

INFO 2000 DISK SYSTEM DOCUMENTATION (Rev. C)  
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## SECTION 1 - GENERAL DESCRIPTION

### 1.1. INTRODUCTION

The INFO 2000 Disk System is a complete dual floppy disk system for your S-100, Digital Group, or Heathkit H8 microcomputer. It incorporates the fastest dual diskette drive (PerSci 277) and the most sophisticated intelligent controller (PerSci 1070) available to provide the highest performance and greatest functional capability of any mass-storage system you can obtain for your microcomputer. INFO 2000 supports this Disk System with the best and most complete library of operating software available anywhere. The complete INFO 2000 Disk System is delivered assembled and fully tested as a system to assure you of an uneventful plug-in-and-go installation in your microcomputer.

Your INFO 2000 Disk System is supplied with an EPROM-resident bootstrap loader and peripheral device driver package especially customized by INFO 2000 for your particular microcomputer and I/O configuration. In addition, your Disk System includes a diskette containing a copy of the Digital Research CP/M disk operating system which has been specially modified to operate with the INFO 2000 Disk System. This makes it possible to use all CP/M-oriented software with the INFO 2000 Disk System, including MicroSoft Disk BASIC, both TDL and MicroSoft ANSI FORTRANs, Software Systems CBASIC, and much more. All of this software is available from INFO 2000.

### 1.2. REQUIRED HARDWARE ENVIRONMENT

To operate with the INFO 2000 Disk System under the CP/M disk operating system, you must have an 8080-, 8085-, or Z80-based microcomputer system with at least 16K bytes of contiguous RAM starting at address zero. Your minimum RAM requirement depends upon the particular language processors and other software that you plan to run on your system. The INFO 2000 Loader/Driver resides in 1K of EPROM at addresses F000 through F3FF hex located on the Disk System Adapter Board.

For S-100 systems, the INFO 2000 S-100 Adapter Board has provision for 3K of 2708 EPROM at addresses F000 through FBFF hex, plus 1K of 2114 RAM at addresses FC00 through FFFF hex. When used with CP/M, the last 2K of EPROM and the 1K of RAM are normally not used and the chips are not supplied by INFO 2000.

For Digital Group systems, the INFO 2000 Digital Group Adapter Board has provision for 5K of 2708 EPROM at addresses EC00 through FFFF hex, but only the 1K located at F000 through F3FF hex is normally used with CP/M, and the other chips are not supplied by INFO 2000. The Digital Group Adapter Board also supports one or two optional RS232 serial interfaces which are supplied by INFO 2000 as an extra-cost item.

For Heathkit H8 systems, the INFO 2000 Z80/Disk Adapter Board replaces the Heathkit 8080 CPU board altogether, and includes a Z80 microprocessor, provision for 7K of EPROM and 1K of RAM, plus the disk controller interface. When used with CP/M, only 1K of

EPROM and no RAM is supplied. An on-board switch is provided to select either Benton Harbor mode (original Heathkit 1K monitor addressed at 0000) or INFO 2000 mode (Disk Monitor addressed at F000 hex).

### 1.3. DIGITAL RESEARCH CP/M DISK OPERATING SYSTEM

CP/M is an advanced disk operating system which has been in wide use for more than three years. As a result, it is a very mature and stable operating system for which a vast library of software is available. CP/M provides rapid access to programs and data by means of a comprehensive file management system which supports dynamic allocation of disk space, and named files with both sequential and random access. CP/M includes its own context editor, 8080 assembler, 8080 dynamic debugging package with dis-assembler, and supports both interactive and batch processing modes.

CP/M is extensively documented in a series of six manuals which have been included with your INFO 2000 Disk System:

- . Introduction to CP/M Features and Facilities
- . CP/M Interface Guide
- . CP/M System Alteration Guide
- . CP/M Dynamic Debugging Tool User's Guide
- . CP/M Assembler User's Guide
- . CP/M Context Editor User's Manual

You should study at least the first of these manuals (Introduction to CP/M) carefully before attempting to use your INFO 2000 Disk System.

### 1.4. INFO 2000 LOADER/DRIVER EPROM

The Loader/Driver EPROM supplied by INFO 2000 contains (1) a cold-start loader which is executed (starting at address F000 hex) to initiate the initial loading of CP/M from diskette; and (2) a set of peripheral driver subroutines which have been customized by INFO 2000 for your particular microcomputer and I/O configuration. Since all configuration-specific drivers are located in EPROM rather than on the CP/M diskette, you can obtain future software updates from INFO 2000 on diskette and make use of them with no further I/O customization required.

