DISKETTE FORMATS

The DJ/DMA and the version of CP/M (or Micronix) supplied with it can read and write a variety of formats. This section of the User Guide goes into considerable detail about what those formats are, and also goes on to define them explicitly. For those of you who are only interested in answers, the following is a list of diskette formats that the DJ/DMA comes ready equipped to read and write:

SOFT SECTORED

| Type | Density | Tracks | Sectors | Bytes/Sector |
|---|---|---|---|---|
| 5 1/4" MicroDecision | double | 40 | 5 | 1024 * |
| 8" IBM 3740 | single | 77 | 26 | 128 |
| 8" IBM Series 34 | double | 77 | 26 | 256 |
| 8" non-IBM (512) | double | 77 | 15 | 512 |
| 8" non-IBM (1024) | double | 77 | 8 | 1024 |

HARD SECTORED

| | | | | |
|---|---|---|---|---|
| 5 1/4" NorthStar | single | 35 | 10 | 256 |
| " " | double | 35 | 10 | 512 |

* CP/M 2.2 revision E.4 and Micronix

The DJ/DMA can distinguish between these formats. All you have to do is insert the diskette, close the door and issue a command to your operating system (such as "DIR"). The DJ/DMA determines which of these formats it is looking at, and will transfer the requested sectors to the operating system.

You can read and write double-sided diskettes if you have double-sided drives (and diskettes). Single-sided drives have only one read/write head, so they can't handle two sides of a diskette. The DJ/DMA is capable of distinguishing single from double sided 8" diskettes because they are physically different. The DJ/DMA can also recognize double-sided MicroDecision diskettes and NorthStar diskettes by looking at a byte in the first sector of the diskette.

You can only obtain useful information from diskettes that your operating system (or software) can understand. For example, the DJ/DMA can read a TRS 80 Model II diskette but can't display a directory or access any of the files on it. The physical format isn't a problem, but the organization of data on the diskette is. If you are using CP/M you can read and write CP/M diskettes. If you are using Micronix you can read or write Micronix, CP/M (with the "far" program) and PC-DOS (with "dar") diskettes.

What about other 5 1/4" formats? There are many other formats that the DJ/DMA could possibly read or write. Most 5 1/4" soft-sectored formats, (IBM PC, Xerox, KayPro, Osborne, to name a few), use a modified form of IBM System 34 format. The DJ/DMA is unable to read or write these formats without help from additional software because these formats have a variety of numbers of sectors per track, sector sizes, sector numbering etc. Some of these formats are described in the section on formatting. It is feasible to write a program that could handle all these formats with the DJ/DMA, but it hasn't been done yet.

The rest of this section is organized as follows. The first part describes the physical organization of diskettes. Next, the formats that can be written are defined in terms of the actual bytes written in each track. Examples are given for 5 1/4" hard sectored, 8" single density and 8" double density. Then, the logical organization of diskettes is briefly described by comparing a CP/M diskette to a Micronix diskette. Finally, the last section explains fdj, the DJ/DMA formatting program.

## DISKETTES: THE MEDIA IS THE MESSAGE

Diskettes of both sizes consist of a black plastic envelope with a circular piece of recording material on the inside. The recording material is visible in the center hole of the diskette, and through an oblong slot between the center and one edge of the diskette. Floppy disks are read and written through this oblong slot.

Although we're sure you've heard these warnings before, we'll repeat them here. Be careful never to touch the recording material revealed though the oblong slot. The oil naturally occuring on your fingertips will ruin the magnetic material. The recording material can also be damaged by: being scratched, heated, folded or getting wet. Floppy disks are cheap and convenient, but somewhat fragile, so be careful when you handle them.

### Differences between 5 1/4" and 8"

Now for the difference between 5 1/4 and 8 inch diskettes. We'll talk about 5 1/4 inch diskettes first. The major difference is their size: 5 and 1/4 inch diskettes are 5 and 1/4 inch square. The other important difference is something called "write-protect". When a diskette is write-protected, it may be read, but not written on. Write-protection is a physical mechanism that cannot be overridden by the DJ/DMA so it provides a good way of protecting valuable data on diskettes from accidental erasure. Cassette tapes in stereo systems have a similar protection scheme.

