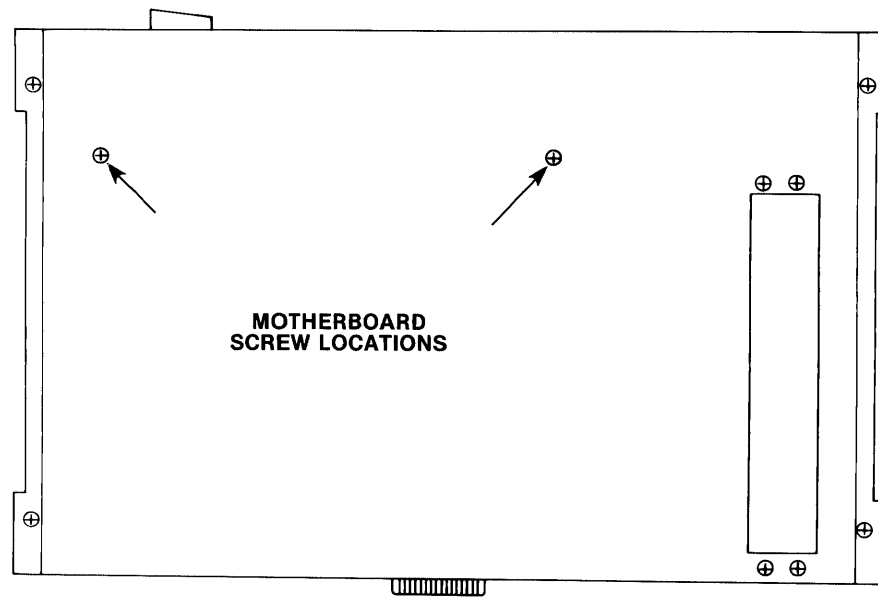


Figure 2-7: Location of Screws - Revision C Chassis

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.

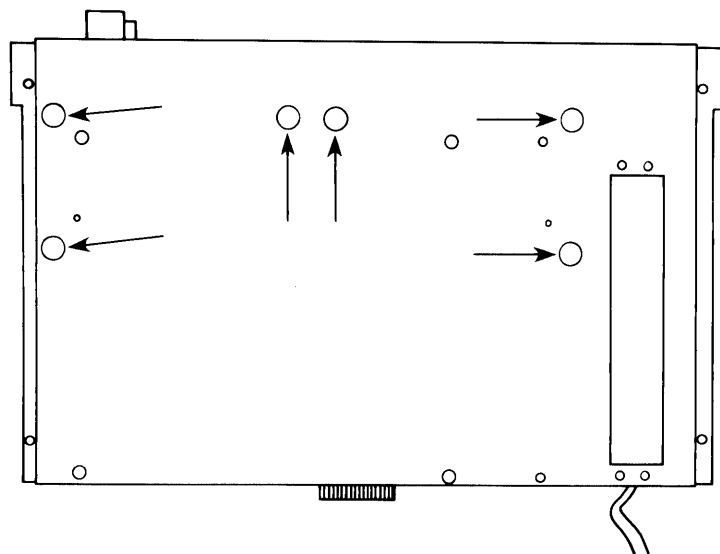


Figure 3-1: MD I/MD II Drive Removal - Revision A Chassis

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).

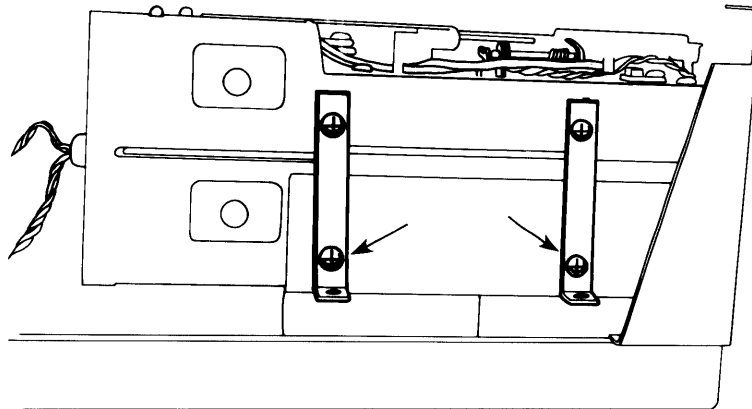


Figure 3-2A: MD I/MD III Drive Removal - Revision B and C Chassis

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).

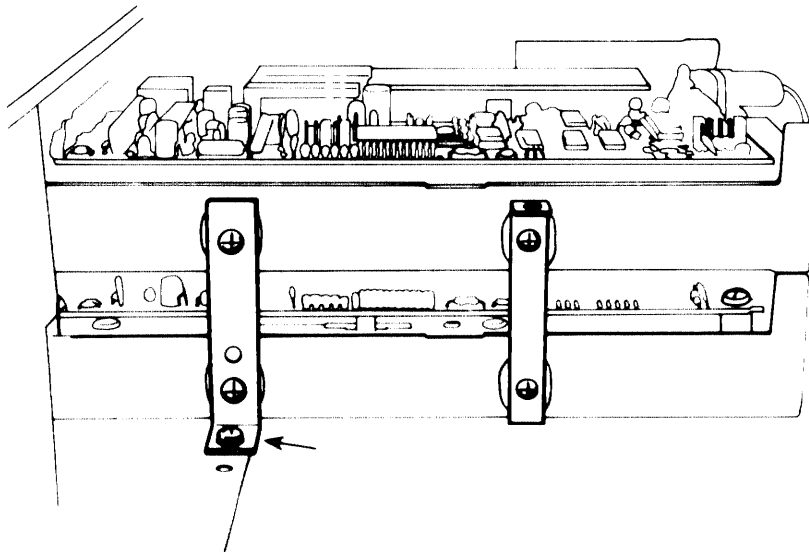


Figure 3-2B: MD I/MD III Drive Removal - Revision B and C Chassis

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.

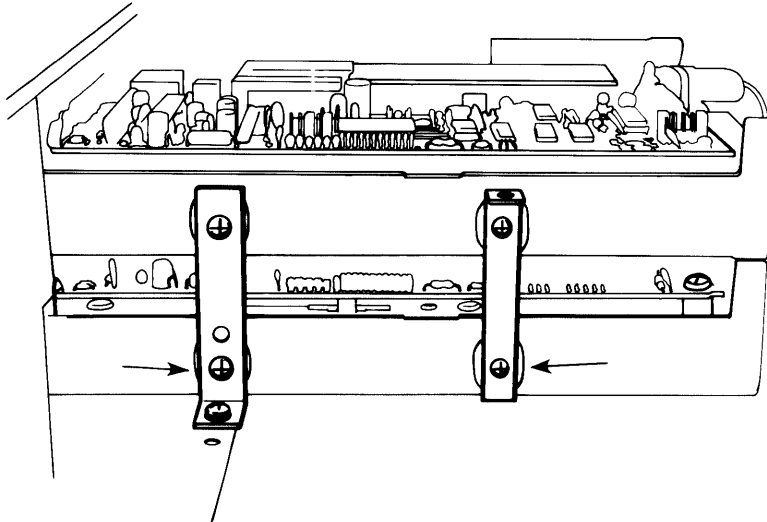


Figure 3-3: Separating MD III Drives - Revision B and C Chassis

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).

