PerSci

USERS MANUAL
Intelligent Diskette Controller
Model 1070

INTRODUCTION

Since the following document was written, version F 1.3 of the PerSci File Management Firmware has been released for use with the 1070 Controller.

The Kill Command Syntax of version F 1.3 is:

KK volume/drive seq.

The remaining commands are as in the previous versions. The double KK was adopted as a device to reduce erroneous deletion of diskette files.

F 1.3 is issued in two versions; F 1.3P for controllers that do not have the serial (RS232) option installed and F 1.3S for those that do.

Two versions have been coded because deletion of the code necessary to handle serial data resulted in significantly faster controller operations.

Version F 1.3S retains the capability of the previous F 1.0 and F 1.2 and will work with either serial or parallel data transfers.

EPROM IDENTIFICATIONS

EPROMs coded at PerSci are marked U21, 22, 23, and 24 to indicate the appropriate sockets on the controller PCB. Additional markings have been made to indicate the coding as follows:

F 1.0	U21, 22, 23, 24
F 1.2	U21A, 22B, 23C, 24D
F 1.3P	21P, 22P, 23P, 24P
F 1.3S	21S, 22S, 23S, 24S

PREFACE

This document describes the definitive production version of the PerSci Model 1070 Intelligent Diskette Controller using PerSci File Management Firmware version F1.2. It is also applicable to the predecessor version, F1.0, with certain exceptions as noted herein. (Version F1.1 was never released.)

Version F1.2 File Management Firmware offers several improvements over its predecessor. It implements two additional commands (Xecute and Zap), supports hexadecimal as well as decimal numeric command parameters, provides automatic switching between the serial and parallel interfaces, and has a number of internal performance improvements. F1.2 also takes advantage of new revisions in the circuitry of the PerSci controller and drives to eliminate the head load delays (and clatter) during disk-to-disk copying and other multi-disk operations.

NOTE: When F1.2 is used with earlier PerSci controllers and drives which do not in combination have the necessary logic circuitry to permit the firmware to load all heads simultaneously, the controller Mode command must be used at each power up to inform the Firmware of this fact. Controllers and drives which in combination support this simultaneous head load capability are:

> Model 1070 Controllers with Assembly 200350
> (PCB 200349A, B, or higher)
>
> Model 277 Drives with Data and Interface
> Assembly 200263-003 Rev. H, or higher
> (PCB 200262C, or higher)
>
> Model 70 Drives with PCB Assembly 200208

(PCB numbers are etched on the non-component side of printed circuit boards.)

NOTE: Predecessor Firmware version F1.0 must be used only with controllers and drives which DO NOT in combination have the simultaneous head load circuitry.

It is the policy of PerSci not to distribute program source listings of other details of the File Management Firmware beyond those described in this manual. From time to time, PerSci will issue new versions of the Firmware (for example, F1.2) to correct any known errors or to provide functional enhancements. Such Firmware revisions in ROMs or EPROMs will be made available to users of previous versions for a nominal charge. PerSci will also assist users in adapting the Model 1070 Controller to special applications (within reason) which require specialized controller software. The "Xecute" command (which permits special disk-resident software to be loaded into the controller and executed) was added to F1.2 to facilitate this. A charge will be made for any such software development work.

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SECTION 1 - GENERAL DESCRIPTION

1.1. SUMMARY OF FEATURES

The PerSci Model 1070 is the first truly intelligent diskette controller. Can you imagine a controller which manipulates diskette files by name and provides the full functional capabilities of an advanced disk operating system, yet which requires no more support software in your microcomputer than does a paper tape reader or magnetic tape cassette drive? The Model 1070 accomplishes all of this on a single 4.5" by 7" circuit board through a combination of state-of-the-art LSI and microprocessor technology, advanced firmware techniques, and high-density packaging. The controller supports up to four PerSci Model 70 single diskette drives or up to two PerSci Model 277 dual diskette drives, providing a high-performance mass storage subsystem with an on-line capacity of more than one million bytes.

1.2. HARDWARE

The controller board incorporates a microprocessor and its associated support electronics, a LSI diskette drive controller chip, 4K bytes of ROM (optionally EPROM) containing the file management firmware, 1K bytes of RAM used for sector buffers and file tables, an eight-bit parallel microcomputer interface, and an optional RS-232 serial asynchronous interface. Required power for the controller (+5, +12, and -12 volts regulated) can be derived either from the microcomputer or diskette drive power supplies.

1.3. FIRMWARE

The controller firmware resides in ROM on the controller board and performs the file management functions normally associated with the most advanced microcomputer disk operating systems. Supported functions include: diskette format initialization with optional sector interleave; maintaining and searching and index of files on each diskette; allocation and deallocation of diskette space; sequential, random, stream, and direct file access methods; blocking and unblocking of both fixed-length and variable-length records; creating, deleting, renaming, and copying of files; error detection and error retry; and even diagnostic testing of the diskette drives. These file management functions are specified by means of a high-level controller command language. Only minimal support software is needed in the host microcomputer, making it exceptionally easy to use the controller with existing non-disk-oriented operating systems, language processors, and other software.

1.4. INTERFACES

Two alternative methods are provided for interfacing with the controller: parallel and serial. The parallel microcomputer interface includes a buffered eight-bit bidirectional data bus with handshake and address selection logic consistent with the interface requirements of most currently-available microprocessors including the 8080, 6800, Z-80, etc. The optional EIA RS-232 serial asynchronous interface provides sixteen switch-selectable transmission speeds from 50 to 19,200 bits per second, interfacing directly with virtually any standard terminal, modem, or serial microcomputer interface port. When using a controller which includes the optional serial interface, switching between parallel and serial is performed automatically by controller firmware.

1.5. DISKETTE FORMAT

The diskette initialization function of the controller creates a soft-sectored diskette format which is IBM 3740 compatible. Each diskette contains 77 tracks with 26 sectors per track and 128 data bytes per sector. The first track is reserved by the controller for use as an index of files, while the remaining 76 tracks are available for data storage. Formatted capacity of each diskette is 252,928 bytes plus the index track.

1.6. COMPANION DISKETTE DRIVES

The PerSci Model 70 single diskette drive and Model 277 dual diskette drive incorporate many design features previously unique to large disk technology, resulting in unexcelled reliability and performance, small size, and fast access to data. The use of voice coil positioning provides access times which are five to seven times faster than other available diskette drives with stepping motor positioners. Automatic motor-driven diskette load and unload assures simple and accurate diskette insertion and eliminates the possibility of diskette damage. Power consumption is one fourth of the power required by competitive drives, no cooling fan is required, and operation is virtually noiseless. Compact design permits five single drives or four dual drives to be mounted within the width of a 19" rack. The PerSci Model 1070 intelligent diskette controller is especially designed to take maximum advantage of the high-performance capabilities of these drives.

SECTION 2 - HARDWARE SPECIFICATIONS

2.1. PHYSICAL SPECIFICATIONS

The controller consists of a single printed circuit board with dimensions 4.50" x 7.00" which mates with edge connectors along the two 4.50" sides of the board. One edge connector has 72 pins (dual 36) with .100" spacing, and carries the parallel interface, RS-232 serial interface, and controller power connections. The other edge connector has 50 pins (dual 25) with .100" spacing and provides the interface with the diskette drive(s). The controller board is physically compatible with Vector Electronics plugboards and card cages with 72 pin connectors.

2.2. MICROCOMPUTER INTERFACE SPECIFICATIONS

2.2.1. Mating Connectors

The microcomputer interface uses an edge connector with 72 pins (dual 36) and .100" spacing (Amphenol 225-23621-201 or equivalent). In the listing below, all signals are TTL active high, except those marked * are TTL active low and those marked ** are EIA RS-232 levels.

Pin ID	Signal Designation	Pin ID	Signal Designation
PARALLEL INTERFACE		RS-232 SERIAL INTERFACE	
1 thru 8	Data Bus 0 thru 7	LL	Transmit Data**
E thru T	Addr Bus 4 thru 15	32	Receive Data**
27	Select*	KK	Data Term. Ready**
18	Read Strobe*	31	Data Set Ready**
19	Write Strobe*	HH	Request to Send**
A	Status/Data	29	Clear to Send**
CONTROLLER RESET		CONTROLLER POWER	
17	Reset Controller*	RR,36	Ground
U	Reset Complete*	PP,35	+5v Regulated
		34	+12v Regulated
		NN	-12v Regulated

2.2.2. Signal Definitions

Address Bus 4 through 15:
When the controller is jumpered for internal address decode (M to N and N to P), the presence of a 12-bit address on these lines which matches the jumper-selected controller address causes the parallel interface to be enabled. These lines are generally connected to the 12 high-order bits of a microcomputer address bus.

Select*:
When the controller is jumpered for internal address decode (M to N and N to P), this line is an output which goes low whenever the parallel interface is enabled by the address decode logic. When the controller is jumpered for external address decode (N to P only), this line is an input which causes the parallel interface to be enabled when it is driven low.

Read Strobe*, Write Strobe*:
Whenever the parallel interface is enabled, a low level on the Read Strobe* or Write Strobe* line causes the controller to transfer a byte of data to or from the data bus, respectively.

Data Bus 0 through 7:
These eight bidirectional data lines are tri-stated (floating) except when the parallel interface is enabled and Read Strobe* or Write Strobe* is active.

Status/Data:
Whenever the parallel interface is enabled, a high level on this line causes the controller status port to be selected, and a low level causes the data port to be selected. This line is generally connected to the low-order bit (A0) of a microcomputer address bus.

Reset Controller*:
A low level on this line causes the controller to be reset.

Reset Complete*:
This line goes high when Reset Controller* is made active or the controller reset button is depressed, and returns low after the reset signal has been removed.

Transmit Data**, Receive Data**, Data Terminal Ready**, Data Set Ready**, Request to Send**, Clear to Send**:
These lines have their standard RS-232 definitions. Transmit Data** from the controller is serial asynchronous with one start and one stop bit, eight data bits, and no parity.

2.3. DISKETTE DRIVE INTERFACE SPECIFICATIONS

2.3.1. Mating Connectors

The diskette drive interface uses an edge connector with 50 pins (dual 25) and .100" spacing (Scotchflex 3415-0000 or equivalent for flat ribbon cable, Viking Connector 3VH25/1JN-5 or TI Connector H312125 or equivalent for solder connections). All odd-numbered pins are connected to ground to facilitate the use of twisted-pair cable between the controller and diskette drive(s), which is strongly recommended.

Pin	Signal Designation	Pin	Signal Designation
4	Drive 3 Select	28	Drive 2 Select
10	Seek Complete	34	Direction
12	Restore	36	Step
14	Remote Eject	38	Write Data
16	Direct Head Load	40	Write Gate
18	Drive 1 Select	42	Track 00
20	Index	44	Write Protect
22	Ready	48	Separate Data
26	Drive 0 Select	50	Separate Clock

2.3.2. Signal Definitions

For signal definitions, refer to PerSci Product Specifications, Model 70 or Model 277 Diskette Drive.

2.4. POWER REQUIREMENTS

Power requirements for the Model 1070 controller are: +5 volts at 1.5 amp maximum, +12 volts at 150 ma maximum, -12 volts at 200 ma maximum, all voltages regulated within plus or minus five percent.

2.5. RS232 SERIAL INTERFACE OPTION

This is a factory-installed option which provides an EIA standard RS-232 serial asynchronous interface in addition to the standard parallel microcomputer interface. Switching between parallel and serial is performed automatically by controller firmware; when the controller receives a command over one of the interfaces, it responds using the same interface. The RS-232 Serial Interface Option includes an on-board speed selection switch with the following settings:

Switch Setting	Transmission Speed (BPS)	Switch Setting	Transmission Speed (BPS)
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

NOTE: The controller outputs serial characters with one start bit, eight data bits (no parity), and one stop bit for all transmission speeds.

SECTION 3 - FIRMWARE SPECIFICATIONS

3.1. THEORY OF OPERATION

3.1.1. File Allocation

A diskette volume contains 77 tracks with 26 sectors per track and 128 data bytes per sector. The outermost track is reserved by the controller for use as an index (i.e., a table of contents) for the volume, while the remaining 76 tracks are available for file storage.

When a new file is created on a diskette volume, it receives an allocation of contiguous sectors. The minimum file allocation is one sector, and the maximum allocation is 1,976 sectors (i.e., 76 tracks of 26 sectors, or 252,928 bytes). The first file created on a newly initialized diskette receives an allocation starting immediately above the index track. Subsequently created files receive an allocation starting immediately above the allocation of the previously created file. The allocation of each file is recorded on the index track.

When a file is deleted, its block of contiguous sectors is deallocated, and its index entry is marked as deleted. The controller provides a command ("Gap") to compress the allocations on a volume, eliminating the gaps caused by previous file deletions and making the space available for subsequent file creations.

3.1.2. File Access Methods

The controller provides four methods for accessing and updating data stored on diskette.

The stream access method permits an entire file to be read or written as a continuous stream of data bytes (as if the diskette file were a very high speed paper tape). Stream access is the simplest access method to use, requiring only a single controller command to read (load) or write (save) an entire file. It is ideally suited to the storage and retrieval of executable programs or any other use in which paper tape or cassette tape is conventionally used. Stream access is performed using the "Load" and "Save" controller commands.

The punctuated access method treats a file as a sequence of variable-length records separated by punctuation marks (the controller uses the ASCII record separator character "RS" for this). A punctuated file may be positioned at its beginning or end, and variable-length records may be read or written in sequence, one at a time. Records may span sector boundaries on the diskette but this is made transparent by the controller. Punctuated access is most appropriate for the storage of text files (e.g., source programs or word processing files) or for any application in which sequential access to variable-length records is desirable. Because of its dependency on a unique punctuation character ("RS") to delimit records, punctuated access is not well suited to the storage of arbitrary binary information.

The relative access method treats a file as a byte-addressable memory. A relative file may be positioned at its beginning, end, or to any desired byte position within the file. Any number of bytes may then be read or written. Relative read and write operations may span sector boundaries but this is made transparent by the controller. Relative access is ideal for data base oriented applications in which random access is required. Both punctuated and relative access are performed using the "File", "Position", "Read", and "Write" controller commands.