The write-protect notch on a 5 and 1/4 inch diskette is on the left hand edge when your are holding the diskette properly (by its label). When this notch is covered, the disk is write-protected. Left uncovered, the diskette can be written on or erased.

notch---
covered

notch---
open

A WRITE-PROTECTED 5 1/4"
DISKETTE

AN UNPROTECTED 5 1/4"
DISKETTE

Eight inch floppy disks have the write-protect notch in a different position. The write-protect notch is on the edge of the diskette nearest the oblong opening. And, to confuse the issue, 8" diskettes use the opposite scheme from 5 and 1/4 inch diskettes: when the notch is open, the disk is write protected; when the notch is covered, it is write enabled. Make sure you've got that straight, or forget it if you don't use 8" diskettes.

notch open

notch covered

A WRITE-PROTECTED 8"
SINGLE-SIDED
DISKETTE

AN UNPROTECTED 8"
DOUBLE-SIDED
DISKETTE

Single and Double-sided Diskettes

There is no difference in appearance between single and double sided 5 1/4" floppy diskettes. However, the 5 1/4" diskettes that are labeled and sold as double sided have passed a test for double-sidedness; the diskettes labeled as single-sided FAILED this test.

There is a physical difference between single and double sided 8" diskettes. If you look at the drawings of 8" diskettes on the previous page, you will notice that one is labeled "SINGLE-SIDED", and the other is labeled "DOUBLE-SIDED". The difference between the two is the location of the index hole. The index hole for single-sided 8" diskettes is located at about 6:30, a little off to the left below the center hole. In double-sided 8" diskettes, this hole is located further to the left, around 7 o'clock. This physical difference allows the hardware and software to distinguish between single and double sided 8" diskettes. If you want to use double-sided 8" diskettes, you must buy them this way.

Hard and Soft Sectored

While we're looking at index holes, I need to talk about hard and soft sectored diskettes. If you rotate a diskette by poking two fingers through the hole in the middle and turning the plastic inside, you can see the plastic moving by through the little window of the index hole. If you see several holes punched in the plastic, you are playing with a hard sectored diskette. Soft sectored diskettes, both 5 1/4" and 8", have only one hole that can appear through the window of the index hole. The importance of this little hole is explained next.

PHYSICAL ORGANIZATION: BULLSEYE AND A PIE

The recording media inside the diskette envelope looks like a disk with a big hole in the middle. Besides this big hole, there is either 1 or 11 smaller holes distributed around the edge of the big hole. The remainder of the disk is unmarked.

DISK MEDIA REVEALED!!

2 circles, with 1/5 diameter hole in the middle

| | |
|---|---|
| this one has one small hole just outside the large central hole. | this one has 11 holes, 10 equally distributed holes, and the 11th is between two of the other holes |
| 5 1/4" soft-sectored | 5 1/4" hard-sectored |

The surface of the disk media is divided two ways. The first is a series of concentric circles, one for each track, like circles around a bullseye. The second way is by sectors which are lines that radiate from the center of the disk to the edge, like slices in a pie.

media with many circles + media sliced in 10 equal pieces = combination of two circles

Concentric TRACKS SECTORS Bullseye + A Pie!

The concentric tracks are there because the media moves in circles underneath the heads. The heads are positioned over the tracks by the drive, which can accurately position the heads exactly over any one of the evenly spaced tracks. 5 1/4" drives have 40 tracks and 8" drives have 77 tracks. If the heads can't be positioned over the tracks, the drive is broken or misaligned.

Sector lines are drawn by two different means. Hard-sectored media are divided into ten slices by the 10 evenly placed sector holes. The eleventh hole is used to mark the first sector, which begins with the next index hole. So, you can number the slices by counting them from the first sector. This is how the DJ/DMA numbers the sectors of hard-sectored diskettes.

Soft-sectored diskettes are sliced up differently. After all, there's only one hole. The single index hole marks the beginning of an entire track. The formatting program slices up the track by writing sector identification and empty data fields for each sector. The way that a track may be divided up is not fixed (hard) but may be different. In other words, a track could have a single sector spanning the entire track, or any number of smaller sectors. The only limitations are that the first sector begins after the index hole and the last sector ends before the index hole comes round again. This is why many diskette formats are incompatible: different ways of slicing up the same track.

PHYSICAL FORMATS: SIGNIFICANT PATTERNS

Once you understand that diskettes are divided up into tracks and the tracks are divided up into sectors, you know most of what you need to know about diskette formats. All that's missing are the details, like, how many sectors can fit on a track, how they are labeled or what fills the empty space <u>between</u> sectors. The answers to these and other questions follow.