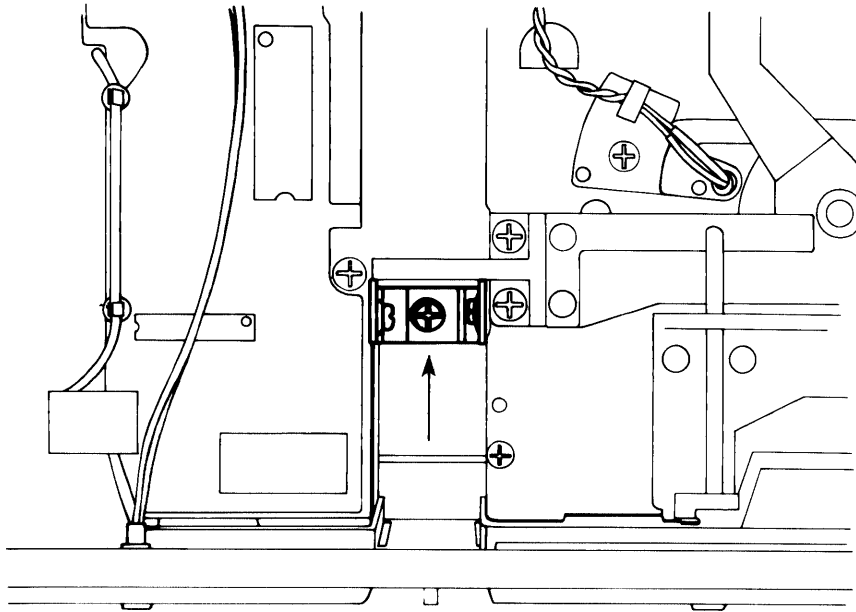


Figure 3-4A: MD II - Revision B and C Chassis - Drive Removal

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

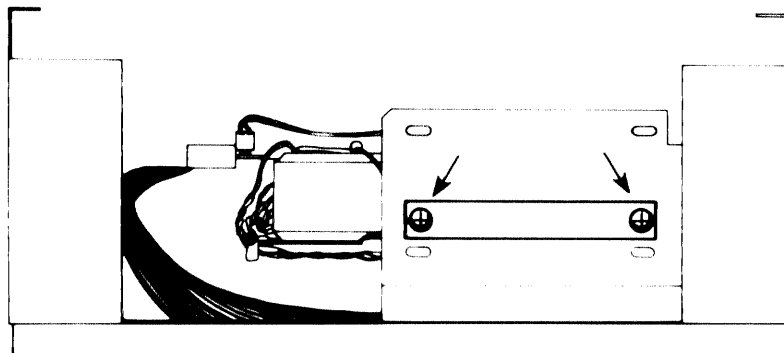


Figure 3-4B: MD II - Revision B and C Chassis - Drive Removal

- 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.

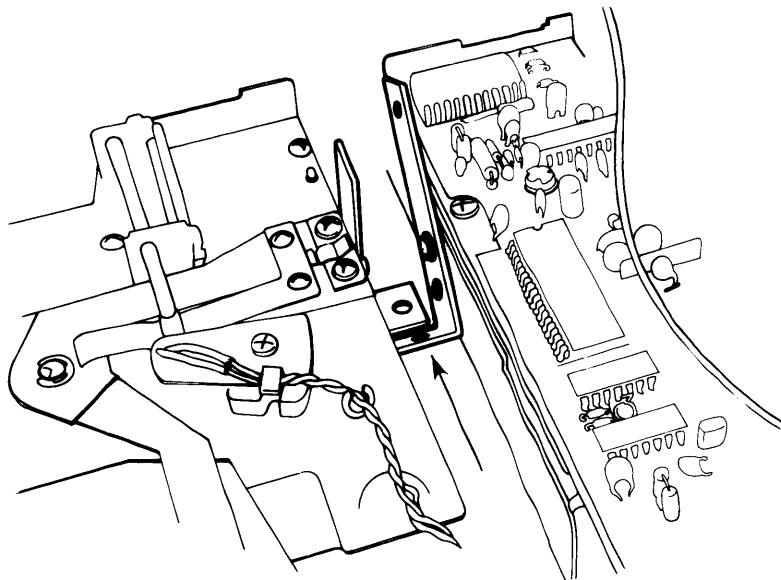


Figure 3-4C: MD II - Revision B and C Chassis - Drive Removal

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.

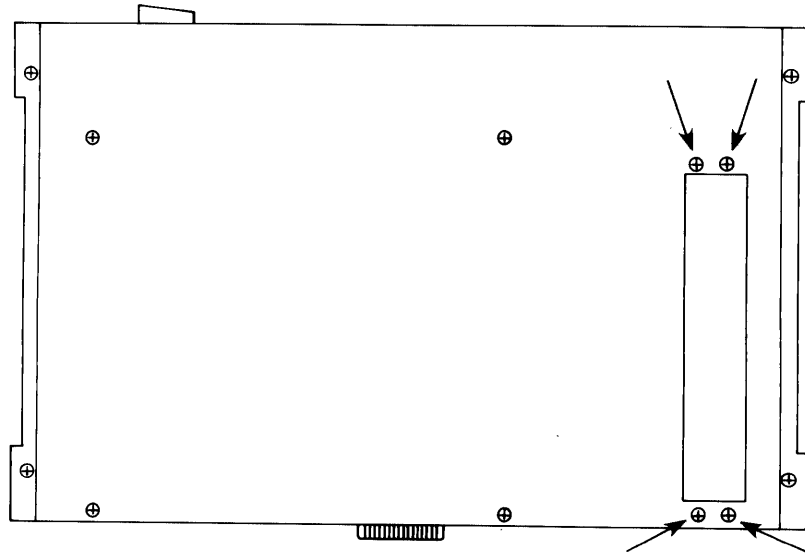


Figure 4-1: Power Supply Removal

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.

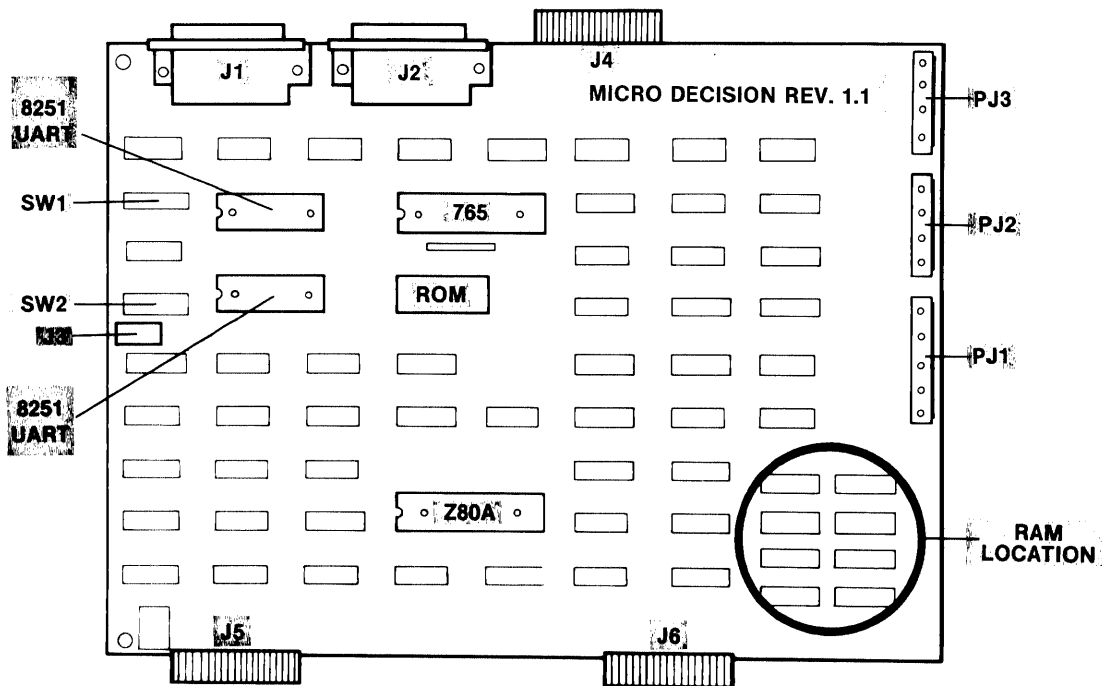


Table 5-1: Micro Decision Rev 1.1 Port Addresses

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	8253 BAUD RATE GENERATOR
OF1	
OF2	
OF3	
OF4	
OF5	CENTRONICS DATA PORT 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).