Finally, the direct access method permits any specified sector of any specified track of a diskette to be read or written directly, bypassing the file management functions of the controller altogether. Direct access is performed using the "Input" and "Output" controller commands.

3.1.3. File References

A file reference identifies a particular file or group of files. File references may be either unique or ambiguous: a unique file reference identifies one file uniquely, while an ambiguous file reference may be satisfied by several different files.

File references consist of four components: a name of up to eight characters (NNNNNNNN), a version consisting of a period followed by up to three characters (.VVV), a type consisting of a colon followed by a single character (:T), and a drive number consisting of a slant followed by a digit between 0 and 3 (/D). The version, type, and drive components are optional and are set off from the name by means of their unique leading punctuation characters (NNNNNNNN.VVV:T/D). A missing name, version, or type is assumed to be blank, and a missing drive number is assumed to refer to the current default drive.

The following are examples of valid unambiguous file references:

```
MONITOR            MASTER/2          STARTREK.BAS/1
MONITOR.SRC        MASTER:$          STARTREK.XQT
MONITOR.OBJ:A      MASTER.ONE        STARTREK:Z/0
```

The special characters "?" and "*" may be used to make a file reference ambiguous so that it may match a number of different files. The "?" is used as a "wild-card" character which matches any character in the corresponding position in a file reference. Thus the ambiguous file reference:

```
PER????.BA?
```

matches all of the following unambiguous file references:

```
PERFECT.BAL        PERSCI.BAS        PERQ.BAX
```

The character "*" is used to denote that all character positions to the right are wild-cards unless otherwise specified. The following examples illustrate the flexibility which this facility provides:

Reference	Equivalent to	Ambiguous Reference Matches
MONITOR.*	MONITOR.???:?	all files with name MONITOR
*.BAS	????????.BAS:?	all files with version .BAS
Z*	Z???????.???:?	all files starting with Z
*	????????.???:?	all files on the diskette

3.2. CONTROLLER COMMANDS

Controller commands consist of a single command letter followed (in most cases) by one or more command parameters. Parameters must not contain embedded spaces, must be set off from one another by spaces, and may optionally be set off from the command letter by spaces.

CONTROLLER COMMAND SUMMARY

Command	Command Syntax	Command Function Summary
Allocate	A file sectors	Allocates an empty file "file" of "sectors" sectors.
Copy	C file1 file2 sectors	Copies files matching "file1" to same or different diskette, optionally renaming according to "file2" and reallocating according to "sectors".
Delete	D file	Deletes all files matching "file".
Eject	E /drive	Ejects diskette in drive "drive".
File	F unit file	Opens "file" and associates with "unit".
	F unit	Closes the open file associated with "unit".
	F	Closes all open files.
Gap	G /drive	Compresses allocations on "drive" to eliminate gaps.
Input	I track sector /drive	Reads specified sector.
*Kill	K volume/drive seq	Initializes diskette with interleave "seq".
	K volume/drive	Deletes all files on diskette without initializing.
Load	L file	Reads entire file "file" as a stream.
Mode	M date:options/drive	Sets current date, I/O options, and/or default drive.
Name	N file1 file2	Renames file "file1" in accordance with "file2".
Output	O track sector /drive	Writes specified sector.

Position	P	unit	sector	byte	Positions the open file associated with "unit".
	P	unit			Reports current position of file associated with "unit".
Query	Q	file			Reports index information for files matching "file".
Read	R	unit	bytes		Relative read of file associated with "unit".
	R	unit			Punctuated read of file associated with "unit".
Save	S	file			Creates new file "file" by writing as a stream.
Test	T	option/drive			Executes a diagnostic test on drive "drive".
Write	W	unit	bytes		Relative write to file associated with "unit".
	W	unit			Punctuated write to file associated with "unit".
Xecute	X	file	option		Loads file "file" into controller RAM and executes it.
Zap	Z	unit			Writes end-of-data mark at present position of file associated with "unit".

NOTE: Numeric command parameters (byte, bytes, sector, sectors, seq, track) must be decimal for version F1.0 Firmware, but may be either decimal or hexadecimal for version F1.2. Hexadecimal parameters must be prefixed by a letter (such as "H" or "X"; for example, the commands:

```
A  FNAME  32
A  FNAME  X20
```

will both allocate a file whose length is 32 (decimal) sectors.

NOTE: The commands Xecute and Zap are not in the F1.0 version.

3.2.1. Allocate Command (A file sectors)

The "Allocate" command creates a new, empty file with the specified allocation (decimal or hex number of sectors).

Example:

```
A  BIGFILE  1000
```

3.2.2. Copy Command (C file1 file2 sectors)

The "Copy" command copies one or a collection of files from a diskette volume to the same or a different diskette volume. The copied files may have the same or different names as the original files, and may have the same or different allocations. The "Copy" command cannot be used if there are any open files.

Examples:

```
C  ALPHA  BETA
C  ALPHA/0  */1
C  ALPHA/0  BETA/1  100
C  */0  */1
C  A*/0  B*/1
```

The first example makes a duplicate of the file ALPHA on the same diskette (default drive), calling the duplicate BETA. The second example copies the file ALPHA from drive 0 to drive 1, leaving the name and allocation unchanged. The third example also copies ALPHA from drive 0 to drive 1, but changes the name to BETA and gives the new file an allocation of 100 sectors (which may be larger or smaller than ALPHA). The fourth example copies all files from drive 0 to drive 1, preserving all file names and allocations. The last example copies only files with names starting with "A" from drive 0 to drive 1, changing the first character of each file name from "A" to "B".

3.2.3. Delete Command (D file)

The "Delete" command deletes a file or a collection of files from a diskette.

Examples:

```
D  GEORGE
D  *.OBJ/1
D  XZ??/2
```

The first example deletes a single file GEORGE from the default drive. The second example deletes all files on drive 1 which have version .OBJ. The last example deletes all files on drive 2 which have two to four character names starting with "XZ".

3.2.4. Eject Command (E /drive)

The "Eject" command causes the diskette to be ejected from the specified drive. Note that this command is effective only if the diskette drive is equipped with the Remote Eject feature.

Examples:

```
E /2
E
```

3.2.5. File Command (F unit file)

The "File" command opens and closes diskette files. A file must be open before punctuated or relative access is permitted by the controller. An open file is associated with a logical unit number between 1 and 5 (a maximum of five files may be open at one time).

Examples:

```
F 2 MASTER/1
F 2
F
```

The first example opens the file MASTER on drive 1 and associates it with logical unit 2. The second example closes the open file associated with logical unit 2. The third example closes all open files.

3.2.6. Gap Command (G /drive)

The "Gap" command compresses the allocations on a diskette volume to eliminate any gaps in the allocations caused by prior file deletions. The "Gap" command cannot be used if there are any open files.

Examples:

```
G /3
G
```

3.2.7. Input Command (I track sector /drive)

The "Input" command reads a single specified sector of a diskette volume. The sector is specified by decimal track number (0-76), decimal sector number (1-26), and drive number. (In F1.2, the track and sector number may also be hexadecimal.)

Examples:

```
I 43 10 /1
I 1 1
```

3.2.8. Kill Command (K volume/drive seq)*

The "Kill" command deletes all files on a diskette volume. Optionally, the command also initializes (formats) the entire diskette, erasing all previously recorded information thereon and writing new sector headers on each track. The diskette may be initialized with any one of thirteen sector interleave sequences to enhance read/write performance. Further discussion of interleave sequences appears in section 3.4.3 of this document.

Examples:

```
K  SCRATCH/3
K  BACKUP  1
K  MASTER  9
```

The first example deletes all files on drive 3, labels the volume SCRATCH, but does not initialize each track. The second example initializes the diskette on the default drive without interleave. The last example initializes with interleave sequence 9.

3.2.9. Load Command (L file)

The "Load" command reads a diskette file in its entirety as a stream.

Examples:

```
L  BASIC
L  EDITOR/3
```

3.2.10. Mode Command (M date:options/drive)

The "Mode" command may be used to set the current date, the default diskette drive, and/or various controller options. The current date is entered as a six character value (the format YYMMDD is suggested but not required by the controller). The default diskette drive is entered as the character "/" followed by a drive number (0-3); this becomes the drive which is used for all subsequent file references and commands which do not include an explicit drive number. The options are entered as the character ":" followed by a single hexadecimal digit (0 through F) whose bits are microcoded as follows (this applies to F1.2 only):

Option	Meaning
:8	Supress non-fatal error messages
:4	Simultaneous head load NOT available
:2	Keep heads loaded continuously
:1	Model 70 drives in use

NOTE: At initial power up, the controller assumes by default that Model 277 drives with the simultaneous head load feature are in use.

*F1.3 syntax KK volume/drive seq.

Examples:

```
M  770819
M  /1
M  :C
```

The last example above informs the controller that the controller and/or drive do not support simultaneous head load, and that non-fatal error messages are to be supressed.

3.2.11. Name Command (N file1 file2)

The "Name" command modifies the name, version, and/or type of a file. The wild-card characters "?" and "*" are used to indicate that selected portions of the file reference are to be left unchanged, as illustrated in the examples.

Examples:

```
N  ALPHA  BETA
N  BACKUP.2  *.3
N  XRATED  R*
```

The first example changes the file ALPHA to BETA. The second example changes BACKUP.2 to BACKUP.3, while the third changes XRATED to RRATED.

3.2.12. Output Command (O track sector /drive)

The "Output" command writes a single specified sector of a diskette volume. Its parameters are identical to those for the "Input" command.

Examples:

```
O  43  10  /1
O  1  1
```

3.2.13. Position Command (P unit sector byte)

The "Position" command permits open files to be positioned at the beginning, end, or at any specified byte position. The command may also be used to report the current position of an open file.

Examples:

```
P  2  213  88
P  2  213
P  2  0
P  2  9999
P  2
```

The first example positions the open file associated with logical unit 2 to byte 88 in sector 213 of the file. The second examples positions the file to byte 0 of sector 213. The third example positions the file at its beginning, and the fourth example position the file at its end-of-data (note that the controller does not permit a file to be positioned beyond its end-of-data).

Finally, the last example simply reports the current position of the file.

3.2.14. Query Command (Q file)

The "Query" command lists the following index information for one, some, or all files on a diskette volume:

- Name, version, and type
- Start of allocation (decimal track and sector)
- Length of allocation (decimal number of sectors)
- End of data (decimal sector and byte offset)
- Date of creation
- Date of last update

This information is preceded by a heading which lists the volume name, next available track and sector, volume interleave, and date initialized.

Examples:

```
Q  ALPHA/2
Q  *.SRC
Q  *
```

Sample Query Listing:

```
SCRATCH.DSK 06-07 09 770215
FMF11.OBJ:3        01-01 0032 0031 082 770430
TEXTED             02-07 0025 0024 000 770503
DOCUMENT.TXT       03-06 0079 0078 001 770503 770618
```

3.2.15. Read Command (R unit bytes)

The "Read" command reads an open file by means of either the relative or punctuated access method (i.e., fixed-length or variable-length records).

Examples:

```
R  2  80
R  2
```

The first example reads a fixed-length record of 80 bytes from the current position of the open file associated with logical unit 2. The second example reads a variable-length record delimited by a record separator character ("RS").

NOTE: The maximum length of a fixed-length read is 65535 bytes (HFFFF).

3.2.16. Save Command (S file)

The "Save" command creates a new file by writing a stream of data onto the diskette. The resulting file receives an allocation of the minimum number of sectors needed to accomodate the length of the stream.

Examples:

```
S  BASIC
S  EDITOR/3
```

3.2.17. Test Command (T option/drive)

The "Test" command performs one of several diagnostic tests on the specified drive. Available tests are: V (random seek-verify test), R (random seek-read test), and I (incremental seek-read test).

Test V is a high-speed random-seek test. It performs a sequence of seeks to a randomly-selected track, reads the first encountered sector header on that track, and verifies that the correct track has been reached.

Test R is a random-seek-read test. It performs a seek to a randomly-selected track, then reads a particular randomly-selected sector on that track, and verifies that both the sector header and sector data are correct (using the CRC in each case).

Test I is an incremental-read test. It reads and verifies both the sector header and sector data of each sector on the diskette, starting at track 0 sector 1 and proceeding incrementally through track 76 sector 26.

Once initiated, tests V and R run indefinitely until the controller is reset or until a hard disk error is encountered which persists for five successive retries. Test I makes a single pass over the diskette, reading each sector once, and then terminates.

Examples:

```
T  V/1
T  R/0
T  I
```

3.2.18. Write Command (W unit bytes)

The "Write" command writes an open file by means of either the relative or punctuated access method (i.e., fixed-length or variable-length records). If data is written beyond the end-of-data of the file, the end-of-data is moved accordingly. The controller will not permit data to be written beyond the last sector allocated to the file.

Examples:

```
W  2  80
W  2
```

The first example writes a fixed-length record of 80 bytes to the open file associated with logical unit 2, starting at the current position of the file. The second example writes a variable-length record to the file, followed by a record separator character ("RS").

NOTE: The maximum length of a fixed-length write is 65535 bytes (HFFFF hex).

3.2.19. Xecute Command (X file option)

The "Xecute" command loads an executable diskette file into controller RAM and executes it. This permits diskette-resident routines to extend the effective command repertoire of the controller. The option is a decimal or hex parameter which is passed to the routine. The "Xecute" command is not available in F1.0.

Note that the "Xecute" command is not required for normal use of the controller, but was included to facilitate special applications of the controller. For further details, contact PerSci.

Examples:

```
X  DRIVTEST  1
X  CONVERT
```

3.2.20. Zap Command (Z unit)

The "Zap" command truncates an open file by establishing the end-of-data at the current position of the file. Note that this command does not affect the allocation of the file, only its end-of-data position. The "Zap" command is not available in F1.0.