INFO 2000 will provide one customized set of peripheral driver routines in accordance with your peripheral configuration specifications if supplied at the time that you order your INFO 2000 Disk System. If you wish to construct your own peripheral driver routines, Section 5 of this document explains how to do this.

## SECTION 2 - INSTALLATION AND CHECKOUT

### 2.1. INSTALLATION

#### 2.1.1. General Installation Instructions

1. Identify the four subassemblies of the INFO 2000 Disk System. These are: (1) the Disk Drive, which has a ribbon cable extending from the rear; (2) the Power Cord, which attaches to the rear of the Disk Drive; (3) the Controller, which is the small circuit board with gold-plated edge connectors on both ends; and (4) the Adapter, which is the large circuit board with a gold-plated edge connector on only one edge. Remove all packaging material from these subassemblies.
2. Attach the ribbon cable coming from the Disk Drive to the smaller (50 pin) edge connector of the Controller board, with the connector positioned so that the cable exits on the component side of the Controller board.
3. Remove the two long screws and nuts from the protruding ends of the right-angle brackets which are mounted on the non-component side of the Adapter board, and put them aside.
4. Insert the larger (72 pin) edge connector of the Controller board into the mating socket on the non-component side of the Adapter board, with the two boards back-to-back (i.e., non-component sides facing one another).
5. Using the two long screws and nuts, secure the 50 pin connector to the two right-angle brackets, resulting in a rigid piggyback assembly. The Controller will angle slightly away from the Adapter; this is normal.
6. Insert the Controller/Adapter assembly into a slot of your microcomputer motherboard. If you have an S-100 Disk System, any slot will do. If you have a Digital Group Disk System, you must use a memory slot. If you have a Heath H-8 Disk System, remove your Heath 8080 CPU board and replace it with the INFO 2000 Z80/Adapter board.
7. On the rear of the Disk Drive you will find a plastic cover plate. Slide it to the left to reveal the voltage selector (a tiny printed circuit board). This board may be removed and reinserted in any of four possible positions to select the proper voltage corresponding to that supplied by the local power mains. INFO 2000 normally ships the Disk Drive with the voltage selector positioned for 120-volt power, but it is worth checking anyway. Slide the plastic cover plate to the right again, and install the Power Cord.

2.1.2. Special Instructions for S-100 Systems

changed to  
EXCL 54-199 POC

The INFO 2000 S-100 Adapter board ties the reset line of the Controller to the External Clear line (pin 54) of the S-100 bus. This permits users of Altair and IMSAI microcomputers (and others compatible with them) to reset the Controller without resetting the CPU. If you are using an S-100 system which does not make use of the External Clear line, then connect a jumper wire between External Clear (pin 54) and Reset (pin 75); this jumper may be installed on the Adapter board or anywhere else in the system that is convenient.

Do this  
on  
No Jumper  
280  
PDS 20

2.1.3. Special Instructions for Digital Group Systems

INFO 2000 supplies a replacement 1702 EPROM chip which causes the Digital Group 280 CPU to jump directly to the INFO 2000 Disk Monitor upon reset. Install this 1702 in place of the Digital-Group-supplied 1702 on your CPU board. Make sure the two chips are labelled so that you can tell them apart.

The CP/M disk operating system requires the use of RAM at low addresses starting at address zero. To facilitate this, you must install a ROM-disable switch to make this low RAM available when needed. Simply obtain a SPST switch, and connect it from the GROUND line to the ROM DISABLE line on the Digital Group motherboard. The switch must be open (off) to enable jump-on-reset to the INFO 2000 Monitor, and closed (on) to make low RAM available.

The INFO 2000 Digital Group Adapter board supports up to two optional RS232 serial ports. If you have ordered one RS232 port on your system, you will find a three pin connector labelled J2 near the top of the board; pin #1 is receive data, pin #2 is ground, and pin #3 is transmit data. Screwdriver adjustable hex switch S2 selects the baud rate. If you have ordered two RS232 ports, J3 and S1 are used by the second port. The relationship of baud rate to switch position is listed below:

Switch Setting	Baud Rate	Switch Setting	Baud Rate
0	50	8	1,800
1	75	9	2,000
2	110	A	2,400
3	134.5	B	3,600
4	150	C	4,800
5	300	D	7,200
6	600	E	9,600
7	1,200	F	19,200

2.1.4. Special Instructions for Heathkit H8 Systems

For instructions on setting up the addresses of your RAM boards and on using the two-position mode switch on the INFO 2000 280/Adapter board, refer to the separate documentation sheet provided.