## Sector Identification: ID Field

The sector ID field is a good place to begin. A field is a part of a sector with a particular use. The ID field, for example, identifies the sector. When a soft-sectored diskette is divided up, the beginning of each sector is labeled with the ID field. So you can think of the ID field as a sign at the beginning of the sector with the complete address of the sector on it. The complete address consists of

track number
side
sector number
size code

Tracks are numbered starting with 0 at the outermost track, and run to 39 for 5 1/4" and 76 for 8" drives. There are, of course, only two sides. The first side is side 0, and the flip side is side 1. Sector numbers start at either 0 or 1 (1 is IBM standard). There are four size codes:

| Size Code | Bytes/Sectors | Sectors/track (8" drives) |
|---|---|---|
| 0 | 128 | 26 |
| 1 | 256 | 26 |
| 2 | 512 | 15 |
| 3 | 1024 | 8 |

With this information, you can easily calculate what's in the ID field of any sector on a disk. For example, the ID field of the fourth sector, first side, thirteenth track of an IBM single density diskette should contain the bytes

| track | side | sector | code |
|---|---|---|---|
| 12 | 0 | 4 | 0 |

in that order. The first sector on the last track of the second side of an 8" diskette formatted with 512 byte sectors would be identified with

| track | side | sector | code |
|---|---|---|---|
| 76 | 1 | 1 | 2 |

The order of these four bytes in the ID field will always remain the same. The DJ/DMA uses this information to check the track number and side, find the correct sector and calculate the number of bytes to read or write. The same four bytes also appear in other diskette formats (Osborne, Hewlet Packard, Xerox, Televideo, KayPro, IBM PC, etc.) marking the beginning of sectors.

## Other Special Bytes: Mark, Sync, and Fill

Before we exhibit the naked byte patterns that make up tracks and sectors, there are a few more bytes to talk about. Since all of these special bytes involve clock bits, we'd better mention them first. The information in this section is somewhat technical and not absolutely necessary for understanding disk formats, so you can skip ahead if you like.

Disk controllers use clock bits to help in correctly reading data bits from a diskette. In single density formats (FM), a clock bit is written before every data bit. In double-density, (MFM), clock bits are written before every data bit that will be a zero. So, in double-density, there is either a clock bit marking a 0 or a data bit marking a 1 for each bit of data, and in single-density, there is both a clock and a data bit written for each data bit. To try to make a difficult topic clearer, here's an example of the byte A1H (10100001 in binary) written in both single density and double density formats:

| | Single Density | Double Density |
|---|---|---|
| Data bits | 1 0 1 0 0 0 0 1 | 1 0 1 0 0 0 0 1 |
| Clock bits | 1 1 1 1 1 1 1 1 | 0 1 0 1 1 1 1 0 |
| Disk image | ¦¦¦_¦¦¦_¦_¦_¦_¦_ | _¦¦__¦¦_¦_¦_¦__¦ |

The bars (¦) represent the little electrical pulses that create the magnetic patterns on a track, and the spaces in between are marked by _. Notice that there are fewer bars in double density than single desity. This is the "trick" that makes double density possible: fewer bars (pulses) to read or write for the same data.

Now for the special bytes. Mark bytes have ~~three~~ clock bits missing from them. This isn't detectable to unequipped humans, but to disk controllers this is both significant and easy to distinguish. For this reason mark bytes were chosen to begin (by marking) both ID fields and data fields.

Sync bytes are nothing other than 0's. Zeroes look like clock bits without data (to disk controllers) and are used to set the disk controller's clock for data separation. Fill bytes fill up the empty spaces between sectors, ID fields and data fields. Fill bytes help keep the disk controller's clock stay set (synchronized) correctly when it's not reading or writing data.

## CRC: Cyclical Redundency Checksum

The CRC is a one or two byte number that is used to check the accuracy of information read from a diskette. The way CRC works is this. Each byte written to a (ID or data) field on a diskette is combined according to a special formula to produce the checksum. The checksum is written as the last one or two bytes of the field. When the field is read later, the checksum is calculated again from the bytes being read, and compared with the checksum written at the end of the field. If the two checksums agree, everything is considered okay. If the checksum calculated doesn't agree with the checksum previously written, a CRC error has occurred. This indicates that the bytes read are not the same as the bytes written earlier. If you are interested in the formulas used for calculating checksums, you can dig into the format program examples given in the Appendix.

IBM 3740 Format: The Only Standard

The IBM 3740 format is the closest thing that computer manufacturers have been able to agree on as a standard for diskette formats. This is to say that the DJ/DMA can probably read any diskette written in IBM 3740 format by any brand of computer, and other computers can read diskettes written in this format by the DJ/DMA.