Example:

```
Z  2
```

3.3. CONTROLLER INTERFACE PROTOCOL

3.3.1. Protocol Definition

The interface protocol between the microcomputer and the controller consists of sequences of ASCII characters and makes use of standard ASCII communications controls. The protocol for the simplest controller commands (Allocate, Eject, File, Kill, Mode, Name, Test, Xecute, Zap) is the following:

```
Microcomputer sends:   command-text  EOT
Controller sends:      ACK  EOT
```

The protocol for controller commands which return informational text (Copy, Delete, Gap, Position, Query) is the following:

```
Microcomputer sends:   command-text  EOT
Controller sends:      informational-text  CR  LF  ACK  EOT
```

The protocol for controller commands which read data from diskette (Input, Load, Read) is the following:

```
Microcomputer sends:   command-text  EOT
Controller sends:      SOH  diskette-data  ACK  EOT
```

The protocol for controller commands which write data to diskette (Output, Save, Write) is the following:

```
Microcomputer sends:   command-text  EOT
Controller sends:      ENQ  EOT
Microcomputer sends:   diskette-data  EOT
Controller sends:      ACK  EOT
```

Finally, the controller may terminate any command at any time wih a fatal error diagnostic message, using the following protocol:

```
Controller sends:      NAK  fatal-error-msg  CR  LF  EOT
```

Note that no ACK will be transmitted by the controller in this case.

3.3.2. Error Diagnostic Messages

The controller issues two classes of error diagnostic messages: fatal and non-fatal. Fatal error diagnostic messages are always preceded by a NAK and followed by an EOT. They indicate the premature and unsuccessful termination of a controller command. The various fatal error diagnostic messages are listed below:

COMMAND ERROR ON DRIVE #n
: Indicates that the controller received an invalid command or command parameter.

DUP FILE ERROR ON DRIVE #n
: Indicates that an attempt was made to create a new file with the same name as an existing file on the same diskette.

HARD DISK ERROR ON DRIVE #n
Indicates that a seek, read, or write error occurred which could not be successfully resolved in five retries.

NOT FOUND ERROR ON DRIVE #n
Indicates that the specified file could not be found in the index of the specified diskette.

OUT OF SPACE ERROR ON DRIVE #n
Indicates that an attempt was made to exceed the capacity of a diskette, an index track, or a file allocation.

READY ERROR ON DRIVE #n
Indicates that an attempt was made to access a diskette drive which is not in ready status.

UNIT ERROR ON DRIVE #n
Indicates that an attempt was made to read, write, or position a logical unit number with which no open file is associated, or that an attempt was made to use the "Copy" or "Gap" commands with one or more files open.

The clause "ON DRIVE #n" is omitted in the case of errors not associated with a particular drive, and is not provided at all in F1.0.

Note that each fatal message begins with a unique letter, so that an interfacing program need only analyze the first character following a NAK to determine the type of fatal error.

Non-fatal error diagnostic messages are issued for soft disk errors. They are not preceded by a NAK, and they contain the following information:

. type of disk operation (seek, read, or write)
. error retry number (1 to 5)
. track and sector at which error occurred
. type of error (protect, fault, verify, CRC, or lost)

Multiple error-type indications may be received on a single non-fatal error message, and their meanings are as follows:

. protect: a write was attempted on a write-protected disk
. fault: a write fault was received from the drive
. verify: the desired sector header could not be found
. CRC: the sector header and/or data failed the CRC test
. lost: one or more bytes were lost during a data transfer

During the transmission of diskette data (Load, Save, Read, Write, Input, and Output commands), non-fatal error messages are suppressed. They may also be supressed under all circumstances by means of the Mode command.

3.3.3. Parallel Interface Considerations

The parallel interface offers a number of advantages in interfacing the controller to a microcomputer system: (1) its transfer rate is very fast, (2) it provides complete handshaking to coordinate data transfers in both directions, and (3) it provides a means for uniquely distinguishing communications control characters (EOT, ACK, NAK, SOH, ENQ) from data characters. The last two of these functions are accomplished by means of the controller status byte, whose format is:

- bit 7 - receive data available, control character
- bit 6 - receive data available, data character
- bits 5,4,3,2 - always "1"
- bit 1 - transmit buffer full, data character
- bit 0 - transmit buffer full, control character

When the microcomputer reads the controller data port, bits 7 and 6 of the controller status byte are reset and remain so until the controller sends another character to the parallel interface. When the microcomputer writes the controller data or status port, bit 1 or bit 0 (respectively) is set and remains so until the controller has processed the character from the parallel interface. Since communications control characters cannot be confused with data characters, arbitrary binary information may be read or written freely when using the parallel interface.

Before attempting to write to the controller, the status byte should be read and tested to ensure that no receive data is available and that the transmit buffer is empty. In particular, when the controller is powered up or reset, it outputs a control EOT (in F1.0, a control ACK followed by a control EOT); these must be read before any command is sent to the controller.

The design of the parallel interface requires two write operations to transmit a control character (e.g., EOT). The first write should address the status register (this will set status bit 0) followed immediately by the second write to the data register (which will set status bit 1). Thus, the controller will see both status bits 0 and 1 set when reading a control character. However, when reading data from the controller, either status bit 6 or status bit 7 will be set by the controller, but never both.

As previously described, reading the controller data register will reset bits 6 and 7 of the status register, but reading the status register does not affect the contents of either register.

3.3.4. RS-232 Serial Interface Considerations

Since the speed of the optional RS-232 serial interface is regulated by a bit-rate clock rather than by cooperative handshaking, another means must be provided for preventing data from being sent to the controller when it is not ready to accept it. (This condition may occur when crossing sector boundaries during the "Save" or "Write" commands.) When it is receiving data over the RS-232 interface, the controller normally keeps its RS-232 transmit data in a mark hold ("1") condition. When it is momentarily unable to accept more data, it places its transmit data in a space hold ("0") condition until it is again able to accept data, then returns it to mark hold.

Since the RS-232 interface provides no means for distinguishing between communications control and data characters, the user must ensure that the significant communications control characters (EOT, ACK, NAK, SOH, ENQ) are not embedded in data sent to or from the controller. If arbitrary binary information is to be read or written, the user must provide a suitable escape convention for these characters.

3.3.5. Sample Driver Program

In order to provide additional guidance in the interfacing of the controller to a microcomputer system, flowcharts and an annotated assembly listing of a sample driver program are provided at the end of this document. The sample driver program makes use of the parallel interface and is coded for an 8080-based microcomputer system.

3.4. DISKETTE FORMAT

3.4.1. General Format

The diskette initialization function of the controller ("Kill" command) creates a diskette format which is IBM 3740 compatible. Each diskette contains 77 tracks with 26 sectors per track and 128 data bytes per sector. Tracks are numbered from 0 to 76 (outer to inner) and sectors are numbered from 1 to 26 on each track. Each sector has a header which defines the track and sector number (soft sectoring). Both the sector header and the data itself are provided with a 16-bit polynomial cyclic redundency check (CRC) word.

3.4.2. Index Track Format

Track 0 is reserved by the controller for use as an index (i.e., table of contents) for the diskette volume. The controller makes use of an index track format which permits up to 100 files on each volume and which is not IBM 3740 compatible (the IBM 3740 index track format allows only 19 files). Sector 1 of the index track serves as a volume label. Sectors 2 through 26 each contain room for four 32-byte file entries:

bytes 1-8	file name
bytes 9-11	version
byte 12	type
byte 13	(reserved)
bytes 14-15	start of allocation
bytes 16-17	end of allocation
bytes 18-19	end of data
byte 20	end of data (byte offset)
bytes 21-26	date of creation
bytes 27-32	date of last update

3.4.3. Interleaved Sector Sequences

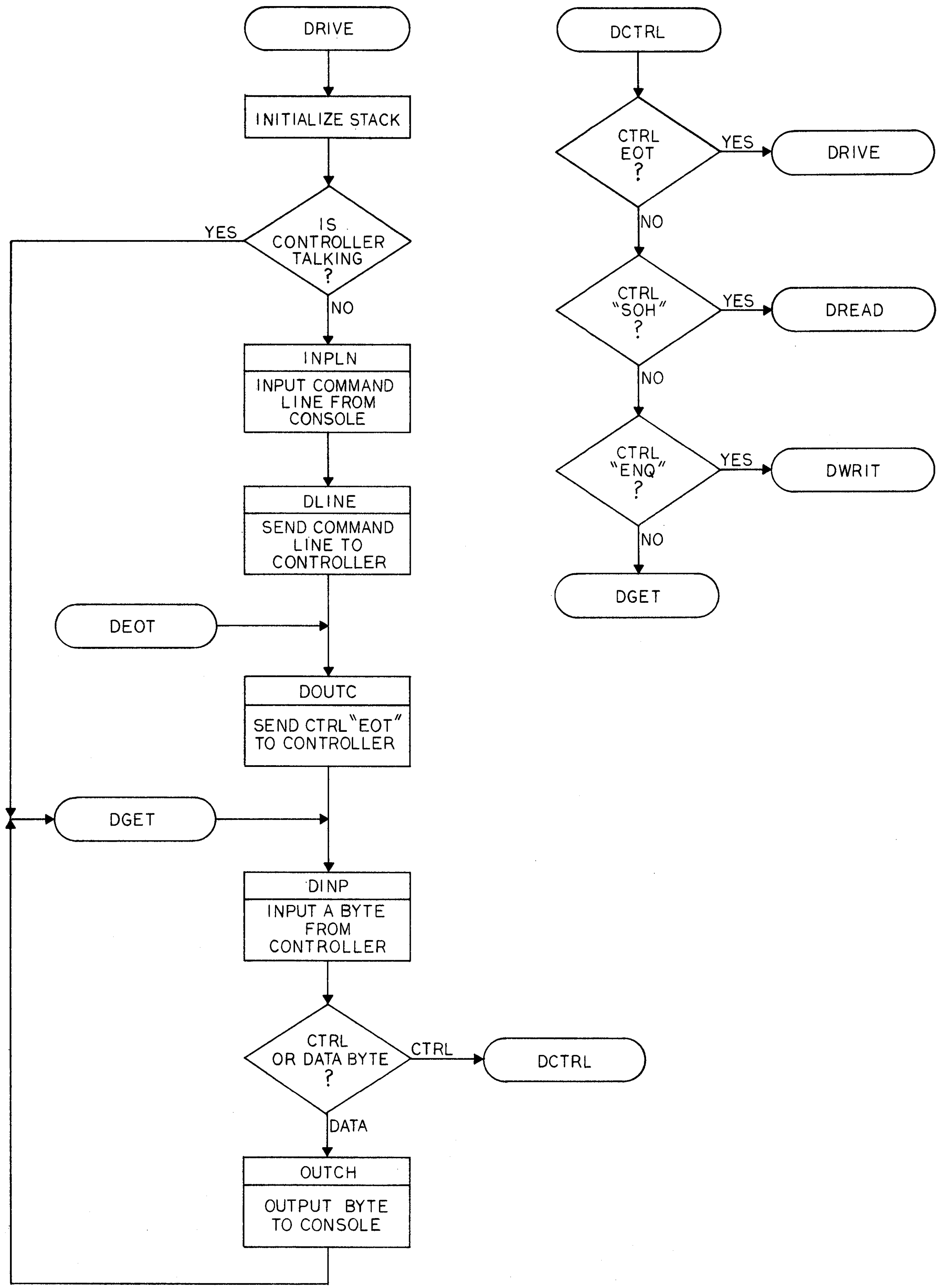
In order to enable users to optimize diskette subsystem performance in a variety of situations, the diskette initialization function of the controller ("Kill" command) supports twelve optional interleaved sector sequences in addition to the ordinary non-interleaved sequence. This function is controlled by the value (1 to 13) of the second parameter of the "Kill" command. The effect of the interleaved sector sequences is to provide additional time to process the data for a sector "N" before sector "N+1" is encountered in the course of diskette rotation. Sequence 1 (non-interleaved) provides the shortest time interval between successively-numbered sectors, and sequences 13 through 2 provide successively longer intervals.

NOTE: Sequences 6 through 9 generally provide optimal results when using the parallel interface in most microcomputer environments.

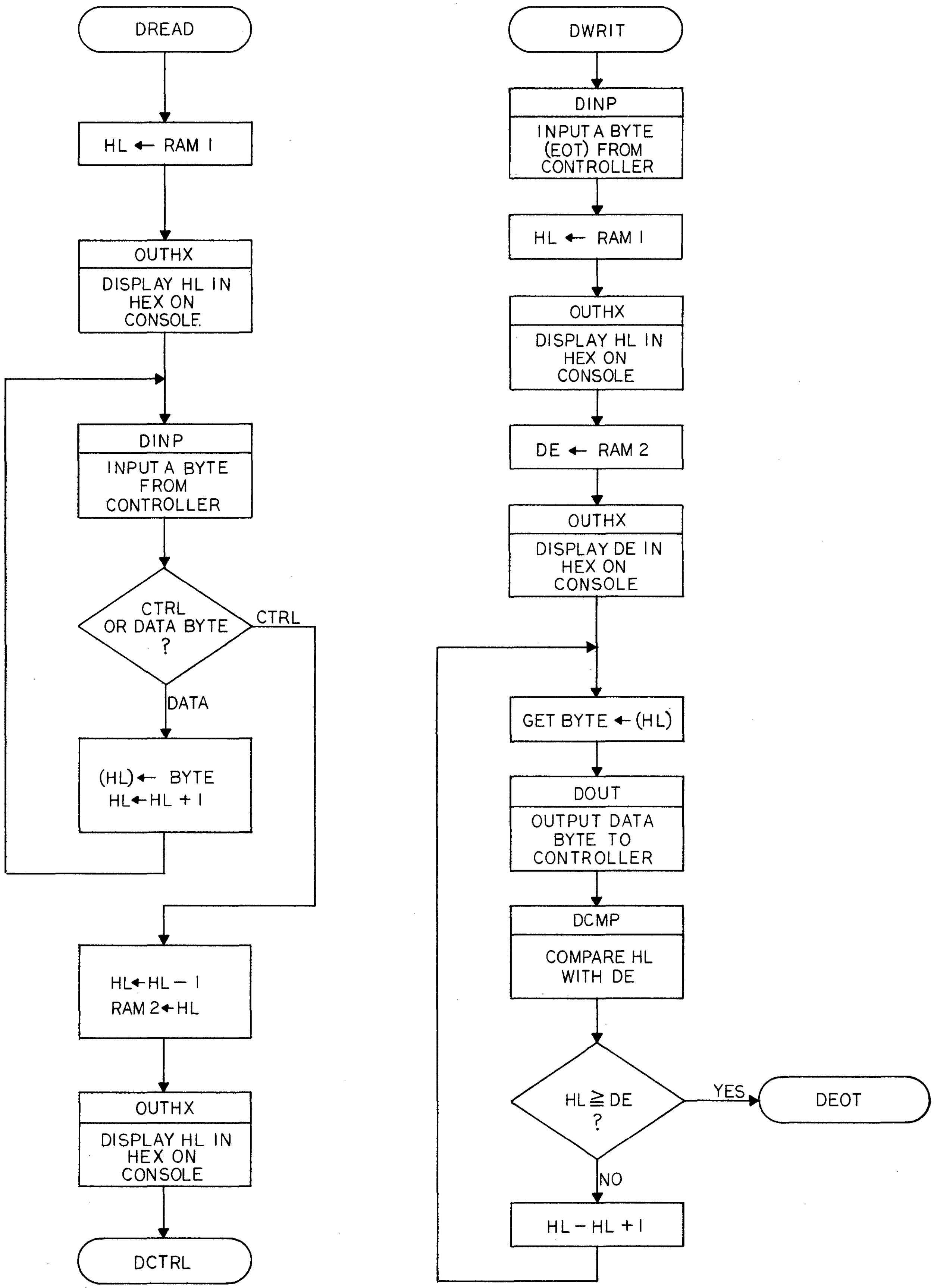
Additional information about these interleaved sector sequences and other diskette formatting considerations may be found in the following IBM document: "The IBM Diskette for Standard Data Interchange", GA 21-9182-0, File No. GENL-03/80.