## 2.2. CHECKOUT

1. Plug in both the microcomputer and the Disk Drive into a GROUNDED outlet. Proper grounding is critical to successful operation, since the rotating diskettes may generate considerable static electricity which must be drained off from the drive. If grounded outlets are not available (or if you suspect that the outlets are not well grounded), then run a separate ground wire connecting the drive and computer chassis to a good ground. Then power up both the computer and Disk Drive; the Disk Drive has a small power switch in the rear. The Disk Drive will have a cardboard restraining card inserted in one of its slots; press the appropriate eject button on the front of the Disk Drive to eject this card, and save it for use whenever you have to move the Disk Drive in the future.
2. If your computer has a front panel, initiate the INFO 2000 Loader/Driver at address F000 hexadecimal (360-000 split octal). If your computer does not have a front panel, set the jump-on-reset address to the Loader/Driver initiation address. (If you have a Digital Group computer, the replacement 1702 EPROM supplied by INFO 2000 accomplishes this.)
3. If you are using an S-100 system with a Cromemco TU-ART as the interface for your console device, strike the "Return" key several times until the INFO 2000 Loader/Driver displays its sign-on message. The driver software supplied by INFO 2000 for TU-ART-equipped systems performs automatic baud-rate detection for 110, 150, 300, 1200, 2400, 4800, 600, and 19200 bits-per-second transmission rates. The driver software requires the entry of several "Return" characters to detect which baud-rate is being used.

If you are using a non-TU-ART-equipped system, the INFO 2000 Disk Monitor should display its sign-on message immediately upon initiation at address F000 hex.

4. In response to the Loader/Driver sign-on message:

<CR> TO BOOT

insert your CP/M system diskette into side A (lefthand slot) of the Disk Drive with the label facing left and in the upper rear corner as you insert it. A motorized gate inside the Disk Drive will close and begin spinning the diskette when you have inserted it far enough. Type carriage-return to initiate cold-start loading of CP/M, as described in Section 3 of this document.

## 2.3. IN CASE OF DIFFICULTY...

Difficulties with the INFO 2000 Disk System most frequently stem from two causes: static electricity in the Disk Drive, or noise in the DC power supplies to the Controller.

Static electricity problems can be cured by being certain that the Disk Drive and computer chassis are well grounded. Normally this can be accomplished by plugging both into grounded (3-prong)

power outlets. However, not all 3-prong outlets are properly grounded. If you suspect a static electricity problem (e.g., high incidence of disk errors on low-humidity days), you may want to run a separate ground wire from the Disk Drive baseplate and the computer chassis to a known good ground such as a cold water pipe or a grounding rod.

Noisy DC power in your computer may be caused by poor power supply bypassing or by some board which generates a lot of noise on the power busses (video display boards such as the VDM-1 or the Digital Group TV board are especially bad offenders in this regard). If you suspect a DC noise problem (e.g., high incidence of "COMMAND ERROR" diagnostics or abnormal disk command terminations), you may want to add supplementary filter and bypass capacitors to your INFO 2000 Adapter board. We suggest the following: a 1 or 2 mfd Tantalum capacitor from each bus DC power input to ground (on S-100 Adapters, these are the unregulated power inputs), and a 1 or 2 mfd Tantalum capacitor plus a 0.1 mfd disk ceramic capacitor from the +5-volt regulated power input to ground located right at the right-angle connector which connects the Adapter to the Controller (the two bottom pins marked "36" and "RR" are both ground, while the two pins immediately above them are both +5-volts regulated). Be careful to observe correct polarity when installing the Tantalum capacitors.

If difficulties persist after you have tried these two suggestions, do not hesitate to contact INFO 2000 for assistance.

## SECTION 3 - USING THE CP/M DISK OPERATING SYSTEM

### 3.1. INTRODUCTION

Digital Research CP/M is a proprietary diskette-oriented monitor for use with 8080-, 8085-, or Z80-based microcomputers and IBM 3740-compatible diskette systems. INFO 2000 is an authorized distributor of CP/M, and offers a specially modified version of CP/M for use with the INFO 2000 Disk System.

Included with CP/M is a complete set of six user manuals covering all facets of the CP/M monitor and associated transients. This section describes only those aspects which are unique to the INFO 2000 version of CP/M and therefore not documented in the CP/M manuals.

### 3.2. COLD-START LOADING PROCEDURES

The INFO 2000 Loader/Driver is initiated at address F000 hex. If you are using a microcomputer with a front panel (Altair, IMSAI, etc.), set F000 into the address switches (leftmost four switches on, rightmost twelve switches off), then depress RESET, EXAMINE, and RUN in this order. If you are using a microcomputer without a front panel, set up the jump-on-reset address to F000 hex, then initiate simply by depressing the RESET switch.