Things get a little technical here because it makes sense to describe the bytes used in this format in hexadecimal. If this bothers you, please hide your eyes and skip ahead several pages to the section on using fdj, the formatting program. For the rest of us, here is track 0, side 0, from an IBM 3740 diskette:

| Description | # Bytes | ~~Byte~~ Data Written | |
|---|---|---|---|
| Index hole begins | 40 | FF | |
| Sync bytes | 6 | 00 | |
| Index Mark | 1 | FC | |
| Gap 1 | 26 | FF | |
| Sync bytes | 6 | 00 | <-+ |
| ID mark | 1 | FE | ¦ |
| Track number | 1 | 00 | ¦ |
| Side number | 1 | 00 | ¦ |
| Sector number | 1 | ss | ¦ |
| Size code | 1 | 00 | ¦ |
| CRC bytes | 2 | xx | ¦ - repeat 26 times |
| Gap 2 | 11 | FF | ¦ |
| Sync bytes | 6 | 00 | ¦ |
| Address Mark | 1 | FB | ¦ |
| Data ~~fill~~ field bytes | 128 | E5 | ¦ |
| CRC bytes | 2 | xx | ¦ |
| Gap 3 | 27 | FF->-+ | |
| Gap 4 | 247 | FF (or until index hole detected) | |

get drawings from 2DB MANUAL

Thus, when the index hole is detected, 40 bytes of FF hex are written, then 6 bytes of 00 hex for clock synchronization, then the index mark byte, 26 more bytes of FF hex, etc.

The pattern for each sector is repeated 26 times, once for every sector. When the next track or side is written, the track or side byte in the ID fields is changed to correspond to the side or track number being written. The sector numbers in the ID field (ss) run from 1 to 26.

You may have noticed that there are four gaps, and that gaps always precede sync bytes. The gaps are filled with FF's, and serve the controller by adding a breathing space between sectors. The Index, ID and Data marks all have clock bits missing from appropriate places.

## IBM System 34 Format

This format is somewhat less dependable as a standard, as variations seem to exist from manufacturer to manufacturer. What is presented here is Morrow's version of this format. You will notice, please, that there are great similarities between the single density format (IBM 3740) and the double density format (this one). There are the same number of sectors (but twice as many bytes per sector), the same number of gaps (but more bytes in each gap), and the same mark bytes. Here are the bytes written in track 1, side 0, of a System 34 diskette.

| Description | * Bytes | ~~Bytes~~ Data Written | |
|---|---|---|---|
| Index hole begins | 80 | 4E | |
| Sync bytes | 12 | 00 | |
| * | 3 | C2 | |
| Index mark | 1 | FC | |
| Gap 1 | 50 | 4E | |
| Sync Bytes | 12 | 00<--+ | |
| * | 3 | A1 | |
| ID address mark | 1 | FE | |
| Track number | 1 | 01 | |
| Side | 1 | 00 | |
| Sector number | 1 | ss | |
| Size code | 1 | 01 | |
| CRC bytes | 2 | xx | - repeat 26 times |
| Gap 2 | 22 | 4E | |
| Sync bytes | 12 | 00 | |
| ** | 3 | A1 | |
| Data address mark | 1 | FB | |
| Data fill bytes | 256 | E5 | |
| CRC bytes | 2 | xx | |
| Gap 3 | 54 | 4E->-+ | |
| Gap 4 | 598 | 4E (or until next index begins) | |

* Clock bits missing between bits 4 and 5
** Clock bits missing between bits 3 and 4

8" diskettes formated with 512 and 1024 byte sectors look very much like this. The differences are: the number of bytes per sector, sector size code, sectors per track, and bytes per each gap. The number of sync bytes, the marks and the ID fields all stay the same.

## MicroDecision Format

MicroDecision format is based on the IBM System 34 format. The difference being, of course, that the diskette used is 5 1/4" instead of 8". Practically speaking, this means that there is room for fewer bytes per track. There are 5-1024 byte sectors per track, (so the size code is 3), and fewer fill bytes in the gaps. Otherwise, MicroDecision format looks very like System 34 format. Here's track 0, side 0 of a MicroDecision diskette:

| Description | Bytes | Bytes Written | |
|---|---|---|---|
| Index hole begins | 80 | 4E | |
| Sync bytes | 12 | 00 | |
| * | 3 | C2 | |
| Index mark | 1 | FC | |
| Gap 1 | 50 | 4E | |
| Sync Bytes | 12 | 00<--+ | |
| ** | 3 | A1 ¦ | |
| ID address mark | 1 | FE ¦ | |
| Track number | 1 | 01 ¦ | |
| Side | 1 | 00 ¦ | |
| Sector number | 1 | ss ¦ | |
| Size code | 1 | 03 ¦ | |
| CRC bytes | 2 | xx ¦ | - repeat 5 times |
| Gap 2 | 22 | 4E ¦ | |
| Sync bytes | 12 | 00 ¦ | |
| ** | 3 | A1 ¦ | |
| Data address mark | 1 | FB ¦ | |
| Data fill bytes | 1024 | E5 ¦ | |
| CRC bytes | 2 | xx ¦ | |
| Gap 3 | 85 | 4E->-+ | |
| | | | |
| Gap 4 | 250 | 4E (or until next index begins) | |