APPENDIX A

Sample Driver Program Flowchart
Sample 8080 or Z80 Driver Program
Sample 6800 Driver Program



SAMPLE DRIVE PROGRAM FLOWCHART



SAMPLE DRIVE PROGRAM FLOWCHART

APPENDIX B

Interface Schematic for S-100 Bus
Interface Schematic for 6800
Interface Timing Data

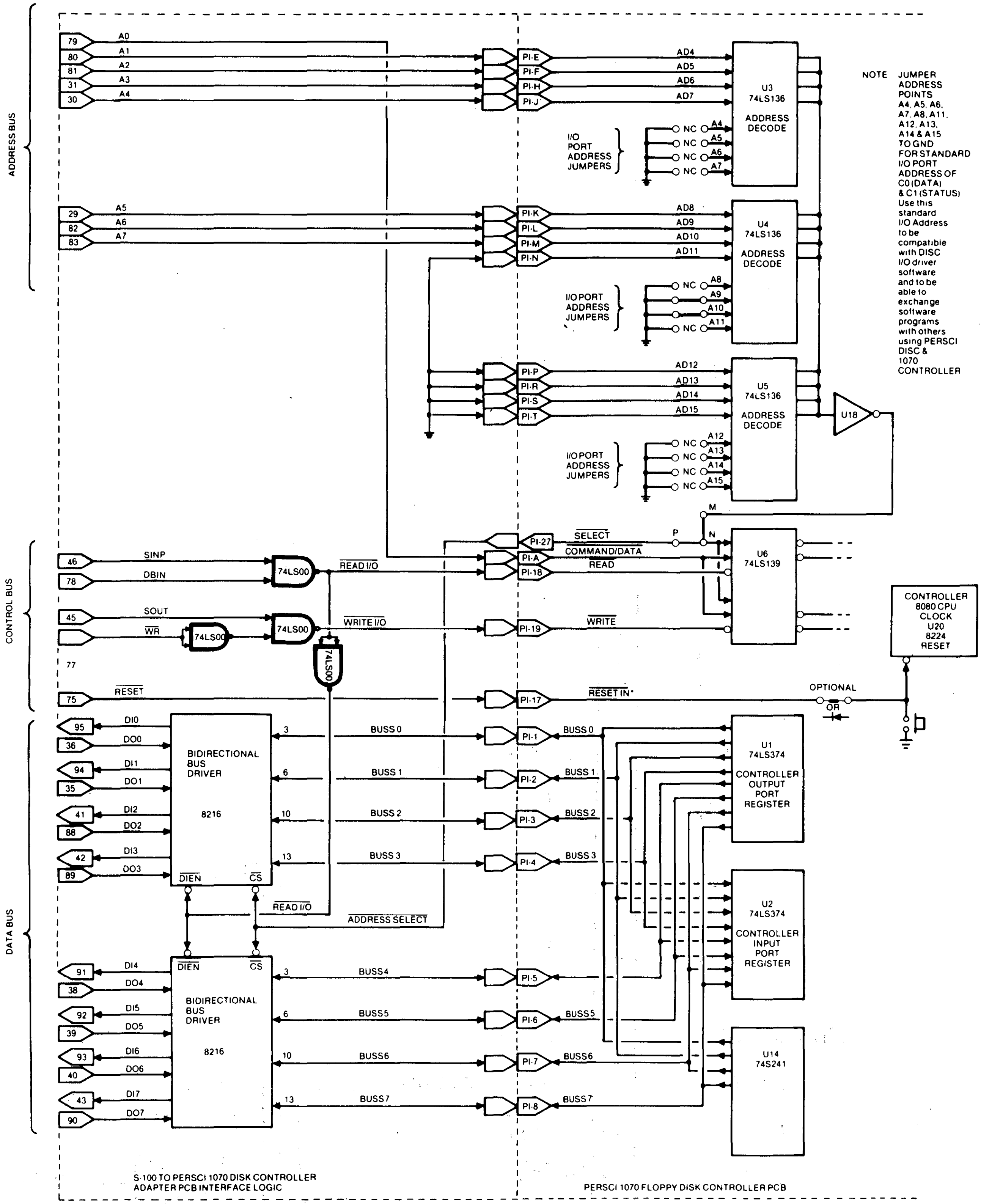
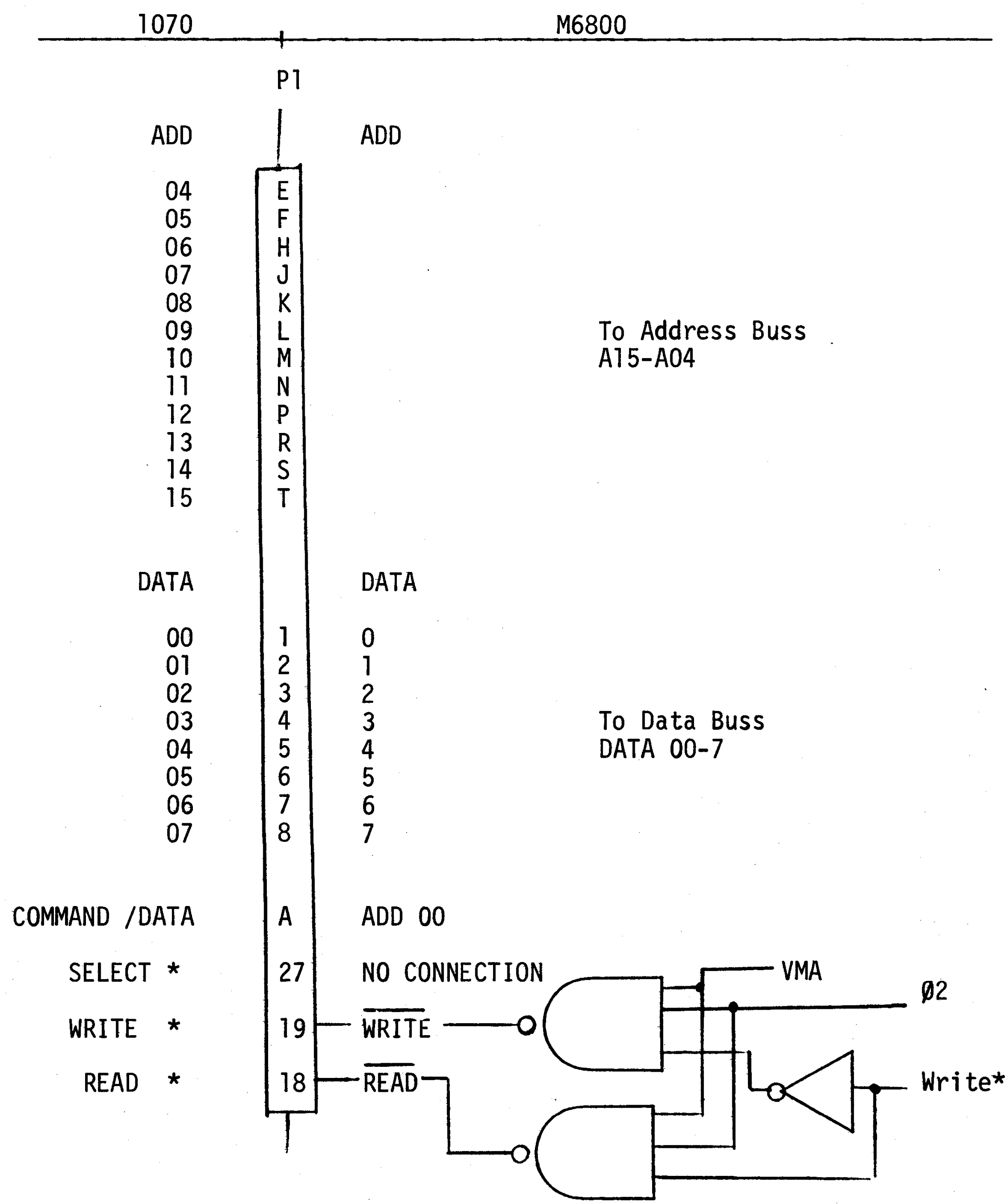


Figure 6. 8080S-100 Bus Controller Interface

Appendix B-2

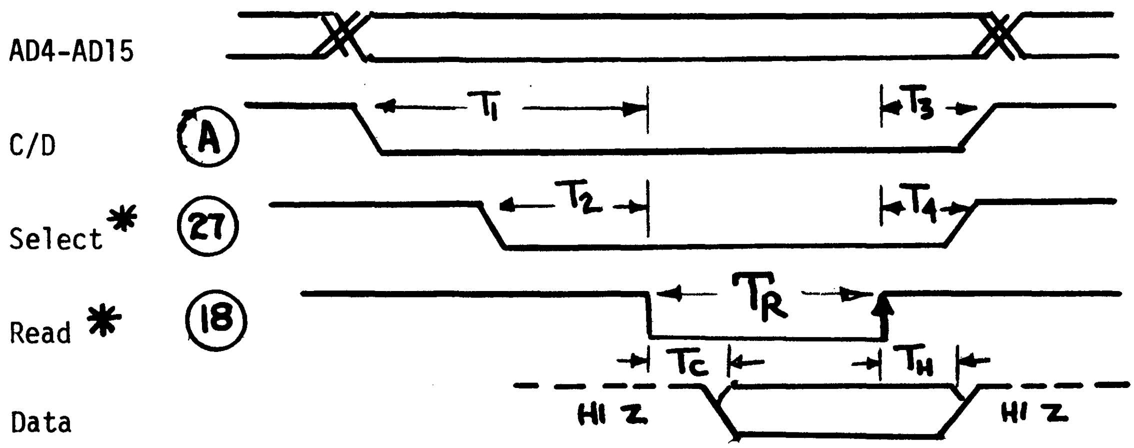
ASSUMPTIONS

1. Controller is operating on a parallel bus.
2. Controller is used as a memory ported device using two addresses with Address Bus 00 selecting command or data address.
3. 6800 MPU data bus enable (DBE) is held high for 50 nanoseconds after Ø2 goes to zero volts.



Appendix B-3 Timing Data - 1070

READ TIMING

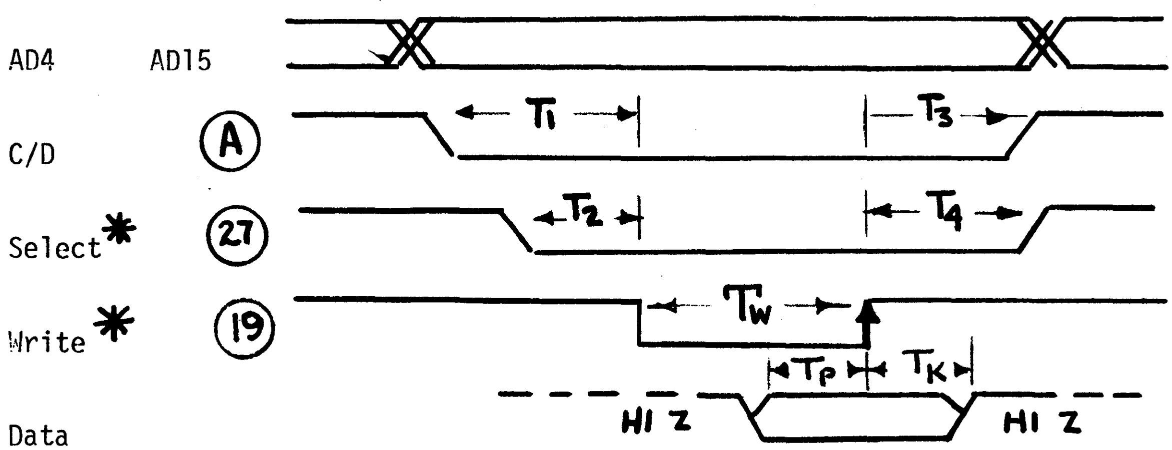


$10\ \mu sec \geq T_R \geq 250\ nsec$

$T_C < 100\ nsec$

$T_H > 5$ "

WRITE TIMING



$T_W \geq 250\ nsec$ $T_P > 150\ nsec$ $T_K > 100\ nsec$

$T_1 \geq T_2 \geq 0$ $T_3 \geq T_4 \geq 0$

* Active Low Signal

↑ Data Transfer Time

○ 1070 Controller Signal Pin Numbers

APPENDIX C

Brief History of the Model 1070 Controller
Option Jumper Data
Connector Data
Schematic for Controller

BRIEF HISTORY OF THE MODEL 1070 CONTROLLER

The PerSci Model 1070 Controller has evolved through several versions in reaching its present state. The stages (in terms of printed circuit board revisions) were:

PCB 200285-X1:
First production version. A number of cuts and jumpers were required on this PCB.