If your microcomputer console is connected to a serial interface with software-selectable baud rates (e.g., Cromemco TU-ART), you must now type carriage return several times until a sign-on message is displayed; this permits the software to detect the baud rate being used and to initialize the interface accordingly. If you are not using such an interface, the sign-on message is displayed immediately upon initiation at address F000 hex.

Upon receiving the sign-on message from the INFO 2000 CP/M Loader:

<CR> TO BOOT

insert the CP/M system diskette into side A (left slot) of the diskette drive. When the diskette is loaded properly, type carriage-return to initiate loading of the CP/M disk operating system.

Cold-start loading requires approximately two seconds. The CP/M sign-on message is displayed, followed by the CP/M command prompt "A>".

### 3.3. CP/M RELOCATION PROCEDURE

The INFO 2000 CP/M system diskette is normally distributed with CP/M set up for a minimum RAM configuration of 16K. However, the system diskette includes a CP/M relocater program which permits a CP/M system to be generated for any memory size from 16K to 60K of RAM (in 1K increments). It is suggested that you create a new system diskette configured for your memory size, and then set the original 16K system diskette aside as a backup. The procedure is



illustrated below, with system messages shown in upper case and user responses shown in lower case.

First, insert the 16K CP/M system diskette into side A and perform a cold-start load in accordance with the instructions above. Next, insert a blank diskette into side B and format it as follows:

```
A>format
INFO 2000 CP/M DISK FORMATTER
INSERT DISKETTE TO BE FORMATTED IN DRIVE B
ENTER CARRIAGE RETURN TO BEGIN FORMATTING
[carriage return]
STARTING VERIFICATION PASS
A>
```

Now, relocate CP/M for the required memory size as follows:

```
A>movecpm xx *
CONSTRUCTING xxK CP/M VERS V.V
READY FOR "SYSGEN" OR
"SAVE 32 CPMxx.COM"
A>
```

where in place of "xx" you must enter a two digit number which specifies the desired RAM size in decimal kilobytes (between 16 and 60). Write this relocated CP/M onto the system area of the newly-formatted diskette in drive B as follows:

```
A>sysgen
ENTER SOURCE DRIVE (OR RETURN TO SKIP)
[carriage return]
ENTER DESTINATION DRIVE (OR RETURN TO REBOOT) b
DESTINATION ON B, THEN TYPE RETURN
[carriage return]
REBOOTING, TYPE RETURN
[carriage return]
A>
```

Finally, use PIP to copy all of the CP/M transients to the new diskette:

```
A>pip b:=a:*. *
COPYING -
MOVECPM.COM
DDT.COM
.
.
.
FORMAT.COM
VERIFY.COM
ASSIGN.COM
A>
```

```
MOVCPM.COM
PIP.COM
SUBMIT.COM
ED.COM
ASM.COM
DDT.COM
LOAD.COM
STAT.COM
SYSGEN.COM
DUMP.COM
DUMP.ASM
BIOS.ASM
CBIOS.ASM
FORMAT.COM
ASSIGN.COM
VERIFY.COM
BACKUP.COM
IPROM.ASM
IBOOT.ASM
FR105.ASM
CASPSK.ASM
TAPELIB.DOC
TAPELIB.COM
```

This completes the procedure.

### 3.4. USE OF INFO 2000 UTILITY TRANSIENTS

In addition to the various transient (i.e., diskette resident) commands provided by Digital Research with CP/M, INFO 2000 includes four new transient command files especially created for use with the INFO 2000 Disk System. These files are named FORMAT.COM, VERIFY.COM, ASSIGN.COM, and BACKUP.COM.

The format command permits a blank diskette in drive B to be initialized in accordance with the industry-standard soft-sectored format required by CP/M. The procedure is:

```
A>format
INFO 2000 CP/M DISK FORMATTER
INSERT DISKETTE TO BE FORMATTED IN DRIVE B
ENTER CARRIAGE RETURN TO BEGIN FORMATTING
[carriage return]
STARTING VERIFICATION PASS
A>
```

The formatting pass requires approximately half a minute, and the verification pass about the same. Entering either escape or control-C instead of carriage return will abort the format command without formatting the diskette, and control-C will cause a warm-start reload of CP/M.

The verify command permits a diskette in either drive A or drive B to be tested for soft errors. The procedure is:

```
A>verify
INFO 2000 CP/M DISK VERIFY
ENTER DRIVE TO BE VERIFIED (A OR B): a [or b]
STARTING VERIFICATION PASS ON DRIVE A
A>
```

Verification requires approximately half a minute. Entering either escape or control-C instead of a drive letter will abort the verify command, and control-C will cause a warm-start reload of CP/M.