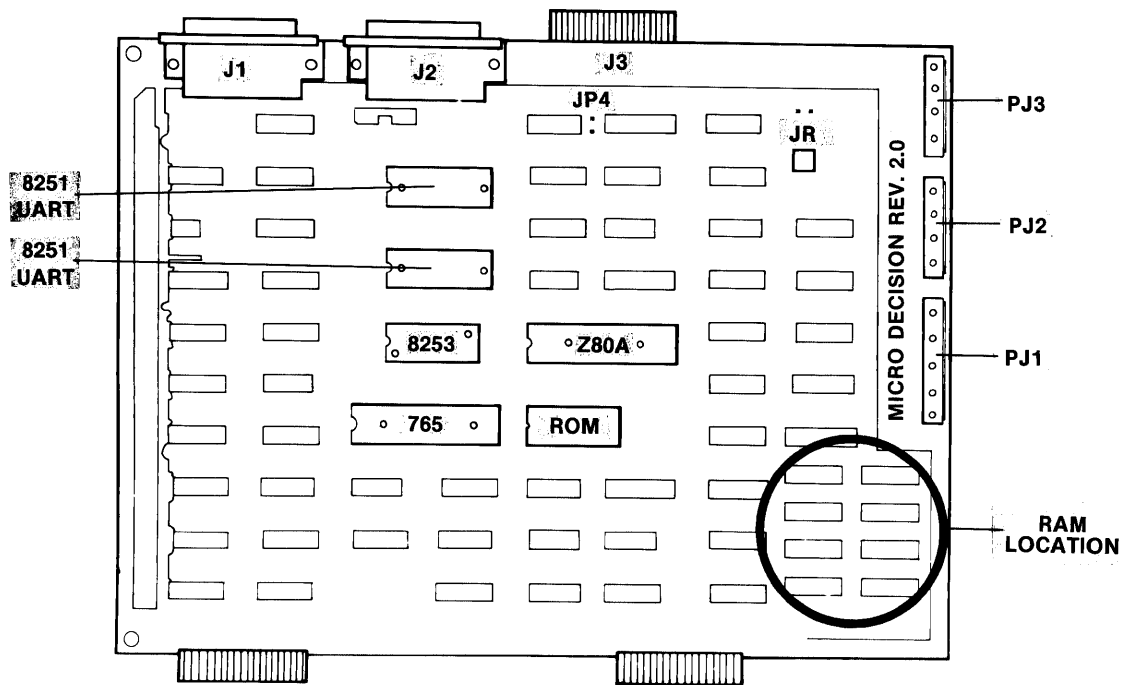


Figure 5-2: Rev 2.0 Motherboard - Kohjinsha

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

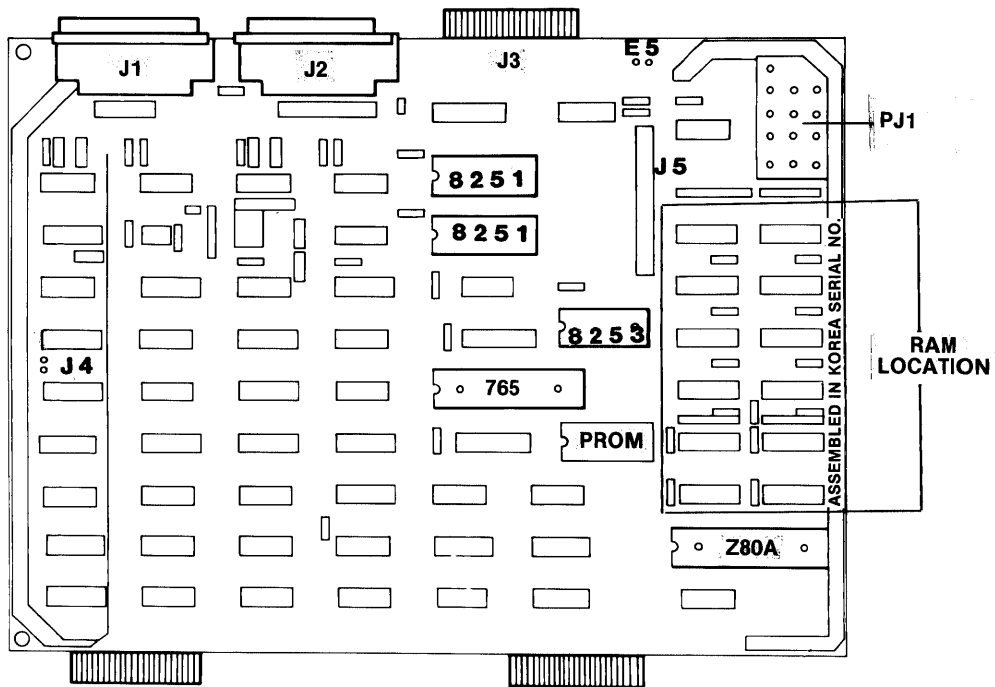


Figure 5-3: Rev 2.0 Motherboard - Korean Assembled

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.

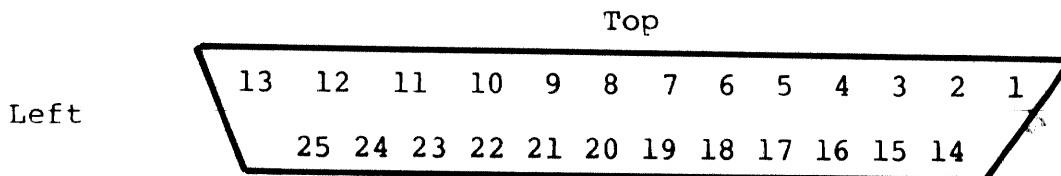


Figure 5-4: Serial Port Pin Arrangement - Rear View

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.

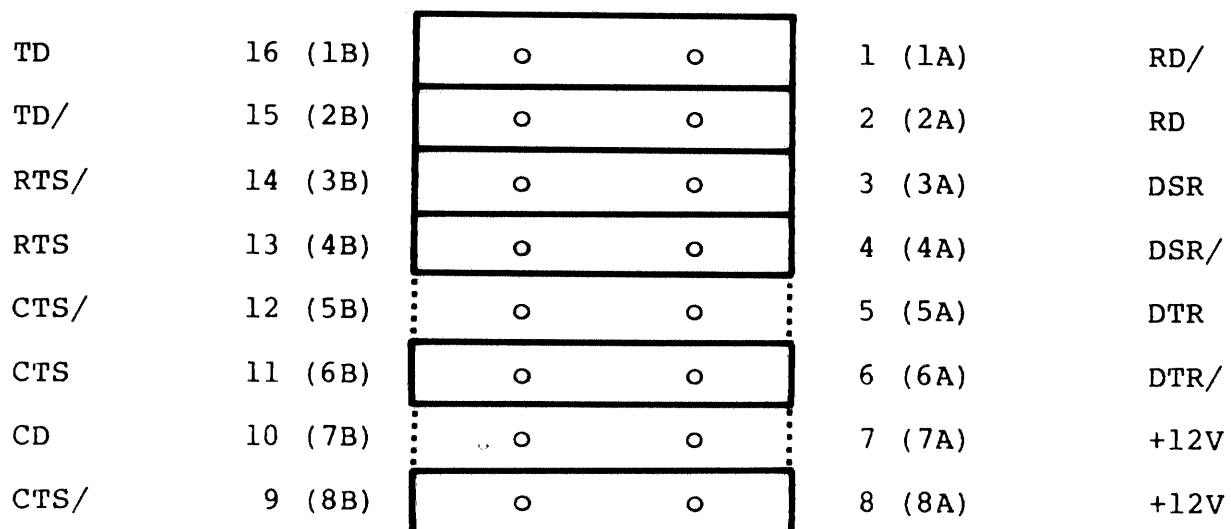


Figure 5-5: Factory Jumper Settings for JPA

JPA Settings for Modems

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

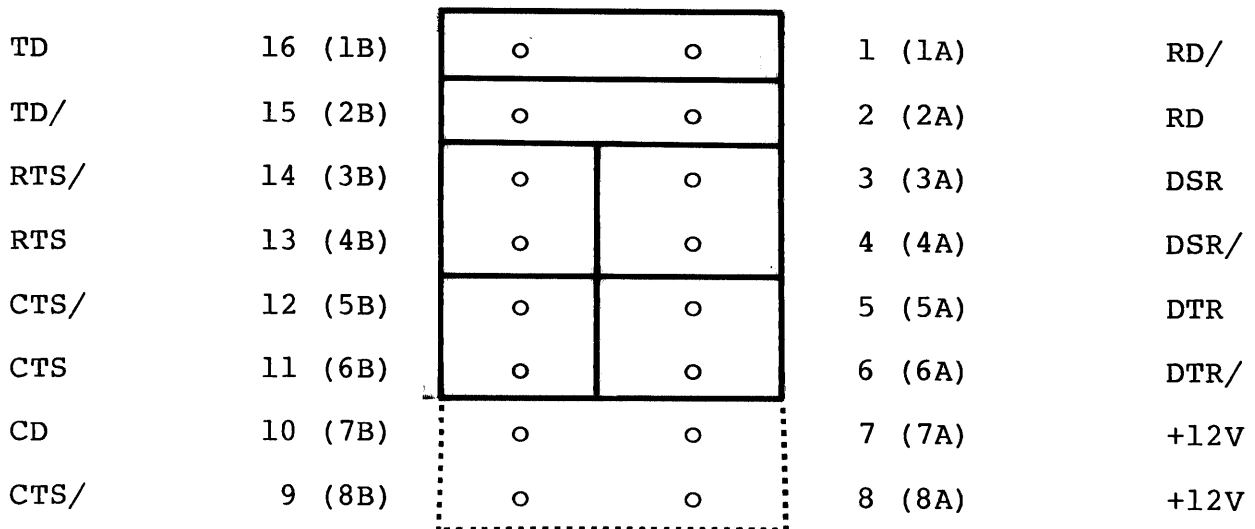


Figure 5-6: JPA Settings for Modems

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.