PCB 200285-X3 (Schematic 200287-X3):
Pull-up resistors (U34) were added to data and control lines from the diskette drives. Filter capacitors were added (C6 and C7). Jumper options were added (C,D,E,F,K,M,N,P,S,R). Two cuts and jumpers were required on this PCB.

PCB 200285-X3 "Kludge" (2114 RAMs on Adapter Boards):
The previously-used RAM chips (9130s and 9131s) used on the -X3 boards became unavailable in the Spring of 1977, and were temporarily replaced with 2114 RAMs mounted on miniature adapter PCBs to correct the incompatibilities in pinouts.

PCB 200249-A (Schematic 200351A):
This is the first production PCB based on the 2114 RAM. The etch is fully correct, with no cuts or jumpers. Space was added between jumper points C and D so that a diode could be used to tie the controller reset line to the host but leave the host reset line isolated from the controller reset pushbutton. A trace was added from U13 pin 15 to J1 pin 16 to enable the controller firmware to simultaneously load all heads when the controller is used with appropriately updated drives. A trace was added to tie U30 pins 8 and 12 to pin 2 (+5v) in order to permit a change from Western Digital 1941 to SMC COM9016 baud-rate generator chips in the optional RS232 serial interface.

PCB 200349-B:
This is now the definitive production printed circuit board for the Model 1070 controller. Primary change from the -A board is the use of a larger-capacity regulator IC for minus 5 volts, to eliminate the need for an add-on thermal radiator used on the previous regulator.

X- and F-Series Firmware:
There have been two different series of firmware used with the Model 1070. Earliest deliveries used various versions of the X-series firmware (X1 through X15), but PerSci no longer issues or supports this firmware. Since Spring of 1977, the controller has been delivered with the newer F-series File Management Firmware. This has been issued in two versions, F1.0 and F1.2, which are described in this document. (F1.1 was never issued.)

PCB 20039-C

The "C" revision of the controller PCB was made the production standard in the spring of 1978. Primary change for this board was the addition of a 10 picofared capacitor in series with the 18.0 MHZ crystal used as the frequency reference for the controller.

FREQUENCY REFERENCE CHANGE

During production of the "B" PCB controllers, the controller frequency standard (Y1) was changed from an 18.432 MHZ crystal to an 18.0 MHZ crystal in series with a 10 picofared capacitor. (See schematic attached Drwg. NO. 200351C). This change was made to improve interchangability of diskettes formatted by different controllers.

FIRMWARE FMF 1.3

Firmware used with the controller was updated to revision F 1.3 in April of 1978. The command set for this revision was changed such that the Kill Command requires a double KK. (KK volume/drive seq.) This change was in response to users request to reduce operators inadverdent deletion of diskettes files.

F 1.3 is issued in two versions. The first, F 1.3P, is coded for use only with controllers that do <u>not</u> have the serial (RS232) option.

The second version, F 1.3S, is coded for use with either the serial or parallel data ports.

FD1771 NEGATIVE VOLTAGE CHANGE

The negative voltage reference for the FD1771 was changed from minus 2.5 volts to minus 4.17 volts by changing R6 from 1K to 200 ohms. This change was made possible by improved chip performance and results in reduced noise sensitivity.

OPTION JUMPER DATA

A number of options are provided on the Model 1070 controller. They may be selected by connecting jumpers between points as described below:

A-to-B (Factory Installed):
This jumper enables the high-speed seek feature of the controller, which permits head positioning signals to operate at the speeds made possible by the PerSci voice-coil positioner.

C-to-D:
This jumper connects the controller reset line to P1 pin 17, where it may be tied to the host system reset line. On later production PCBs (200349), points C and D were separated to facilitate the use of an isolation diode (cathode at C) in place of a jumper.

E-to-F:
This jumper connects the controller reset complete signal to P1 pin U.

U-to-T:
This jumper is required only when the controller is used with three or four PerSci Model 70 (single) Diskette Drives.

R-to-S:
This jumper should be used if the optional RS232 serial interface is installed to ground the Clear-to-Send line when using RS232 devices which do not provide this control signal. The serial interface will not operate unless either a valid Clear-to-Send signal is present or this jumper is installed.

J-to-H:
This jumper connects the output of flip-flop U9B (receive data available) to P1 pin 22, so that it can be used as an interrupt or other signal to the host system that the controller has a data byte in its transmit buffer for the host.

M, N, P, K Combinations:
Jumpers between these points determine how the controller is selected, described below.

M-to-N-to P (Internal Address Decode):
This connection will allow the controller to be selected by a combination of 12 address signals (AD4 through AD15) determined by jumpers at points A4 through A15. The select signal (active low) is available at P1 pin 27 as an indication to the host system that the controller has recognized its address.

N-to-P (External Select):
This connection will allow the controller to be selected by an external signal (active low) at P1 pin 27.

K-to-P (Test Connection):
This connection makes the receive clock of the optional RS232 interface available at P1 pin 27. This connection is sometimes used by PerSci for test purposes.

A4-through-A15 (Address Selection):
Jumpers at these points determine which address will select the controller. Each jumper is associated with an address input line at P1 (e.g., jumper A7 with address line AD7). The jumper should be connected if the associated address bit should be high to select the controller.

For example, if the 12 most significant bits of a 16-bit host system address bus (A15 through A0) are connected to controller inputs AD15 through AD4, and if the least significant host system address line (A0) is connected to controller P1 pin A (Command/Data), and if jumpers are installed at points A15, A14, A9, and A5, then host address C200 hex will select the controller data port, and host address C201 hex will select the controller status port (addresses C202 through C20F hex are redundant and should not be used).

CAUTION: Controllers will usually be delivered with jumpers installed at M-to-N-to-P, A15, A14, and R-to-S (for the RS232 option). These jumpers are used by PerSci in checkout and final test. PerSci may change these jumpers to other combinations, without notice. Be certain to verify the proper jumper configuration for your application before placing the controller into service.

CONNECTION OF ADDITIONAL DRIVES

The 1070 Controller will accomodate two Model 277 drives or four Model 70's, without change to the controllers. However, the address logic of the drives added must be modified.

Address logic for the Model 70 and 277 drives is set by jumpers on a select module on the biggest PCB of the drives.

The following are the necessary jumpers:

Model 277	Select Module Jumpers (U11)
Drive 1 (Side 0 and 1)	2 to 13, 4 to 11
Drive 2 (Side 2 and 3)	1 to 14, 6 to 9

Model 70	Select Module Jumpers (U5)
Drive 1 (Side 0)	7 to 8, 3 to 12
Drive 2 (Side 1)	7 to 8, 4 to 11
Drive 3 (Side 2)	7 to 8, 5 to 10
Drive 4 (Side 3)	7 to 8, 6 to 9

P1

1070 CONTROLLER/HOST INTERFACE

SIGNAL	CONTROLLER PINS	CONNECTOR PINS	CONNECTOR PINS	CONTROLLER PINS	SIGNAL
COMMAND(+)/DATA(-)	A	2	1	1	BUSS 00
	B	4	3	2	BUSS 01
	C	6	5	3	BUSS 02
	D	8	7	4	BUSS 03
AD 04	E	10	9	5	BUSS 04
AD 05	F	12	11	6	BUSS 05
AD 06	H	14	13	7	BUSS 06
AD 07	J	16	15	8	BUSS 07
AD 08	K	18	17	9	
AD 09	L	20	19	10	
AD 10	M	22	21	11	
AD 11	N	24	23	12	
AD 12	P	26	25	13	
AD 13	R	28	27	14	
AD 14	S	30	29	15	
AD 15	T	32	31	16	
RESET COMPLETE	U	34	33	17	RESET IN*
	V	36	35	18	READ*
	W	38	37	19	WRITE*
	X	40	39	20	
	Y	42	41	21	
	Z	44	43	22	
	AA	46	45	23	
	BB	48	47	24	
	CC	50	49	25	
	DD	52	51	26	
	EE	54	53	27	SELECT*
	FF	56	55	28	
RTS	HH	58	57	29	CTS
	JJ	60	59	30	
DTR	KK	62	61	31	DSR
TXD (XMT DATA)	LL	64	63	32	RXD (RCV DATA)
	MM	66	65	33	
-12V	NN	68	67	34	+12V
+5V	PP	70	69	35	+5V
GROUND	RR	72	71	36	GROUND

CONNECTOR, CONTROLLER INTERFACE

Optional Sector Interleave Sequence

DISK RECORD SEQUENCES

blank	01	02	03	04	05	06	07	08	09	10	11	12	13
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	3	4	5	6	7	8	9	10	11	12	13	14
3	3	5	7	9	11	13	15	17	19	21	23	25	2
4	4	7	10	13	16	19	22	25	2	2	2	2	15
5	5	9	13	17	21	25	2	2	11	12	13	14	3
6	6	11	16	21	26	2	9	10	20	22	24	26	16
7	7	13	19	25	2	8	16	18	3	3	3	3	4
8	8	15	22	2	7	14	23	26	12	13	14	15	17
9	9	17	25	6	12	20	3	3	21	23	25	4	5
10	10	19	2	10	17	26	10	11	4	4	4	16	18
11	11	21	5	14	22	3	17	19	13	14	15	5	6
12	12	23	8	18	3	9	24	4	22	24	26	17	19
13	13	25	11	22	8	15	4	12	5	5	5	6	7
14	14	2	14	26	13	21	11	20	14	15	16	18	20
15	15	4	17	3	18	4	18	5	23	25	6	7	8
16	16	6	20	7	23	10	25	13	6	6	17	19	21
17	17	8	23	11	4	16	5	21	15	16	7	8	9
18	18	10	26	15	9	22	12	6	24	26	18	20	22
19	19	12	3	19	14	5	19	14	7	7	8	9	10
20	20	14	6	23	19	11	26	22	16	17	19	21	23
21	21	16	9	4	24	17	6	7	26	8	9	10	11
22	22	18	12	8	5	23	13	15	8	18	20	22	24
23	23	20	15	12	10	6	20	23	17	9	10	11	12
24	24	22	18	16	15	12	7	8	26	19	21	23	25
25	25	24	21	20	20	18	14	16	9	10	11	12	13
26	26	26	24	24	25	24	21	24	18	20	22	24	26

Numbers at column top are interleave sequences specified by kill command.

Columns show sector sequence for specified interleave.

N.B. "Blank" sequence changes index track only.

APPENDIX D

Applications Note for Simultaneous Head Load

APPENDIX D

APPLICATIONS NOTE FOR SIMULTANEOUS
HEAD LOAD CIRCUIT MODIFICATION

CONTROLLER MODIFICATIONS

Applicable: PCB 200285 X1, X3

Add Jumper U13 Pin 15 → J1 Pin 16

DRIVE MODIFICATIONS

Applicable: Model 277 drive with Data and Interface Assembly 200263-003, Rev. A, B. C, D, E, or F (PCB 200262A).

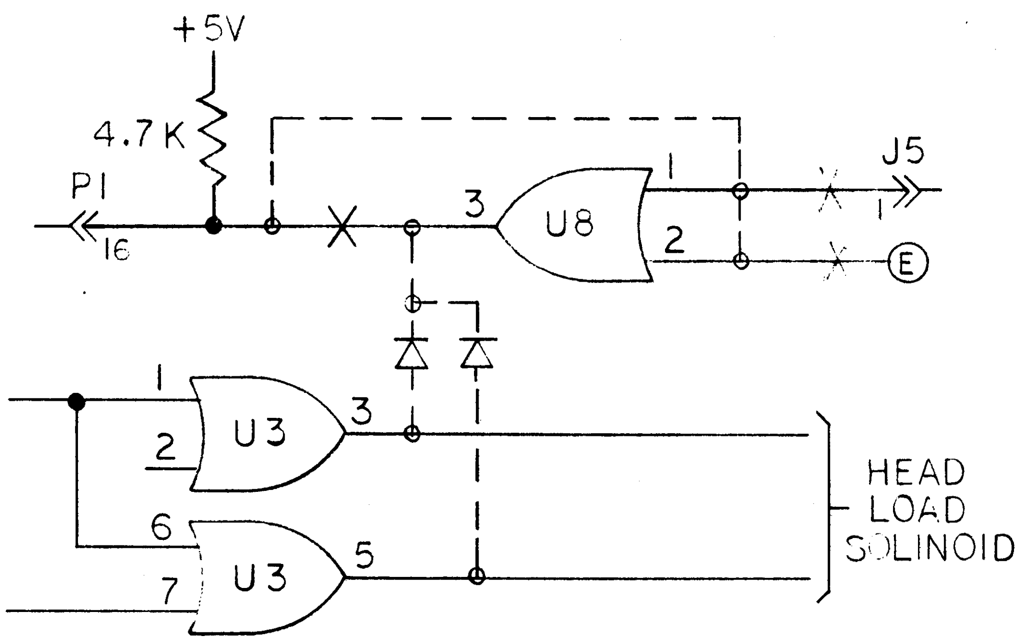
1. Cut traces at U8 Pins 1, 2, and 3.