The assign command permits each of the four logical I/O devices (console, reader, punch, list) to be assigned to one of four physical devices (denoted "T", "X", "Y", and "Z"). The syntax of the assign command is:

```
A>assign [logical]=[physical]
```

where "[logical]" must be one of the four letters "C", "R", "P", or "L" to denote console, reader, punch, or list, and "[physical]" must be one of the four letters "T", "X", "Y", or "Z". For example, to assign the logical list device to physical device "Y", enter the command:

```
A>assign l=y
```

To determine the correspondence between the letters "T", "X", "Y", and "Z" to the actual peripheral devices of your microcomputer system, refer to the listing of your customized

device drivers supplied by INFO 2000.

The backup command permits a rapid full-diskette copy from drive A to drive B, with complete verification. The procedure is:

```
A>backup
INFO 2000 CP/M DISK COPY
INSERT SOURCE DISK IN DRIVE A
INSERT DESTINATION DISK IN DRIVE B
ENTER CARRIAGE RETURN TO BEGIN COPYING
[carriage return]
SUCCESSFUL COPY
ENTER CARRIAGE RETURN TO REBOOT
[carriage return]
A>
```

SECTION 4 - INTERFACING WITH THE LOADER/DRIVER EPROM

The INFO 2000 Loader/Driver EPROM starts with an entrypoint branch table which is used by calling programs to interface with various I/O functions. Each entrypoint should be CALLED, and will RETURN to the caller when done.

Address	Function
F000	Initial Cold-Start Loader Entrypoint.
F003	Console Input, returns character in A.
F006	Reader Input, returns character in A, sets carry if EOF.
F009	Console Ouptut, outputs character in C.
F00C	Punch Output, outputs character in C.
F00F	List Output, outputs character in C.
F012	Console Status, returns A=FF if console input is waiting, returns A=0 otherwise.
F01E	Loader Trap, breakpoints and returns to the Loader are made via a call to this entrypoint.
F021	Floppy Input, returns character in A, sets carry if control byte.
F024	Floppy Input until EOT.
F027	Floppy Output, outputs character in C.
F02A	Floppy Output an EOT.

## SECTION 5 - WRITING PERIPHERAL DRIVER ROUTINES

With each Disk System, INFO 2000 offers the unique service of providing a set of EPROM-resident peripheral device driver routines which are customized to your particular I/O configuration (within reason) if specified at the time that you place your order for the INFO 2000 Disk System. If your I/O configuration should change in the future, you may want to modify or rewrite these routines yourself.

To assist you, INFO 2000 has supplied a complete assembly listing of your customized driver routines. You should save this listing, and use it as a model for any drivers that you may wish to write yourself in the future. Also, you will find three assembly language source files on the CP/M system diskette supplied by INFO 2000. The file IPROM.ASM is the assembler source for the loader portion of the Loader/Driver EPROM. The file IBOOT.ASM is the assembler source for the CP/M bootstrap which is located at track 0 sector 1 of your CP/M system diskette. The file IBIOS.ASM is the assembler source for the INFO 2000 version of the CP/M BIOS which interfaces with the driver routines in the Loader/Driver EPROM.

All driver routines must terminate with a RETURN instruction, and must save restore all registers as they were found except as noted. Driver routines may save registers by pushing them into the stack, as long as the stack pointer is returned intact (i.e. equal number of PUSHes and POPs).

The INIT routine is called by the Loader once each time the Loader is started at its initial entrypoint (hex F000). It may be used to initialize programmable USARTs such as the Intel 8251 or the TMS-5501, to clear the refresh memory of a video board, etc. INIT may spoil all registers except the stack pointer.

The console input routines CIT, CIX, CIY, and CIZ are called to obtain the next input character for devices T, X, Y, and Z. The routines must return the character in the A-register.