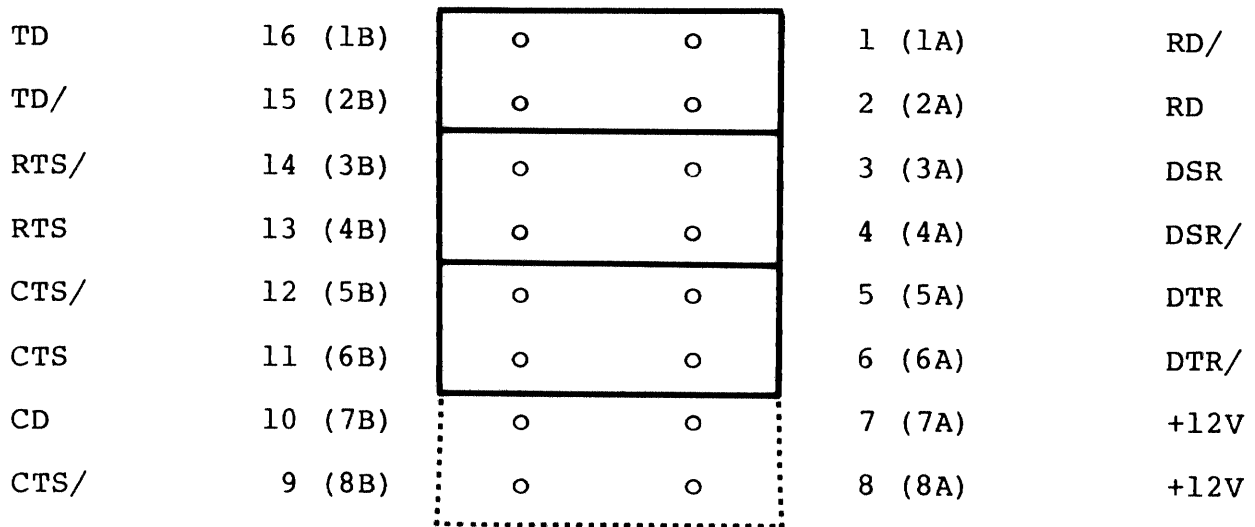


Figure 5-7: Jumper Settings (Pin 2 to Pin 2, Pin 3 to Pin 3)

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.

TD	26 (1B)	<input type="checkbox"/>	<input type="checkbox"/>	1 (1A)	RD/
TD/	25 (2B)	<input type="checkbox"/>	<input type="checkbox"/>	2 (2A)	RD
RTS/	24 (3B)	<input type="checkbox"/>	<input type="checkbox"/>	3 (3A)	DSR
RTS	23 (4B)	<input type="checkbox"/>	<input type="checkbox"/>	4 (4A)	DSR/
CTS/	22 (5B)	<input type="checkbox"/>	<input type="checkbox"/>	5 (5A)	DTR
CTS	21 (6B)	<input type="checkbox"/>	<input type="checkbox"/>	6 (6A)	DTR/
CD	20 (7B)	<input type="checkbox"/>	<input type="checkbox"/>	7 (7A)	<-3V
CTS/	19 (8B)	<input type="checkbox"/>	<input type="checkbox"/>	8 (8A)	<-3V
DET	18 (9B)	<input type="checkbox"/>	<input type="checkbox"/>	9 (9A)	<-3V
	17 (10B)	<input type="checkbox"/>	<input type="checkbox"/>	10 (10A)	
	16 (11B)	<input type="checkbox"/>	<input type="checkbox"/>	11 (11A)	
RxCB	15 (12B)	<input type="checkbox"/>	<input type="checkbox"/>	12 (12A)	
U2CLK	14 (13B)	<input type="checkbox"/>	<input type="checkbox"/>	13 (13A)	

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.

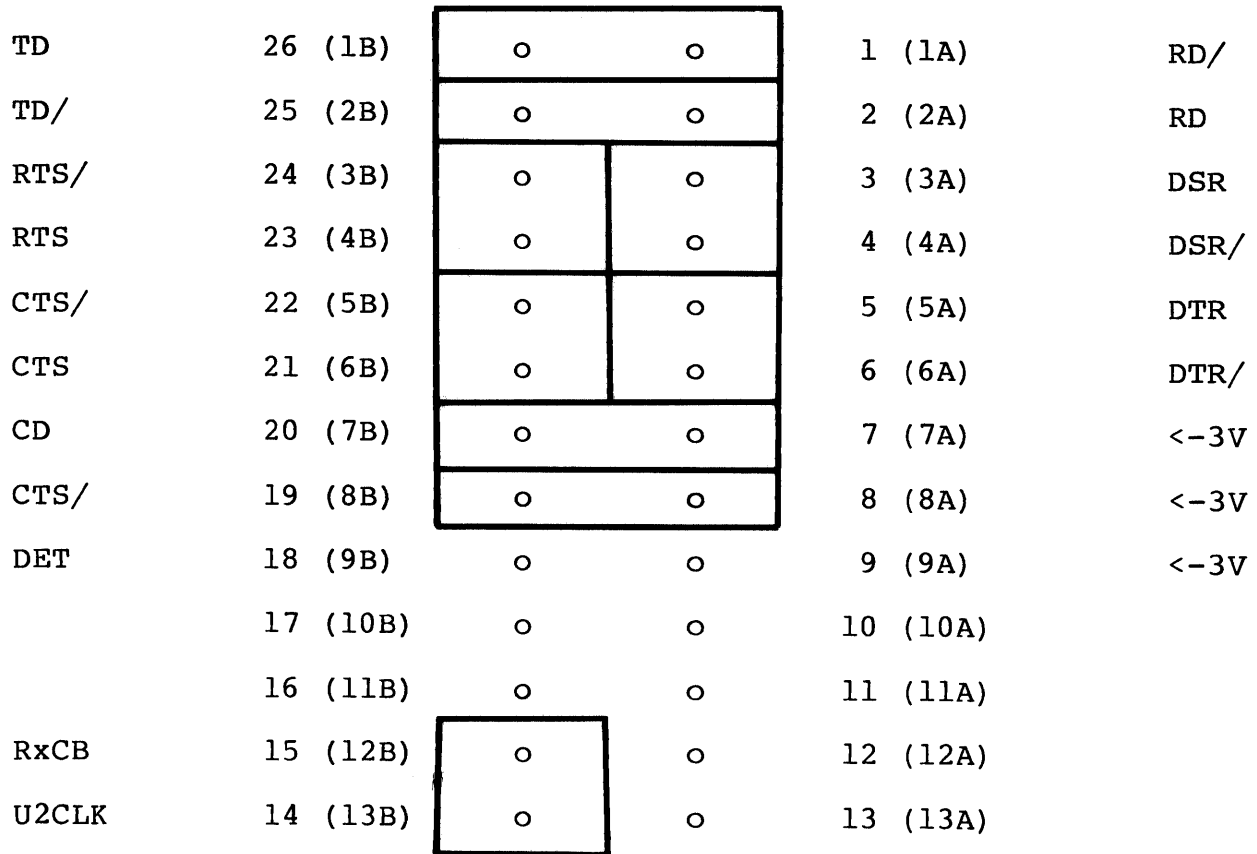


Figure 5-9: JPB Jumper Settings (Crisscross Modem Cable)

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.