2. Add jumper from P1 Pin 16 to U8 Pins 1 and 2.

3. Add diode — anode at U3 Pin 3, cathode at U8 Pin 1.

4. Add diode — anode at U3 Pin 5, cathode at U8 Pin 1

The result should be as shown in the sketch below:



CONTROLLERS AND DRIVE WHEN MODIFIED AS ABOVE REQUIRE
FILE MANAGEMENT FIRMWARE VERSION F1.2

```
                        .SBTTL "Section 1 - Controller Interface Routines"
                        ;
                        ;
                        ; This is the basic driver routine which sends console
                        ; commands to the controller, controller messages to
                        ; the console, and controls the transmission of files
                        ; and records between the controller and microcomputer
                        ; RAM.
                        ;
0000  319B01    DRIVE:  LXI     SP,STACK        ;INITIALIZE STACK
0003  DBC1              IN      DSTAT   ;GET DISK STATUS
0005  E6C0              ANI     0C0H    ;IS DISK TALKING?
0007  C21500            JNZ     DGET    ;IF SO, LISTEN FIRST
000A  CDAA00            CALL    INPLN   ;INPUT CONSOLE LINE
000D  CD7200            CALL    DLINE   ;SEND COMMAND TO DISK
0010  3E04      DEOT:   MVI     A,EOT   ;SEND "EOT" TO DISK
0012  CD8D00            CALL    DOUTC   ;AS CONTROL BYTE
0015  CD7C00    DGET:   CALL    DINP    ;INPUT BYTE FROM DISK
0018  DA2100            JC      DCTRL   ;CONTROL OR DATA BYTE?
001B  CD4C01            CALL    OUTCH   ;DATA, SEND TO CONSOLE
001E  C31500            JMP     DGET
0021  FE04      DCTRL:  CPI     EOT     ;CONTROL, WHAT KIND?
0023  CA0000            JZ      DRIVE   ;"EOT", COMMAND IS DONE
0026  FE01              CPI     SOH
0028  CA3300            JZ      DREAD   ;"SOH", DO DISK READ
002B  FE05              CPI     ENQ
002D  CA5000            JZ      DWRIT   ;"ENQ", DO DISK WRITE
0030  C31500            JMP     DGET    ;ELSE IGNORE (ERROR)
                        ;
                        ;
                        ; This routine controls a disk read into RAM.
                        ;
0033  2AA600    DREAD:  LHLD    RAM1    ;GET RAM STARTING ADDR
0036  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
0039  CD7C00    DREAL:  CALL    DINP    ;INPUT BYTE FROM DISK
003C  DA4400            JC      DREAX   ;CONTROL OR DATA BYTE?
003F  77                MOV     M,A     ;DATA, MOVE TO RAM
0040  23                INX     H       ;INCREMENT RAM ADDR
0041  C33900            JMP     DREAL   ;NEXT BYTE
0044  F5        DREAX:  PUSH    PSW     ;CONTROL, SAVE BYTE
0045  2B                DCX     H       ;DECREMENT RAM ADDR
0046  22A800            SHLD    RAM2    ;SAVE RAM ENDING ADDR
0049  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
004C  F1                POP     PSW     ;GET CONTROL BYTE
004D  C32100            JMP     DCTRL   ;GO ANALYZE IT
                        ;
                        ;
                        ; This routine controls a disk write from RAM.
                        ;
0050  CD7C00    DWRIT:  CALL    DINP    ;INPUT BYTE FROM DISK
0053  D25000            JNC     DWRIT   ;SHOULD BE AN "EOT"
0056  2AA600            LHLD    RAM1    ;GET RAM STARTING ADDR
0059  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
005C  EB                XCHG
005D  2AA800            LHLD    RAM2    ;GET RAM ENDING ADDR
```

```
0060  CD0501            CALL    OUTHX   ;DISPLAY ON CONSOLE
0063  EB                XCHG            ;START IN HL, END IN DE
0064  7E        DWRIL:  MOV     A,M     ;GET BYTE FROM RAM
0065  CD8700            CALL    DOUT    ;SEND DATA TO DISK
0068  CD3C01            CALL    DCMP    ;COMPARE ADDR TO END
006B  D21000            JNC     DEOT    ;AT END, SEND "EOT"
006E  23                INX     H       ;ELSE INCREMENT RAM ADDR
006F  C36400            JMP     DWRIL   ;PROCESS NEXT BYTE
                ;
                ;
                ; This routine sends a command to the controller.
                ;
0072  CD2601    DLINE:  CALL    GETCH   ;GET CHAR FROM BUFFER
0075  D8                RC              ;EXHAUSTED, ALL DONE
0076  CD8700            CALL    DOUT    ;SEND CHARACTER TO DISK
0079  C37200            JMP     DLINE   ;PROCESS NEXT CHARACTER
                ;
                ;
                ; This routine inputs a byte from the controller
                ; and sets the carry flag if it is a control byte.
                ;
007C  DBC1      DINP:   IN      DSTAT   ;GET DISK STATUS BYTE
007E  E6C0              ANI     0C0H    ;RECEIVE DATA AVAILABLE?
0080  CA7C00            JZ      DINP    ;NO, WAIT UNTIL IT IS
0083  17                RAL             ;SET CARRY IF CONTROL
0084  DBC0              IN      DDATA   ;GET DISK DATA BYTE
0086  C9                RET             ;ALL DONE
                ;
                ;
                ; This routine outputs a data byte to the controller.
                ;
0087  CD9500    DOUT:   CALL    DOUTW   ;WAIT UNTIL READY
008A  D3C0              OUT     DDATA   ;WRITE DISK DATA BYTE
008C  C9                RET             ;ALL DONE
                ;
                ;
                ; This routine outputs a control byte to the controller.
                ;
008D  CD9500    DOUTC:  CALL    DOUTW   ;WAIT UNTIL READY
0090  D3C1              OUT     DSTAT   ;WRITE DISK STATUS BYTE
0092  D3C0              OUT     DDATA   ;WRITE DISK DATA BYTE
0094  C9                RET             ;ALL DONE
                ;
                ;
                ; This routine waits for the disk transmit buffer to be
                ; empty and ready for another byte.  It also arbitrates
                ; if disk and host try to transmit to one another at
                ; the same time.
                ;
0095  F5        DOUTW:  PUSH    PSW     ;SAVE BYTE TO SEND
0096  DBC1              IN      DSTAT   ;GET DISK STATUS BYTE
0098  E6C0              ANI     0C0H    ;IS DISK TRANSMITTING?
009A  C2A400            JNZ     DOUTX   ;YES, BREAK THE TIE
009D  DBC1              IN      DSTAT   ;GET DISK STATUS AGAIN
009F  E603              ANI     03H     ;IS TRNSMT BUFFER EMPTY?
```

```
00A1  C29600          JNZ     DOUTW+1 ;NO, WAIT UNTIL IT IS
00A4  F1      DOUTX:  POP     PSW     ;RESTORE BYTE TO SEND
00A5  C9              RET             ;ALL DONE
              ;
              ;
              ; Symbolic Equivalences
              ;
00C0          DDATA   = 0C0H  ;CONTROLLER DATA PORT
00C1          DSTAT   = 0C1H  ;CONTROLLER STATUS PORT
0004          EOT     = 04H   ;ASCII "EOT"
0001          SOH     = 01H   ;ASCII "SOH"
0005          ENQ     = 05H   ;ASCII "ENQ"
              ;
              ;
              ; RAM Working Storage
00A6  0000    RAM1:   .WORD   0       ;SAVE/LOAD START ADDR
00A8  0000    RAM2:   .WORD   0       ;SAVE/LOAD END ADDR
              ;
              ;
              .PAGE
```

```
                        .SBTTL "Section 2 - Common Subroutines"
                        ;
                        ;
                        ; This routine inputs a line from the console device
                        ; into a RAM buffer, and processes backspace and
                        ; line-delete functions.
                        ;
00AA    CDFA00          INPLN:  CALL    CRLF    ;CR/LF TO CONSOLE
00AD    3E3E                    MVI     A,'>'   ;GET COMMAND PROMPT
00AF    CD4C01                  CALL    OUTCH   ;SEND TO CONSOLE
00B2    215801                  LXI     H,IBUFF ;GET BUFFER ADDRESS
00B5    227801                  SHLD    IBUFP   ;INITIALIZE POINTER
00B8    0E00                    MVI     C,0     ;INITIALIZE COUNT
00BA    CD4201          INPLI:  CALL    INPCH   ;GET CHAR FROM CONSOLE
00BD    E67F                    ANI     7FH     ;STRIP PARITY BIT
00BF    FE20                    CPI     ' '     ;TEST IF CONTROL CHAR
00C1    DAD400                  JC      INPLC   ;YES, GO PROCESS
00C4    77                      MOV     M,A     ;NO, PUT IN BUFFER
00C5    3E20                    MVI     A,32    ;GET BUFFER SIZE
00C7    B9                      CMP     C       ;TEST IF FULL
00C8    CABA00                  JZ      INPLI   ;YES, LOOP
00CB    7E                      MOV     A,M     ;RECALL CHARACTER
00CC    23                      INX     H       ;INCR POINTER
00CD    0C                      INR     C       ;AND INCR COUNT
00CE    CD4C01          INPLE:  CALL    OUTCH   ;ECHO CHARACTER
00D1    C3BA00                  JMP     INPLI   ;GET NEXT CHAR
00D4    FE08            INPLC:  CPI     08H     ;TEST IF BACKSPACE
00D6    CAEB00                  JZ      INPLB   ;YES, KILL CHAR
00D9    FE1B                    CPI     1BH     ;TEST IF ESCAPE
00DB    CAF500                  JZ      INPLK   ;YES, KILL LINE
00DE    FE0D                    CPI     0DH     ;TEST IF RETURN
00E0    C2BA00                  JNZ     INPLI   ;NO, IGNORE CHAR
00E3    79                      MOV     A,C     ;GET COUNT
00E4    327A01                  STA     IBUFC   ;SAVE IT
00E7    CDFA00                  CALL    CRLF    ;SEND CR/LF TO CONSOLE
00EA    C9                      RET             ;DONE
00EB    2B              INPLB:  DCX     H       ;DECREMENT POINTER
00EC    0D                      DCR     C       ;DECREMENT COUNT
00ED    F2CE00                  JP      INPLE   ;IF NOT NEG, GO ECHO
00F0    23                      INX     H       ;IF NEG, UNDO DECR
00F1    0C                      INR     C
00F2    C3BA00                  JMP     INPLI   ;GET NEXT CHAR
00F5    AF              INPLK:  XRA     A       ;KILL BY SETTING
00F6    327A01                  STA     IBUFC   ;COUNT TO ZERO
00F9    C9                      RET             ;DONE
                        ;
                        ;
                        ; This routine sends a CR LF sequence to the console.
                        ;
00FA    3E0D            CRLF:   MVI     A,0DH   ;GET A CR
00FC    CD4C01                  CALL    OUTCH   ;DISPLAY IT
00FF    3E0A                    MVI     A,0AH   ;GET A LF
0101    CD4C01                  CALL    OUTCH   ;DISPLAY IT
0104    C9                      RET             ;DONE
                        ;
```

```
                        ;
                        ; This routine outputs the contents of registers H-L
                        ; as a four-digit hexadecimal number on the console.
                        ;
0105    3E20            OUTHX:  MVI     A,' '   ;GET A SPACE
0107    CD4C01                  CALL    OUTCH   ;SEND TO CONSOLE
010A    7C                      MOV     A,H     ;GET TOP HALF OF WORD
010B    CD0F01                  CALL    OUTH1   ;DISPLAY IN HEX
010E    7D                      MOV     A,L     ;SAME WITH BOTTOM HALF
010F    F5              OUTH1:  PUSH    PSW     ;SAVE LOW-ORDER DIG
0110    1F                      RAR             ;GET HIGH-ORDER DIG
0111    1F                      RAR
0112    1F                      RAR
0113    1F                      RAR
0114    CD1801                  CALL    OUTH    ;DISPLAY HEX DIGIT
0117    F1                      POP     PSW     ;GET OTHER DIGIT
0118    E60F            OUTH:   ANI     0FH     ;EXTRACT DIGIT
011A    C630                    ADI     '0'     ;ADD ASCII ZONE BITS
011C    FE3A                    CPI     '9'+1   ;TEST IF A-F
011E    DA4C01                  JC      OUTCH   ;NO, OUTPUT IT
0121    C607                    ADI     'A'-'9'-1       ;YES, ADD BIAS FOR A-F
0123    C34C01                  JMP     OUTCH   ;OUTPUT IT
                        ;
                        ;
                        ; This routine obtains a character from the RAM buffer
                        ; and sets the carry flag if exhausted.
                        ;
0126    E5              GETCH:  PUSH    H       ;SAVE REGS
0127    2A7801                  LHLD    IBUFP   ;GET POINTER
012A    3A7A01                  LDA     IBUFC   ;GET COUNT
012D    D601                    SUI     1       ;DECREMENT WITH CARRY
012F    DA3A01                  JC      GETCX   ;NO MORE CHARACTERS
0132    327A01                  STA     IBUFC   ;REPLACE COUNT
0135    7E                      MOV     A,M     ;GET CHARACTER
0136    23                      INX     H       ;INCR POINTER
0137    227801                  SHLD    IBUFP   ;REPLACE POINTER
013A    E1              GETCX:  POP     H       ;RESTORE REGS
013B    C9                      RET             ;DONE (CARRY IF NO CHAR)
                        ;
                        ;
                        ; This routine compares D-E with H-L.
                        ;
013C    7C              DCMP:   MOV     A,H     ;GET MOST SIGNIF
013D    BA                      CMP     D       ;COMPARE MOST SIGNIF
013E    C0                      RNZ             ;NONZERO, DONE
013F    7D                      MOV     A,L     ;GET LEAST SIGNIF
0140    BB                      CMP     E       ;COMPARE LEAST SIGNIF
0141    C9                      RET             ;DONE
                        ;
                        ;
                        ; These routines perform input and output from and to
                        ; the console device, passing on character in the A-reg.
                        ; They must be coded to work with the particular console
                        ; I/O interface arrangement of each microcomputer.  The
                        ; two routines must not modify any registers other than
```

```
                        ; the A-reg.
                        ;
0142  DB00              INPCH:  IN      0        ;GET CONSOLE STATUS
0144  E601                      ANI     01H      ;RECEIVE DATA AVAILABLE?
0146  C24201                    JNZ     INPCH    ;NO, WAIT UNTIL IT IS
0149  DB01                      IN      1        ;GET CONSOLE DATA
014B  C9                        RET              ;ALL DONE
                        ;
014C  F5                OUTCH:  PUSH    PSW      ;SAVE DATA TO BE SENT
014D  DB00                      IN      0        ;GET CONSOLE STATUS
014F  E680                      ANI     80H      ;TRANSMIT BUFFER EMPTY?
0151  C24D01                    JNZ     OUTCH+1  ;NO, WAIT UNTIL IT IS
0154  F1                        POP     PSW      ;GET SAVED DATA
0155  D301                      OUT     1        ;SEND TO CONSOLE
0157  C9                        RET              ;ALL DONE
                        ;
                        ;
                        ; RAM Working Storage
                        ;
0158                    IBUFF:  .BLKB   32       ;INPUT TEXT BUFFER
0178                    IBUFP:  .BLKB   2        ;INPUT POINTER
017A                    IBUFC:  .BLKB   1        ;INPUT COUNTER
017B                            .BLKB   32       ;STACK AREA
019B                    STACK   = .     ;TOP OF STACK
                        ;
                        ;
0000                            .END    DRIVE    ;END OF ASSEMBLY
```