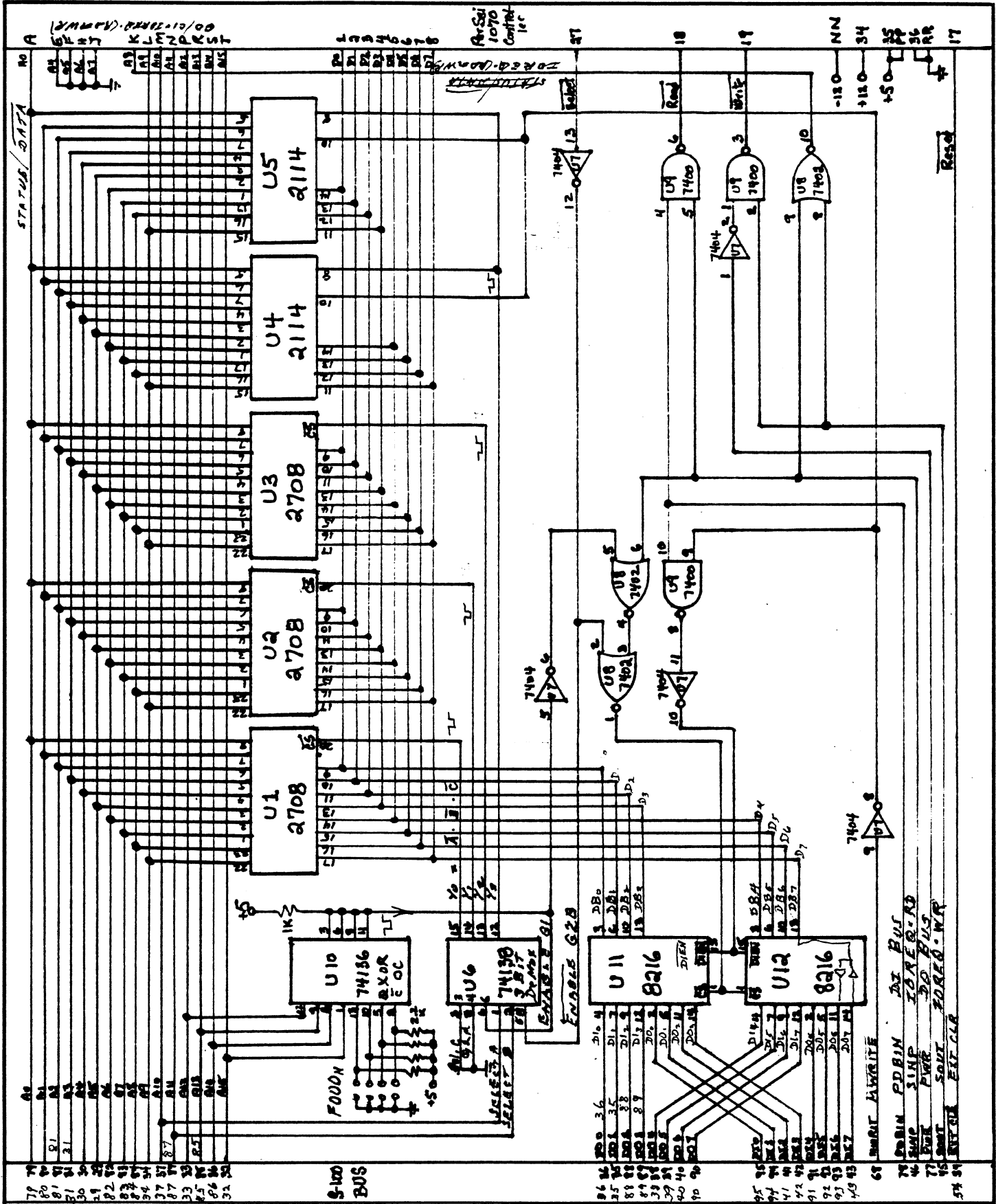
The console status routines CST, CSX, CSY, and CSZ are called to determine whether or not there is a console input character available. They must return hex FF in the A-register if there is, and zero in the A-register if there is not.

The console output routines COT, COX, COY, and COZ are called with the character to be output in the C-register. The routines must return with the character moved into the A-register and also preserved in the C-register. The punch output routines POT, POX, POY, and POZ, and the list output routines LOT, LOX, LOY, and LOZ are similar.

The reader input routines RIT, RIX, RIY, and RIZ are called to obtain the next character from the reader device. The character must be returned in the A-register with the carry flag reset, unless an end-of-file condition was detected in which case the carry flag must be set.

Selection of which console, reader, punch and list routine is to be used (T, X, Y, or Z) is determined by the setting of the CP/M I/O control byte at RAM address 0003. Upon initial cold-start load, the I/O control byte is initialized to use the "X" routine for console, reader, punch, and list.