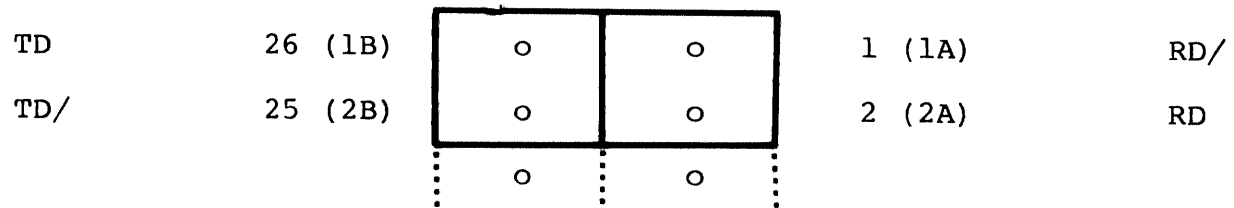


Figure 5-10: Alternate JPB Jumper Settings

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	

<p>Sample #1</p> <table> <thead> <tr> <th>MORROW</th> <th></th> <th>PRINTER</th> </tr> </thead> <tbody> <tr><td>1</td><td>←→</td><td>1</td></tr> <tr><td>2</td><td>←→</td><td>2</td></tr> <tr><td>3</td><td>←→</td><td>3</td></tr> <tr><td>7</td><td>←→</td><td>7</td></tr> <tr><td>20</td><td>←→</td><td>20</td></tr> </tbody> </table>	MORROW		PRINTER	1	←→	1	2	←→	2	3	←→	3	7	←→	7	20	←→	20	<p>Sample #2</p> <table> <thead> <tr> <th>MORROW</th> <th></th> <th>PRINTER</th> </tr> </thead> <tbody> <tr><td>1</td><td>←→</td><td>1</td></tr> <tr><td>2</td><td>←→</td><td>2</td></tr> <tr><td>3</td><td>←→</td><td>3</td></tr> <tr><td>6</td><td>←→</td><td>6</td></tr> <tr><td>7</td><td>←→</td><td>7</td></tr> <tr><td>20</td><td>←→</td><td>11</td></tr> </tbody> </table>	MORROW		PRINTER	1	←→	1	2	←→	2	3	←→	3	6	←→	6	7	←→	7	20	←→	11												
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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  $\pm 30$ Khz on the Kohjinsha board, or 500 Khz  $\pm 30$ Khz 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.

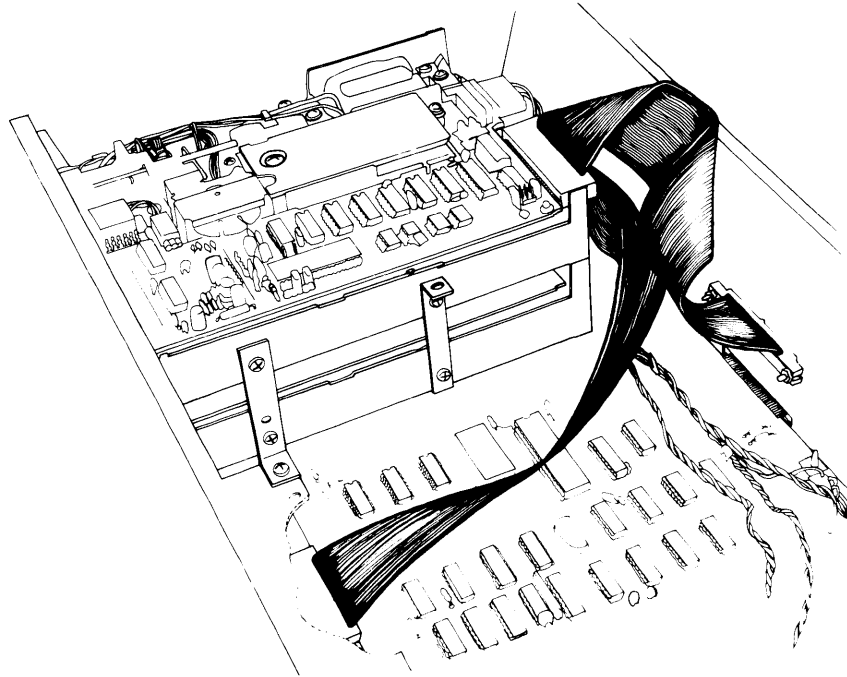


Figure 5-11: Drive Expansion

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.