+++++ SYMBOL TABLE +++++

```
CRLF    00FA      DCMP    013C      DCTRL   0021      DDATA   00C0
DEOT    0010      DGET    0015      DINP    007C      DLINE   0072
DOUT    0087      DOUTC   008D      DOUTW   0095      DOUTX   00A4
DREAD   0033      DREAL   0039      DREAX   0044      DRIVE   0000
DSTAT   00C1      DWRIL   0064      DWRIT   0050      ENQ     0005
EOT     0004      GETCH   0126      GETCX   013A      IBUFC   017A
IBUFF   0158      IBUFP   0178      INPCH   0142      INPLB   00EB
INPLC   00D4      INPLE   00CE      INPLI   00BA      INPLK   00F5
INPLN   00AA      OUTCH   014C      OUTH    0118      OUTH1   010F
OUTHX   0105      RAM1    00A6      RAM2    00A8      SOH     0001
STACK   019B
```

```
                NAM     DRIVER
        *
        *  ADAPTED TO 6800 FROM PERSCI 8080
        *  PROGRAM BY MIKE SMITH
        *  D.I.Y. INDUSTRIES
        *  17315 S.E. RIVER ROAD
        *  MILWAUKIE, OREGON   97222
        *
        *
        ************************************
        *SAMPLE DRIVER PROGRAM TO INTERFACE WITH
        *PERSCI MODEL 1070 DISKETTE CONTROLLER
        ************************************
        *
        *THIS PROGRAM OPERATES ON A 6800 BASED MICRO-
        *COMPUTER. IT ASSUMES THAT THE PERSCI MODEL
        *1070 DISKETTE CONTROLLER IS INTERFACED VIA
        *ITS PARALLEL PORT IN SUCH A MANNER THAT ITS
        *DATA AND STATUS BYTES APPEAR TO THE 6800 AS
        *MEMORY LOCATIONS E000 AND E001 HEX. RESPECT-
        *IVELY. IT ALSO ASSUMES THAT AN ASCII CONSOLE
        *DEVICE IS CONNECTED TO THE MICROCOMPUTER.
        *
        *
        *THIS PROGRAM HAS BEEN MODIFIED TO BE
        *CALLED AS A SUBROUTINE.
        *
        *
        *THIS PROGRAM LISTING IS DIVIDED IN TWO SEC-
        *TIONS. SECTION ONE CONTAINS THOSE ROUTINES
        *WHICH ARE UNIQUE TO THE DISKETTE CONTROLLER
        *INTERFACE. IT REQUIRES ONLY 151 BYTES OF
        *PROGRAM STORAGE AND 5 BYTES OF RAM.
        *
        *SECTION TWO CONTAINS GENERAL I/O SUBROUTINES
        *WHICH ARE ROUTINELY A PART OF MOST MICRO-
        *COMPUTER OPERATING SYSTEM OR MONITORS, AND
        *THUS WHICH WILL NOT NEED TO BE DUPLICATED IN
        *MOST INSTALLATIONS.
        *
        *
        **********SECTION ONE******************
        *
        *
        *THIS IS THE BASIC DRIVER ROUTINE WHICH SENDS
        *CONSOLE COMMANDS TO THE CONTROLLER, CONTROLLER
        *MESSAGES TO THE CONSOLE, AND CONTROLS THE
        *TRANSMISSION OF FILES AND RECORDS BETWEEN THE
        *CONTROLLER AND MICROCOMPUTER RAM.
        *
        *
        *
        *
        *
```

```
                       *
                       *
D000                          ORG          $D000
                              OPT          P
                              OPT          S
                              OPT          M
                       *
                       *
D000 B6 E001 DRIVE     LDA A        DSTAT       GET DISC STATUS
D003 84 C0             AND A        #$C0        SEE IF READY YET
D005 26 0A             BNE          DGET        IF NOT THEN CLEAN UP
D007 BD D098 START     JSR          INPLN       INPUT CONSOLE LINE
D00A 8D 56             BSR          DLINE       SEND COMMAND TO DISK
D00C 86 04   DEOT      LDA A        #$04        SEND "EOT" TO DISK
D00E BD D07E           JSR          DOUTC       AS CONTROL BYTE
D011 8D 59   DGET      BSR          DINP        INPUT BYTE FROM DISK
D013 25 05             BCS          DCTRL       CONTROL OR DATA BYTE?
D015 BD FEAA           JSR          OUTCH       DATA, SEND TO CONSOLE
D018 20 F7             BRA          DGET        GET NEXT BYTE
D01A 81 04   DCTRL     CMP A        #$04        CONTROL, WHAT KIND?
D01C 26 01             BNE          GO          EOT, COMMAND IS DONE
D01E 39                RTS                      RETURN TO CALLER
D01F 81 01   GO        CMP A        #$01
D021 27 06             BEQ          DREAD       SOH, DO DISK READ
D023 81 05             CMP A        #$05
D025 27 1C             BEQ          DWRIT       ENQ, DO DISK WRITE
D027 20 E8             BRA          DGET        ELSE IGNORE
                       *
                       *
                       *THIS ROUTINE CONTROLS A DISK READ INTO RAM
                       *
                       *
D029 FE E100 DREAD     LDX          RAM1        GET RAM STARTING ADDR
D02C BD D11F           JSR          OUTHX       DISPLAY ON CONSOLE
D02F 8D 3B   DREAL     BSR          DINP        INPUT BYTE FROM DISK
D031 25 05             BCS          DREAX       CONTROL OR DATA BYTE?
D033 A7 00             STA A        0,X         DATA, MOVE TO RAM
D035 08                INX                      INCREMENT RAM ADDR
D036 20 F7             BRA          DREAL       NEXT BYTE
D038 36      DREAX     PSH A                    CONTROL, SAVE BYTE
D039 09                DEX                      DECREMENT RAM ADDR
D03A FF E102           STX          RAM2        SAVE RAM ENDING ADDR
D03D BD D11F           JSR          OUTHX       DISPLAY ON CONSOLE
D040 32                PUL A                    GET CONTROL BYTE
D041 20 D7             BRA          DCTRL       GO ANALYZE IT
                       *
                       *
                       *
                       *
                       *
                       *
                       *
                       *
                       *
```

```
                     *THIS ROUTINE CONTROLS A DISK WRITE FROM RAM
                     *
                     *
D043 8D 27    DWRIT  BSR        DINP     INPUT BYTE FROM DISK
D045 24 FC           BCC        DWRIT    SHOULD BE AN EOT
D047 FE E100         LDX        RAM1     GET RAM STARTING ADDR
D04A BD D11F         JSR        OUTHX    DISPLAY ON CONSOLE
D04D FE E102         LDX        RAM2     GET RAM ENDING ADDR
D050 BD D11F         JSR        OUTHX    DISPLAY ON CONSOLE
D053 FE E100         LDX        RAM1     GET STARTING ADRS
D056 A6 00    DWRIL  LDA A      0,X      GET BYTE FROM RAM
D058 8D 1E           BSR        DOUT     SEND DATA TO DISK
D05A BC E102         CPX        RAM2     COMPARE ADRS TO END
D05D 27 AD           BEQ        DEOT     AT END, SEND EOT
D05F 08              INX                 ELSE INCREMENT RAM ADDR
D060 20 F4           BRA        DWRIL    PROCESS NEXT BYTE
                     *
                     *
                     *THIS ROUTINE SENDS A LINE TO THE CONTROLLER
                     *
                     *
D062 BD D14A  DLINE  JSR        GETCH    GET CHAR FROM BUFFER
D065 24 01           BCC        CONT     CHECK IF DONE
D067 39              RTS                 DONE? THEN RETURN
D068 8D 0E    CONT   BSR        DOUT     SEND CHARACTER TO DISK
D06A 20 F6           BRA        DLINE    PROCESS NEXT CHARACTER
                     *
                     *
                     *THIS ROUTINE INPUTS A BYTE FROM THE CONTROLLER
                     *AND SETS CARRY=1 IF A CONTROL BYTE
                     *
                     *
D06C B6 E001  DINP   LDA A      DSTAT    GET DISK STATUS BYTE
D06F 84 C0           AND A      #$C0     RECEIVE DATA AVALIABLE?
D071 27 F9           BEQ        DINP     NO, WAIT UNITL IT IS
D073 49              ROL A               SET CARRY IF CONTROL
D074 B6 E000         LDA A      DDATA    GET DISK DATA BYTE
D077 39              RTS                 AND RETURN
                     *
                     *
                     *THIS ROUTINE SENDS A DATA BYTE TO THE CONTOLLER
                     *
                     *
D078 8D 0D    DOUT   BSR        DOUTW    WAIT UNTIL READY
D07A B7 E000         STA A      DDATA    WRITE DISK DATA BYTE
D07D 39              RTS                 ALL DONE RETURN
                     *
                     *
                     *
                     *
                     *THIS ROUTINE SENDS A CTRL BYTE TO THE CONTROLLER
                     *
                     *
D07E 8D 07    DOUTC  BSR        DOUTW    WAIT UNTIL READY
```

```
D080 B7 E001          STA A      DSTAT     WRITE DISK STATUS BYTE
D083 B7 E000          STA A      DDATA     WRITE DISK DATA BYTE
D086 39               RTS                  ALL DONE, RETURN
                *
                *
                *THIS ROUTINE WAITS FOR THE DISK TRANSMIT BUFFER
                *TO BE EMPTY AND READY FOR ANOTHER BYTE. IT ALSO
                *ARBITRATES IF DISK AND HOST TRY TO TRANSMIT
                *TO ONE ANOTHER AT THE SAME TIME.
                *
                *
D087 36         DOUTW PSH A                SAVE BYTE TO SEND
D088 B6 E001          LDA A      DSTAT     GET DISK STATUS BYTE
D08B 84 C0            AND A      #$C0      IS DISK TRANSMITTING?
D08D 26 07            BNE        DOUTX     YES,BREAK THE TIE
D08F B6 E001          LDA A      DSTAT     GET DISK STATUS AGAIN
D092 84 03            AND A      #$03      IS TRNSMT BUFFER EMPTY?
D094 26 F2            BNE        DOUTW+1   NO, WAIT UNTIL IT IS
D096 32         DOUTX PUL A                RESTORE BYTE TO SEND
D097 39               RTS                  ALL DONE RETURN
                *
                *
                *SYMBOLIC EQUIVALENCES
                *
                *
     E000       DDATA EQU        $E000     CONTROLLER DATA BYTE
     E001       DSTAT EQU        $E001     CONTROLLER STATUS BYTE
                *
                *
                *RAM WORKING STORAGE
                *
                *
     E100       RAM1  EQU        $E100     RAM START ADDR
     E102       RAM2  EQU        $E102     RAM END ADDR
     E104       XTEMP EQU        $E104     TEMP INDEX STORE
                *
                *
```

```
                        *
                        *
                        **************SECTION TWO*****************
                        *
                        *
                        *THIS ROUTINE INPUTS A LINE FROM THE CONSOLE
                        *INTO A RAM BUFFER, AND PROCESSES BACKSPACE
                        *AND LINE DELETE FUNCTIONS.
                        *
                        *
D098 8D 7A      INPLN  BSR      CRLF      CR/LF TO CONSOLE
D09A 86 3E             LDA A    #$3E      GET COMMAND PROMPT >
D09C BD FEAA           JSR      OUTCH     SEND TO CONSOLE
D09F CE E106           LDX      #IBUFF    GET BUFFER ADDRESS
D0A2 FF E126           STX      IBUFP     INITIALIZE POINTER
D0A5 7F E129           CLR      CTEMP     INITIALIZE COUNT
D0A8 BD FD61    INPLI  JSR      INPCH     GET CHAR FROM CONSOLE
D0AB 84 7F             AND A    #$7F      MASK OUT PARITY
D0AD 81 40             CMP A    #$40      CHECK FOR NO PRINT @
D0AF 26 08             BNE      EXCL      NO THEN CONT
D0B1 BD FEAA           JSR      OUTCH     ECHO
D0B4 7F E12A           CLR      PRINT     SET NO PRINT
D0B7 20 DF             BRA      INPLN     GO BACK FOR MORE
D0B9 81 21      EXCL   CMP A    #$21      TEST IF SET PRINT !
D0BB 26 0A             BNE      EQUAL     NO THEN CONT
D0BD BD FEAA           JSR      OUTCH     ECHO
D0C0 86 FF             LDA A    #$FF      GET PRINT CH
D0C2 B7 E12A           STA A    PRINT     SET TO PRINT
D0C5 20 D1             BRA      INPLN     GO BACK FOR MORE
D0C7 81 3D      EQUAL  CMP A    #$3D      TEST IF EQUAL SGN
D0C9 26 05             BNE      UTST      NO THEN CONT
D0CB BD D164           JSR      SETUP     GO SET ADDRESSES
D0CE 20 C8             BRA      INPLN     GO BACK FOR MORE
D0D0 81 3C      UTST   CMP A    #$3C      TEST IF UTILITY <
D0D2 26 03             BNE      GO1       NO THEN CONTINUE
D0D4 7E FE32           JMP      UTIL      GO TO UTILITY
D0D7 81 20      GO1    CMP A    #$20      TEST IF CONTROL CHAR
D0D9 25 14             BCS      INPLC     YES, GO PROCESS
D0DB A7 00             STA A    0,X       NO, PUT IN BUFFER
D0DD 86 20             LDA A    #32       GET BUFFER SIZE
D0DF B1 E129           CMP A    CTEMP     TEST IF FULL
D0E2 27 C4             BEQ      INPLI     YES, LOOP
D0E4 A6 00             LDA A    0,X       RECALL CHARACTER
D0E6 08                INX                INCREMENT POINTER
D0E7 7C E129           INC      CTEMP     AND INCR COUNT
D0EA BD FEAA    INPLE  JSR      OUTCH     ECHO CHARACTER
D0ED 20 B9             BRA      INPLI     GET NEXT CHAR
D0EF 81 0F      INPLC  CMP A    #$0F      TEST IF BACKSPACE ↑O
D0F1 27 0F             BEQ      INPLB     YES,KILL CHAR
D0F3 81 18             CMP A    #$18      TEST IF ↑X
D0F5 27 19             BEQ      INPLK     YES,KILL LINE
D0F7 81 0D             CMP A    #$0D      TEST IF RETURN
D0F9 26 AD             BNE      INPLI     NO,IGNORE CHAR
D0FB B6 E129           LDA A    CTEMP     GET COUNT
```

```
D0FE B7 E128        STA A    IBUFC     SAVE IT
D101 39             RTS                DONE,RETURN
D102 09       INPLB DEX                DECREMENT POINTER
D103 A6 00          LDA A    0,X       GET DELETED CHARACTER
D105 7A E129        DEC      CTEMP     DECREMENT COUNT
D108 2C E0          BGE      INPLE     IF NOT NEG,GO ECHO
D10A 08             INX                IF NEG,UNDO DECR
D10B 7C E129        INC      CTEMP     IF NEG,INC COUNT
D10E 20 98          BRA      INPLI     GET NEXT CHAR
D110 7F E128  INPLK CLR      IBUFC     KILL COUNT TO 0
D113 39             RTS                DONE, RETURN
              *
              *
              *
              *THIS ROUTINE SENDS A CR/LF TO CONSOLE
              *
D114 86 0D    CRLF  LDA A    #$0D      GET A CR
D116 BD FEAA        JSR      OUTCH     DISPLAY IT
D119 86 0A          LDA A    #$0A      GET A LF
D11B BD FEAA        JSR      OUTCH     DISPLAY IT
D11E 39             RTS                DONE, RETURN
              *
              *THIS ROUTINE OUPTUTS THE CONTENTS OF THE INDEX
              *REGISTER AS A FOUR DIGIT HEXADECIMAL NUMBER.
              *
D11F 7D E12A  OUTHX TST      PRINT     TEST FOR PRINT
D122 26 01          BNE      OUTHX1    YES THEN PRINT
D124 39             RTS                NO THEN RETURN
D125 86 20   OUTHX1 LDA A    #$20      GET A SPACE
D127 BD FEAA        JSR      OUTCH     SEND TO CONSOLE
D12A FF E104        STX      XTEMP     SAVE INDEX REG
D12D B6 E104        LDA A    XTEMP     GET HI BYTE
D130 8D 03          BSR      OUTH1     DISPLAY IN HEX
D132 B6 E105        LDA A    XTEMP+1   GET OTHER HALF
D135 36       OUTH1 PSH A              SAVE LOW ORDER DIG
D136 44             LSR A              GET HIGH ORDER DIG
D137 44             LSR A
D138 44             LSR A
D139 44             LSR A
D13A 8D 01          BSR      OUTH      DISPLAY HEX DIGIT
D13C 32             PUL A              GET OTHER DIGIT
D13D 84 0F    OUTH  AND A    #$0F      EXTRACT DIGIT
D13F 8B 30          ADD A    #$30      ADD ASCII ZONE BITS
D141 81 39          CMP A    #$39      TEST IF A-F
D143 23 02          BLS      CON       IF CLEAR THEN CONT
D145 8B 07          ADD A    #$07      YES,ADD BIAS FOR A-F
D147 7E FEAA  CON   JMP      OUTCH     AND PRINT IT
              *
              *THIS ROUTINE OBTAINS A CHARACTER FROM THE RAM
              *BUFFER AND SETS CARRY=1 IF EXHAUSTED.
              *
D14A FF E104  GETCH STX      XTEMP     SAVE INDEX REG
D14D FE E126        LDX      IBUFP     GET POINTER
D150 B6 E128        LDA A    IBUFC     GET COUNT
```