SECTION 6 - SCHEMATIC DIAGRAMS





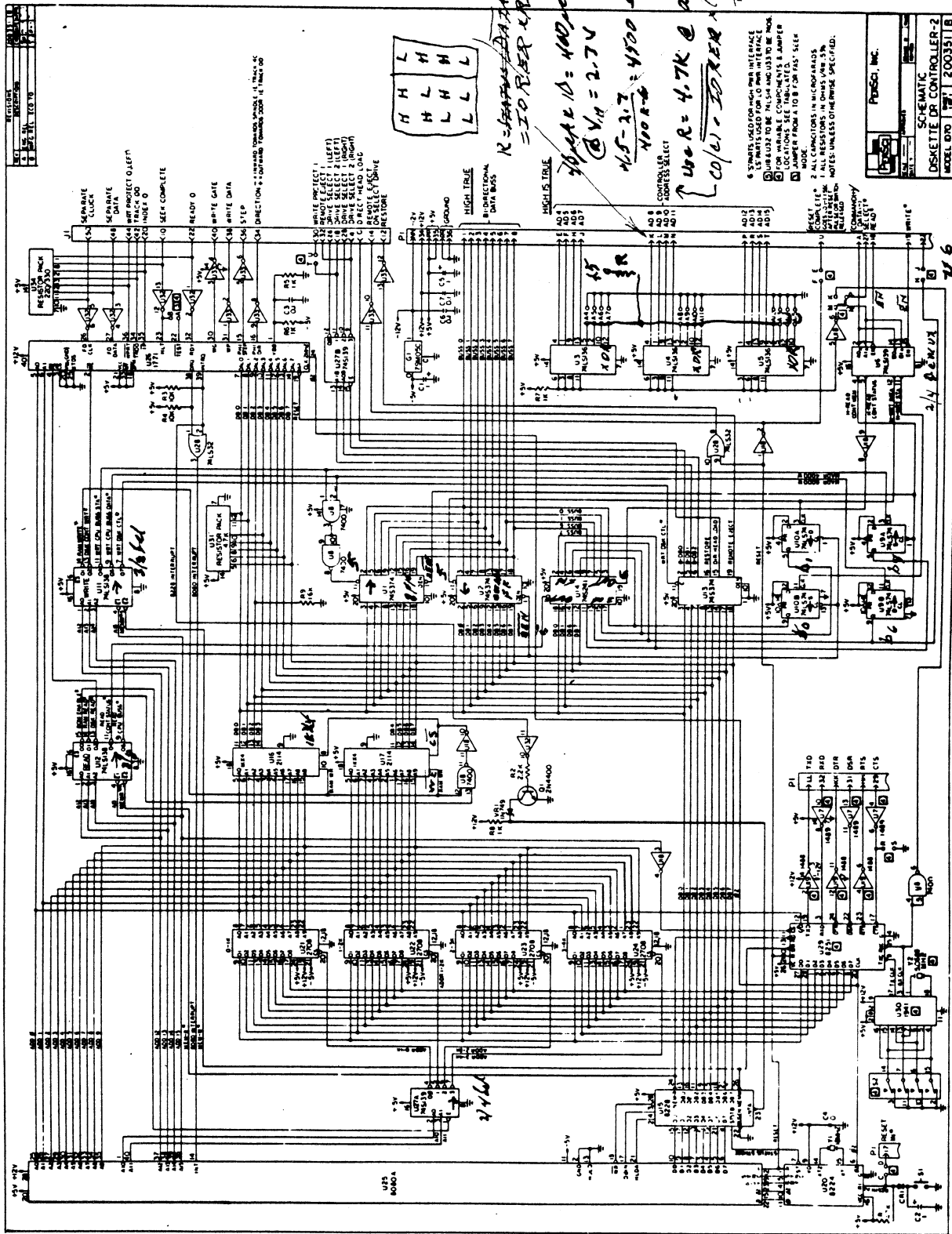


Figure 3. Model 1070 Intelligent Floppy Disk Controller Logical Program

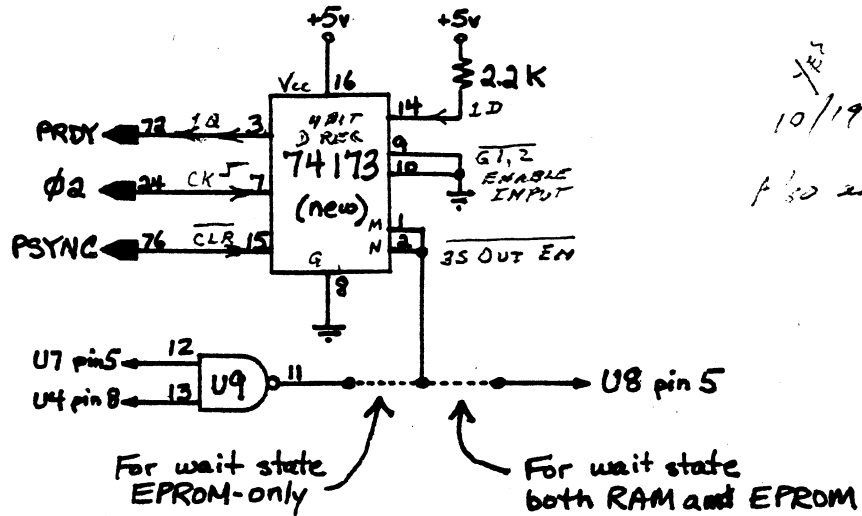






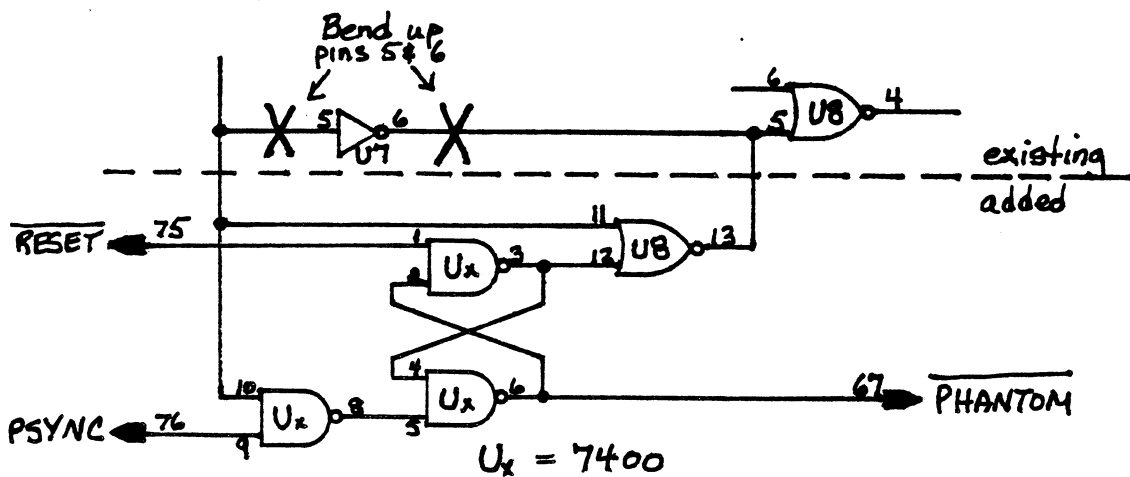
SECTION 7 - SUGGESTED USES FOR PROTOTYPE AREA

7.1. WAIT STATE MODIFICATION FOR S-100 OPERATION AT 4 MHZ



7.2. JUMP-ON-RESET MODIFICATION FOR S-100 SYSTEMS USING  
 RAM BOARDS WITH "PHANTOM" LINE ON BUS PIN 67

NO



L I M I T E D   W A R R A N T Y

INFO 2000 Corporation (INFO 2000), in recognition of its responsibility to provide quality products, components, and workmanship, warrants each new disk system and computer system it manufactures and each part and component thereof installed by INFO 2000 (except those excluded by paragraph 4 below) to be free from defects in material and workmanship for a period of 90 days after delivery to the first user of the system. This warranty is subject to the terms and conditions stated below:

1. Warrantor.

This warranty is granted by INFO 2000 Corporation, 20630 South Leapwood Avenue, Carson, California 90746, telephone (213) 532-1702.

2. Parties to Whom Warranty is Extended.

This warranty shall extend to any owner and to any person to whom the warranted system is transferred during the duration of this warranty.

3. Parts and Components Covered.

All parts and components of the warranted system manufactured and/or installed by INFO 2000 are covered by this warranty, except those parts and components excluded by paragraph 4 below.

4. Parts and Components Not Covered.

The following components are not covered by this warranty: (a) any part or component that shall have been subject to abnormal electrical or mechanical abuse, negligence or accident (as determined by INFO 2000); (b) any part or component that shall have deteriorated from ordinary wear and tear, such as paint; (c) expendable items that would normally be replaced within the warranty period, such as paper and ribbons.

5. Procedure for Obtaining Performance Under This Warranty.

In order to qualify under this warranty, the owner must notify INFO 2000 within ten days after discovery of the defect and receive authorization by INFO 2000 to return the defective system or component to INFO 2000. Upon receipt of such system or component, if it is found not to be defective in material or workmanship, INFO 2000 shall notify the owner of this fact and request instructions for its return to the owner. All cost of transporting the system or component to and from INFO 2000 shall be paid by the owner.

6. Remedy.

If, within the duration of this warranty, a system or component covered by this warranty is returned to INFO 2000 and proves to be defective in material or workmanship, INFO 2000 shall (at its option) repair or replace the defective item at its expense. Replacement of a defective component pursuant to this warranty shall be warranted for the remainder of the warranty period applicable to the replaced component. After the expiration of this warranty, a system or component