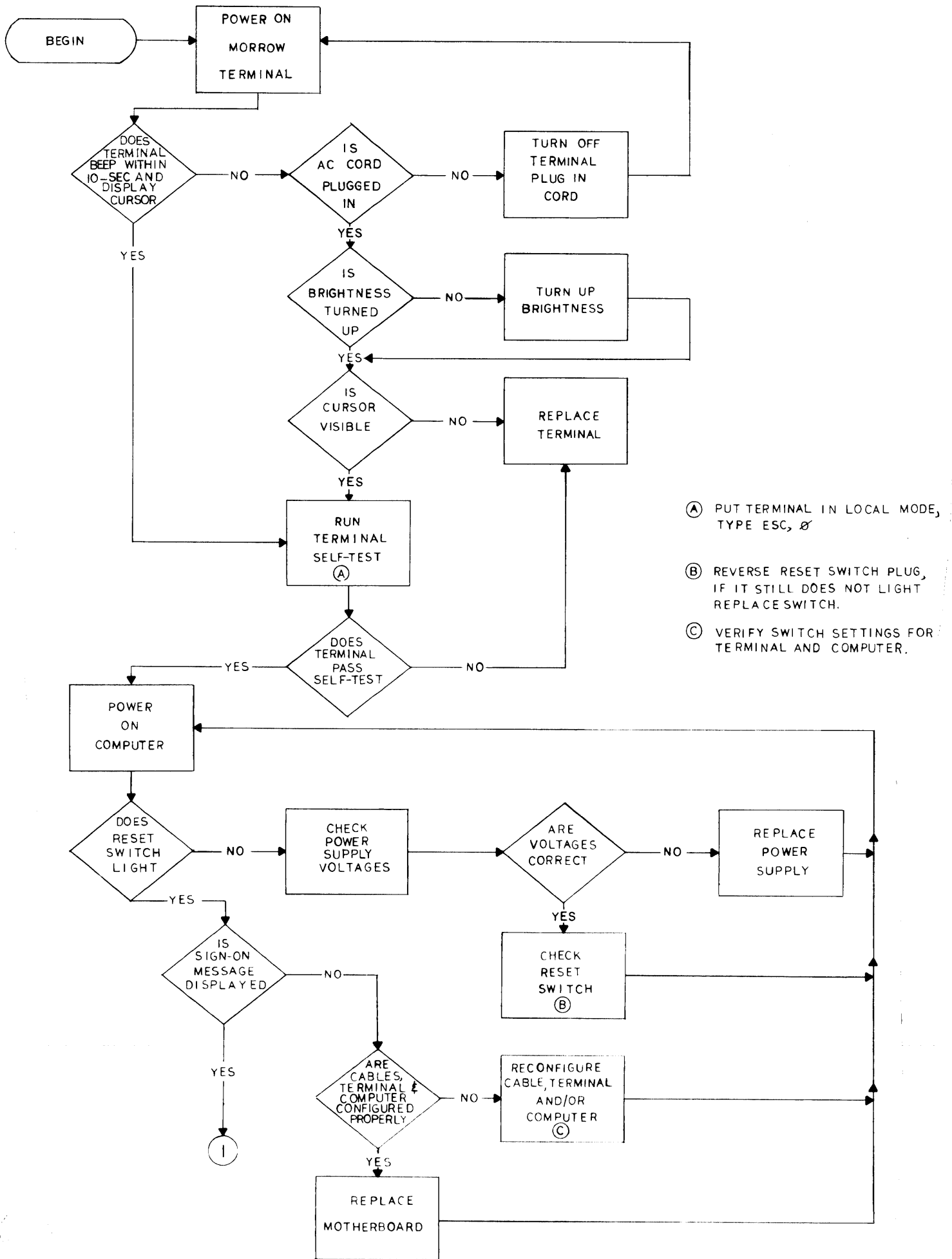
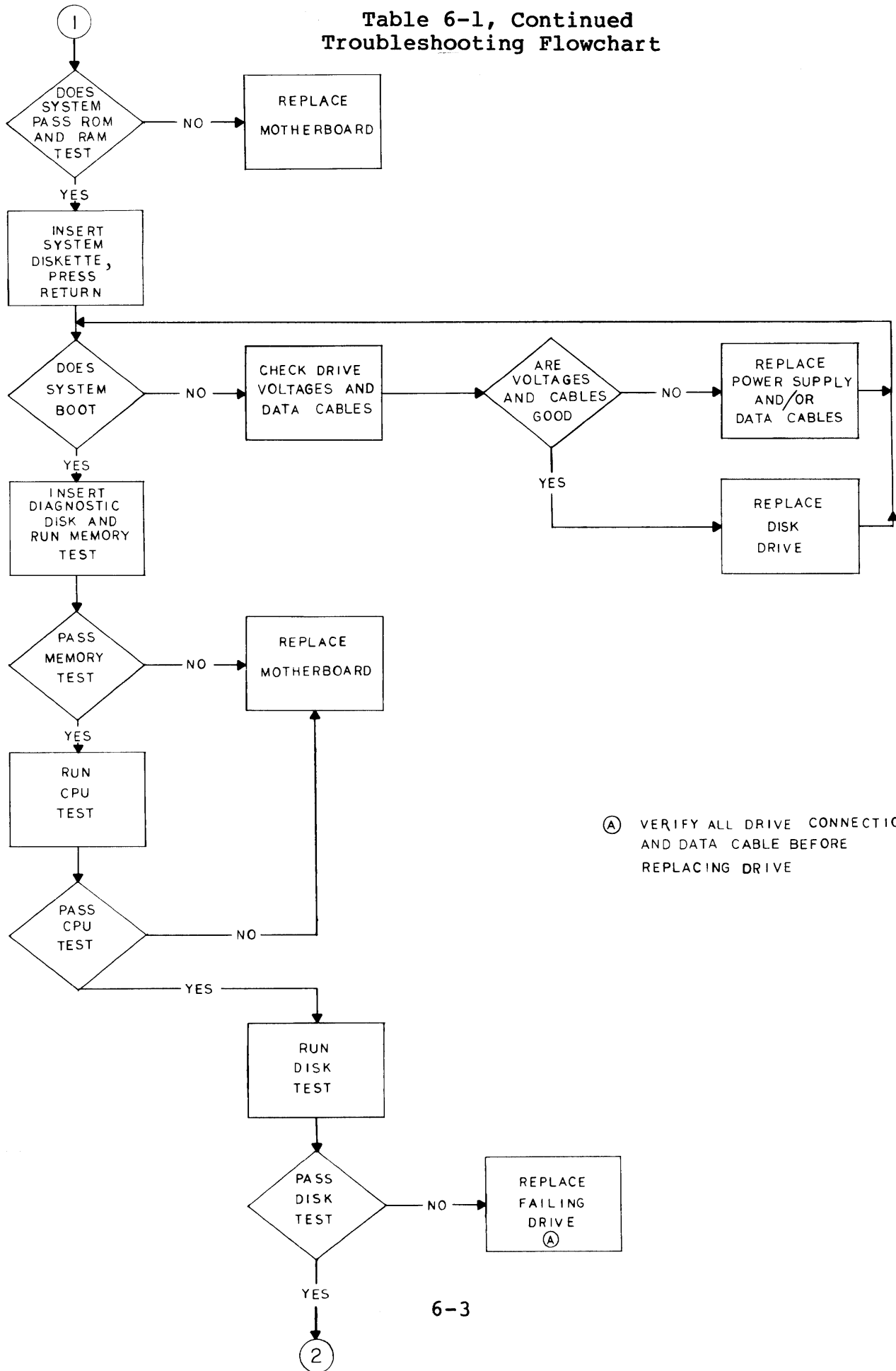
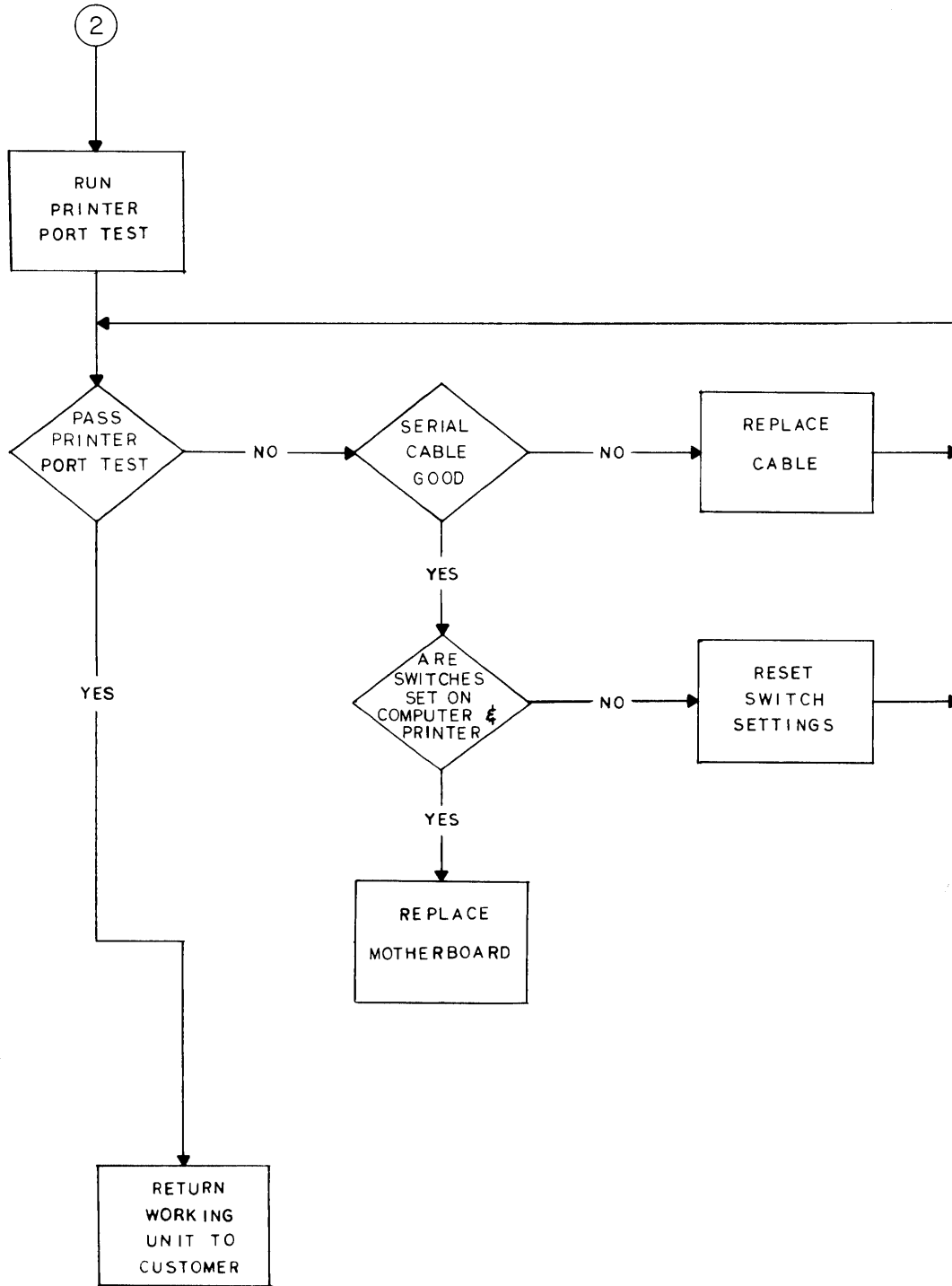


Table 6-1, Continued  
Troubleshooting Flowchart



(A) VERIFY ALL DRIVE CONNECTIONS AND DATA CABLE BEFORE REPLACING DRIVE

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.

If you find that a voltage being output by the power supply is outside of its 10% range, even after another problem has been fixed, you should still replace the power supply anyway.

Finally, as with all intermittent problems, if you suspect an intermittent power supply, substitution is your best troubleshooting bet. Run the Micro Decision with the cover on, exercising both disk drives, until you are reasonably confident that the new power supply did the job.

## 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<br>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<br>1-Micro PCB<br>1-Micro SPS<br>1-LED Panel<br>1-Reset Harness<br>1-Connector 4P<br>1-Connector LED<br>1-Connector Fl<br>2-Cable 34 S<br>4-Rubber Ft<br>1-Front Panel<br>6-Stand-offs | 2-Disk Drive 2S<br>1-Micro PCB<br>1-Micro SPS<br>1-LED Panel<br>1-Reset Harness<br>1-Connector 4P<br>1-Connector LED<br>1-Connector Fl<br>2-Cable 34 S<br>4-Rubber Ft<br>1-Front Panel<br>6-Stand-offs | 1-HDDCA<br>1-MPZ80<br>1-DM256<br>1-Multi I/O<br>1-DJDMA<br>1-HDDMA<br>2-Sw Pwr Supply<br>1-DEC Buss 14 s<br>1-Reset switch<br>1-Complete set<br>of manuals<br>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 |