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D153 82 01              SBC A     #$01      DECREMENT WITH CARRY
D155 25 09              BCS       GETCX     NO MORE CHARACTERS
D157 B7 E128            STA A     IBUFC     REPLACE COUNT
D15A A6 00              LDA A     0,X       GET CHARACTER
D15C 08                 INX                 INCR POINTER
D15D FF E126            STX       IBUFP     REPLACE POINTER
D160 FE E104 GETCX      LDX       XTEMP     RESTORE INDEX REG
D163 39                 RTS                 DONE, CARRY IF NO CHAR
                   *
                   *
                   *THIS ROUTINE ALLOWS THE SETTING OF THE BEGINNING
                   *AND ENDING ADDRESSES IN RAM1 AND RAM2 WITHOUT
                   *HAVING TO RETURN TO YOUR MONITOR PROGRAM.
                   *
                   *
D164 BD FEAA SETUP      JSR       OUTCH     GO PRINT =
D167 8D 18              BSR       BYTEA     MSB OF ADDRS
D169 B7 E100            STA A     RAM1      AND STORE
D16C 8D 13              BSR       BYTEA     GET LSB
D16E B7 E101            STA A     RAM1+1    AND STORE
D171 86 20              LDA A     #$20      GET A SPACE
D173 BD FEAA            JSR       OUTCH     AND PRINT IT
D176 8D 09              BSR       BYTEA     INPUT MSB
D178 B7 E102            STA A     RAM2      AND STORE
D17B 8D 04              BSR       BYTEA     GET LSB
D17D B7 E103            STA A     RAM2+1    AND STORE
D180 39                 RTS                 AND RETURN
D181 8D 0A   BYTEA      BSR       INHEX     PUT IN HEX CH
D183 48                 ASL A               PUT IN HIGH HALF
D184 48                 ASL A
D185 48                 ASL A
D186 48                 ASL A
D187 16                 TAB                 SAVE A
D188 8D 03              BSR       INHEX     INPUT OTHER HEX CH
D18A 1B                 ABA                 ADD
D18B 16                 TAB
D18C 39                 RTS                 AND RETURN
D18D 8D 18   INHEX      BSR       INCHA     INPUT HEX CH
D18F 84 7F              AND A     #$7F      MASK OUT PARITY
D191 BD FEAA            JSR       OUTCH     AND PRINT IT
D194 80 30              SUB A     #$30
D196 2B 17              BMI       C1        NOT HEX
D198 81 09              CMP A     #$09
D19A 2F 0A              BLE       IN1HG
D19C 81 11              CMP A     #$11      NOT HEX
D19E 2B 0F              BMI       C1        NOT HEX
D1A0 81 16              CMP A     #$16
D1A2 2E 0B              BGT       C1        NOT HEX
D1A4 80 07              SUB A     #$07
D1A6 39      IN1HG      RTS                 AND RETURN
D1A7 7E FD61 INCHA      JMP       INPCH
D1AA 86 3F              LDA A     #$3F      SEND A ?
D1AC BD FEAA            JSR       OUTCH
D1AF 7E D000 C1         JMP       DRIVE
```

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                   *
                   *
                   *THESE ROUTINES PERFORM INPUT AND OUTPUT FROM
                   *AND TO THE CONSOLE, PASSING ONE CHARACTER IN
                   *THE A ACCUMULATOR. THEY MUST BE CODED TO WORK
                   *WITH THE PARTICULAR CONSOLE I/O INTERFACE
                   *ARRANGEMENT OF EACH MICROCOMPUTER.
                   *
                   *
          FE32     UTIL    EQU        $FE32     START OF UTILITY
          FD61     INPCH   EQU        $FD61     CONSOLE INPUT ROUTINE
          FEAA     OUTCH   EQU        $FEAA     CONSOLE OUTPUT ROUTINE
                   *
                   *
                   *RAM WORKING STORAGE
                   *
                   *
     E106                  ORG        XTEMP+2
                   *
     E106 0020     IBUFF   RMB        32        INPUT TEXT BUFFER
     E126 0002     IBUFP   RMB        02        INPUT POINTER
     E128 0001     IBUFC   RMB        01        INPUT COUNTER
     E129 0001     CTEMP   RMB        01        PHONY C REGISTER
     E12A FF       PRINT   FCB        $FF       PRINT INDICATOR
                   *
                   *
                   *
                   *
                           END

DRIVE   D000
START   D007
DEOT    D00C
DGET    D011
DCTRL   D01A
GO      D01F
DREAD   D029
DREAL   D02F
DREAX   D038
DWRIT   D043
DWRIL   D056
DLINE   D062
CONT    D068
DINP    D06C
DOUT    D078
DOUTC   D07E
DOUTW   D087
DOUTX   D096
DDATA   E000
DSTAT   E001
RAM1    E100
RAM2    E102
XTEMP   E104
INPLN   D098
INPLI   D0A8
```

```
EXCL    D0B9
EQUAL   D0C7
UTST    D0D0
GO1     D0D7
INPLE   D0EA
INPLC   D0EF
INPLB   D102
INPLK   D110
CRLF    D114
OUTHX   D11F
OUTHX1  D125
OUTH1   D135
OUTH    D13D
CON     D147
GETCH   D14A
GETCX   D160
SETUP   D164
BYTEA   D181
INHEX   D18D
IN1HG   D1A6
INCHA   D1A7
C1      D1AF
UTIL    FE32
INPCH   FD61
OUTCH   FEAA
IBUFF   E106
IBUFP   E126
IBUFC   E128
CTEMP   E129
PRINT   E12A

TOTAL ERRORS 00000
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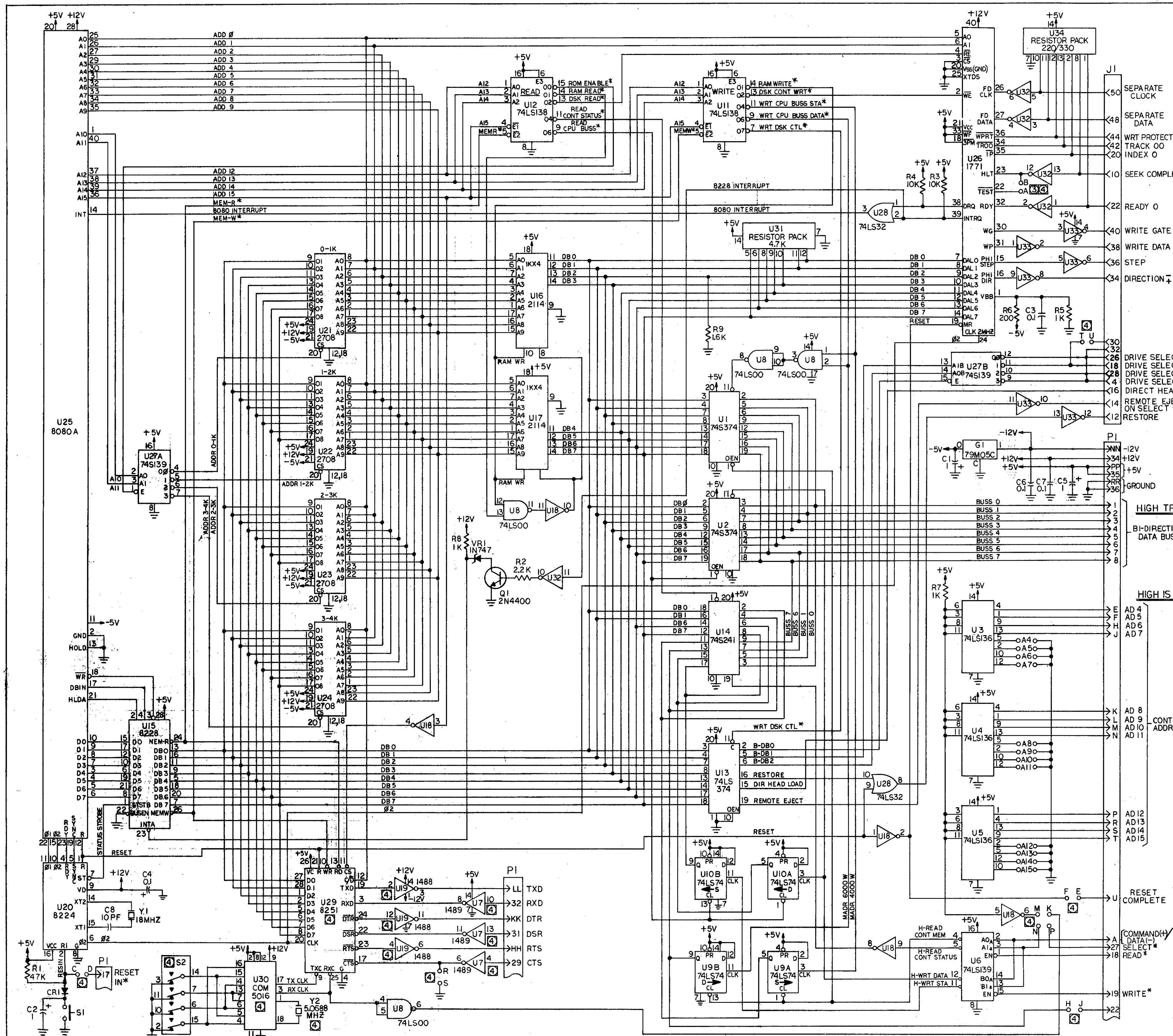
PERSCI, INC.

12210 Nebraska Ave
W Los Angeles
CA 90025

APRIL, 1978



REVISIONS		200351		
REV	DESCRIPTIONS	CHK	DATE	APPR
A	ENG REL	PGM	29 JULY	PGM
B	MFG REL ECO 70	PGM	29 JULY	PGM
C	ECO 121	PGM	11 DEC	PGM
D	ECO 174	PGM	27 MAR 78	PGM

6. 'S' PARTS USED FOR HIGH PWR INTERFACE. 'LS' PARTS USED FOR LO PWR INTERFACE.

[5] U18 & U32 TO BE 74LS14 AND U33 TO BE 7406.

[4] FOR VARIABLE COMPONENTS & JUMPER LOCATIONS SEE MANUAL.

[3] JUMPER FROM A TO B FOR FAST SEEK MODE.

2. ALL CAPACITORS IN MICROFARADS.

1. ALL RESISTORS IN OHMS 1/4W., 5%.

NOTES: UNLESS OTHERWISE SPECIFIED;

200351 D

PERSCI

PERSCI, INC.

SCALE — APPROVED P. G. Moore DRAWN SA 4/20/77

DATE 29 JULY 77 REVISED

SCHEMATIC
DISKETTE DR CONTROLLER-2

MODEL 1070 | SHEET 1 OF 1 | 200351 | D