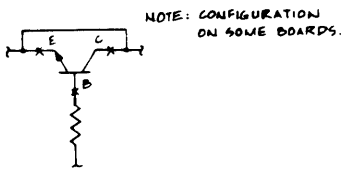
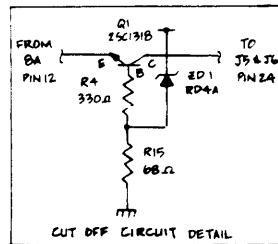
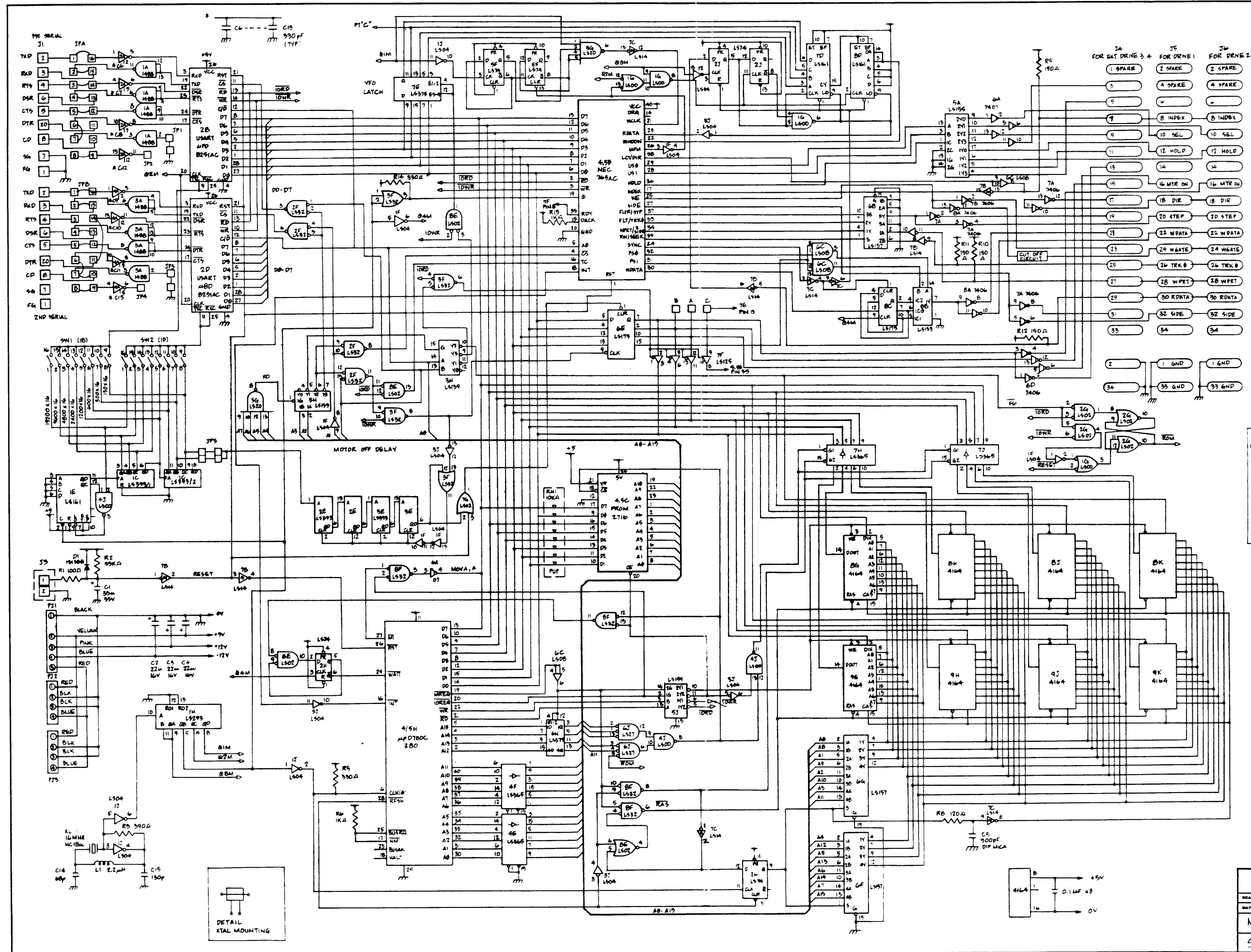
Above prices are NOT discountable.

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 change without notice.

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



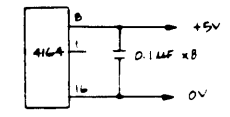
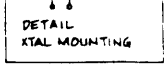


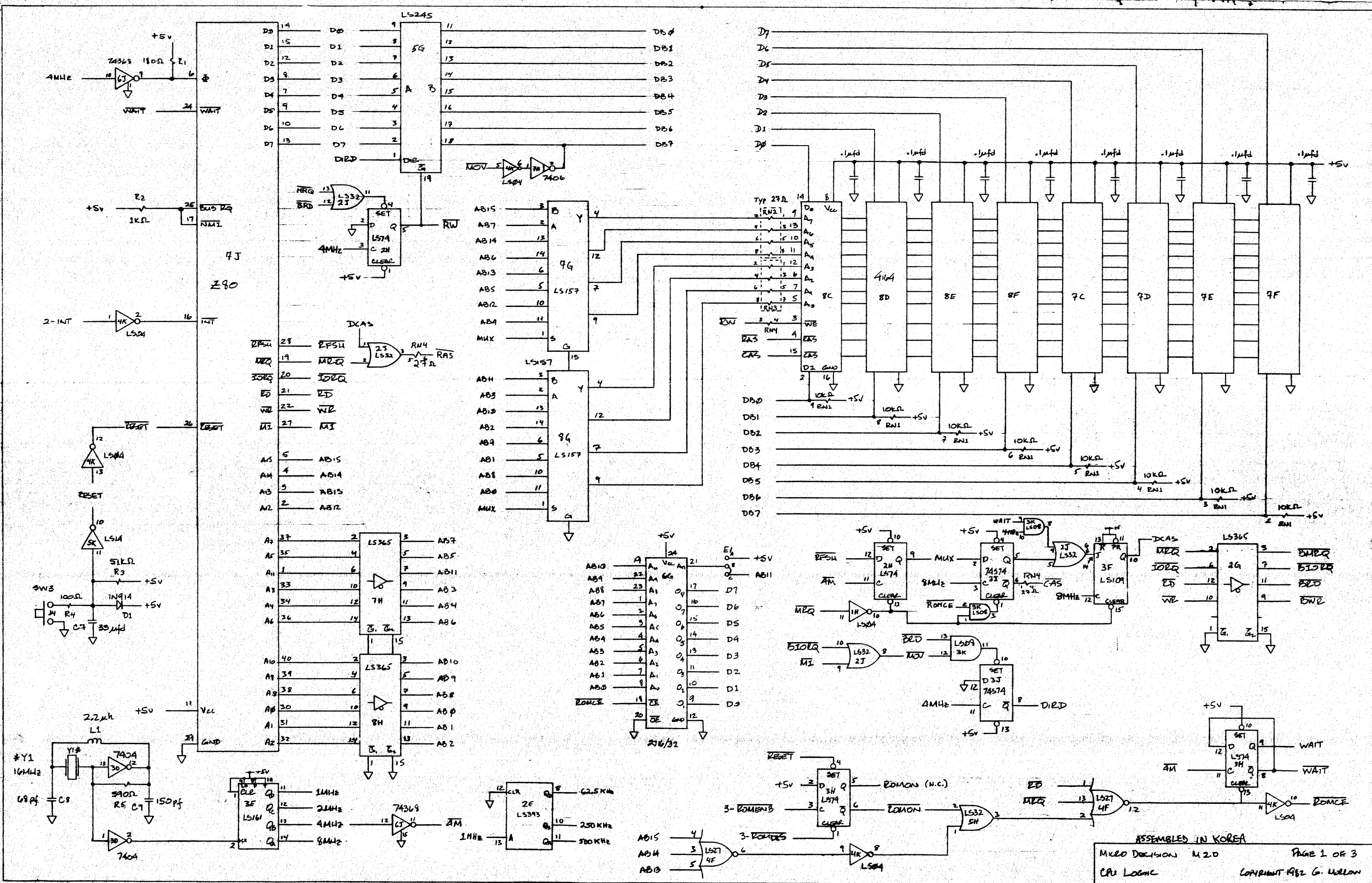
Logic voltages are TTL unless specified otherwise

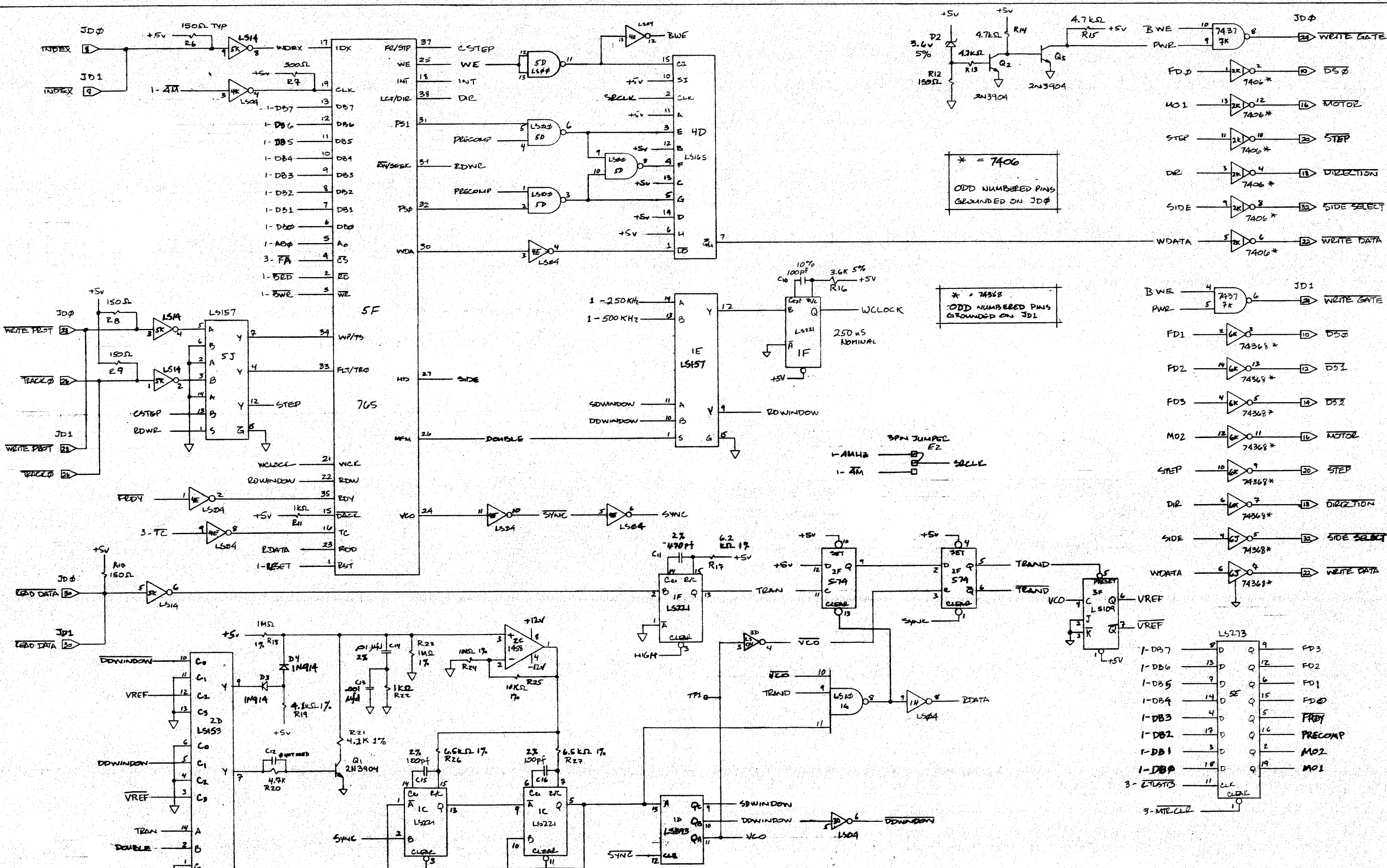
High 2.4-5.25 v False  
Low 0-0.4 v True

Typical input impedance  
150 ohms at 5 v

|                                           |                             |                 |
|-------------------------------------------|-----------------------------|-----------------|
| MORROW DESIGNS<br>SAN LEANDRO, CALIFORNIA |                             |                 |
| SCALE: _____                              | APPROVED BY: <i>D. Blak</i> | DRAWN BY: PELL  |
| DATE: 2-7-85                              | REVISION: _____             | REVISION: _____ |
| MICRO DECISION REV. 1.1                   |                             |                 |
| SCHEMATIC DIAGRAM                         |                             |                 |



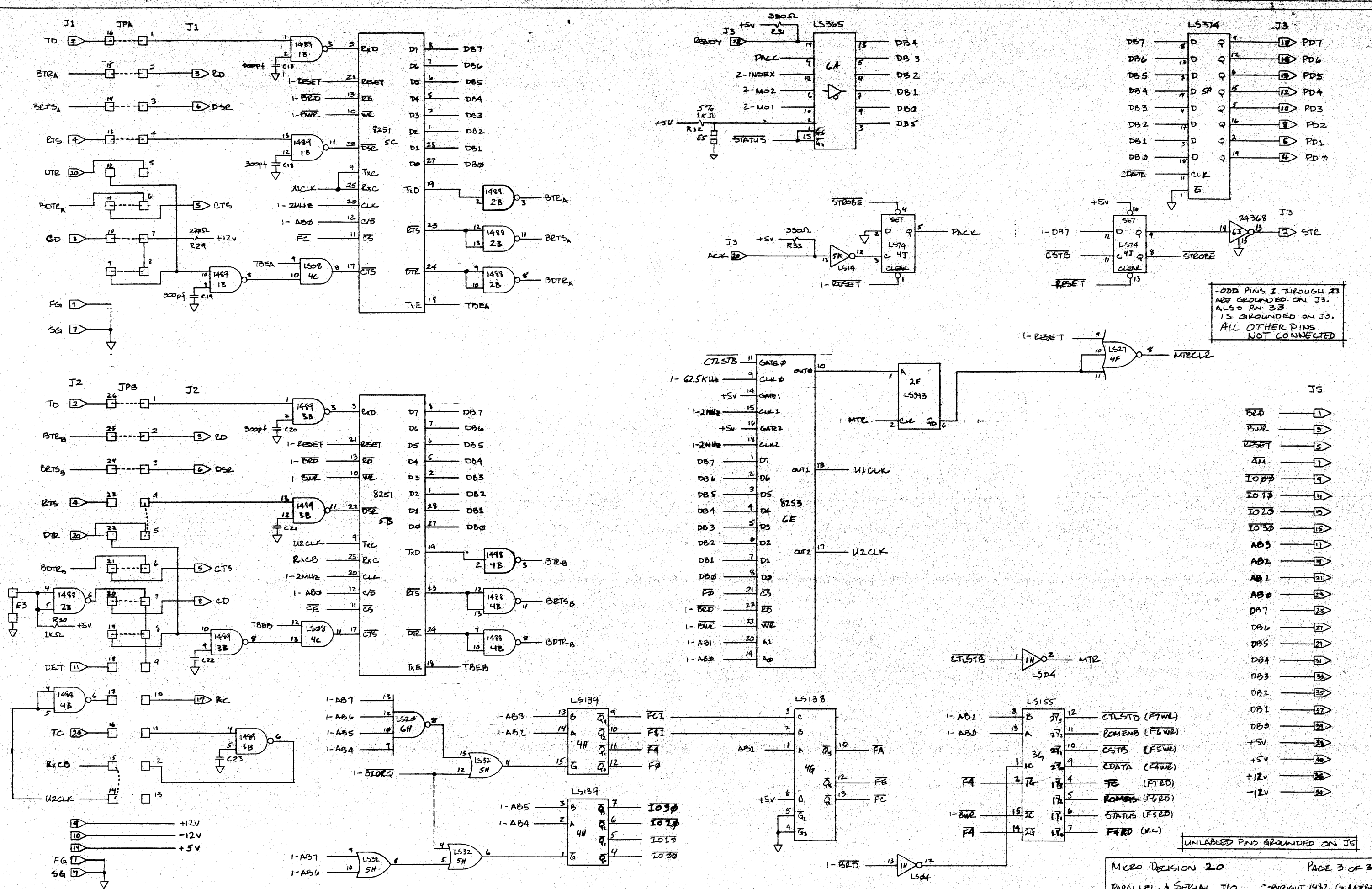




\* = 7400  
 ODD NUMBERED PINS  
 GROUNDED ON JDφ

\* = 74368  
 ODD NUMBERED PINS  
 GROUNDED ON JD1

| Signal    | LS273 Pin | LS273 Pin | Signal  |
|-----------|-----------|-----------|---------|
| 1-DB7     | 9         | Q9        | FD3     |
| 1-DB6     | 13        | Q12       | FD2     |
| 1-DB5     | 9         | Q6        | FD1     |
| 1-DB4     | 14        | Q15       | FD0     |
| 1-DB3     | 4         | Q5        | PRDY    |
| 1-DB2     | 19        | Q16       | PRECOMP |
| 1-DB1     | 3         | Q2        | MO2     |
| 1-DB0     | 18        | Q19       | MO1     |
| 3-FLTSB   | 11        | CLK       |         |
| 3-MTE CLR | 1         | CLR       |         |



- ODD PINS 1 THROUGH 23 ARE GROUNDED ON J3. ALSO PIN 33 IS GROUNDED ON J3. ALL OTHER PINS NOT CONNECTED

UNLABELED PINS GROUNDED ON J5