* Clock bits missing between bits 4 and 5
** Clock bits missing between bits 3 and 4

You might have noticed that the only differences between MicroDecision format and the System 34 format example are: the size code is 3, there are 5 1024 bytes sectors, more (85) Gap 3 bytes and fewer (250) Gap 4 bytes in MicroDecision format.

Hard Sectored 5 1/4" Format

The hard sectored format presented here was developed by NorthStar Computers. You remember that the sector holes slice up the tracks into sectors, and an index hole marks the first sector. So, to locate a particular sector, a disk controller waits for the index hole and starts counting sectors when the next sector hole comes around. This does away with the necessity for sector ID fields, although it is also somewhat slower to access than soft-sectored formats because you have to wait for the index hole to come around.

There are two hard-sectored formats, single and double density. The bytes written are the same for both, but the number of bytes is approximately twice as many:

| Description | Bytes Single | Bytes Double | Bytes Written |
|---|---|---|---|
| Index hole | | | |
| Sync bytes | 17 | 32 | 00 |
| Mark byte | 1 | 2 | FB |
| Data fill | 256 | 512 | 20 |
| CRC | 1 | 1 | xx |
| Fill byte | 17 | 32 | 20 (or until next index hole) |

This pattern is repeated without changes for every sector and every track. The words Single and Double, under the word Bytes, refer to single and double density. You might also note that only one CRC byte is used, since NorthStar uses a differant equation for calculating checksums.

LOGICAL ORGANIZATION: MAPS

We've already mentioned how diskette formats differ in sector sizes, sectors per track and starting sector number. These differences are part of the physical format written on the diskette. There is another category of differances that involves where information is stored on a diskette. Essentially, you can have two identically formatted diskettes that are organized in two non-compatible fashions. This logical organization is imposed by the operating system used to read and write the diskette. We'll briefly discuss three aspects of logical organization in this section: system tracks, directories and skew.

System Tracks

IBM diskette formats provide a fixed location for storage of an operating system (or loading program) on the first two tracks of the first side of diskettes. These two tracks are called the system tracks. By convention, the first track of 8" diskettes is written in single density, IBM 3740 format. The second track will be in the same format as the remainder of the diskette.

The first sector of the first track of most diskettes is called the boot block. This sector usually contains information about the diskette's format and a short program to load the rest of the system tracks. It is not essential that anything be written on the rest of the system tracks (through the SYSGEN program, for example), but these tracks are still reserved and cannot be used for data storage. Both Micronix and CP/M follow this convention for floppy diskettes: boot block in sector 1, first track in single density and first and second tracks reserved. TRS 80 Model II's, for contrast, do not reserve tracks 0 and 1 for system use.

Directories

The level of diskette organization that is most visible to people is the directory. Disk directories contain a list of the files written on the diskette which can be displayed though an operating system command such as DIR. But beyond the list of filenames, directories also contain information about the logical location of the files on the diskette. The logical location of files is translated by the operating system into physical sectors on a diskette. Both the physical location of the directory and the way logical locations are mapped to physical sectors differs from operating system to operating system.

The CP/M standard for directories is that the directory begins in the first sector of the third track, the first non-system track. This fixed location is required because the directory is the map for the rest of the diskette. Without the map, the data on the diskette is unusable. The TRS 80 Model II uses a very different location for directories. A track (or two) is chosen near the middle of the diskette for the directory and marked with a special byte (a deleted data mark). Thus, TRSDOS has a way of finding a Model II directory, but other operating systems, CP/M for example, know nothing about the location of Model II directories.

The way that directories describe files also differs. A CP/M directory entry can contain 16 block addresses, with each block address identifying a set number of sectors. Our other example, TRS 80 Model II, also has 16 addresses in a directory entry, but these addresses define "granules" of five sectors each. Model II and MS-DOS directories keep track of allocated groups of sectors with a special table that is part of the directory. CP/M, on the other hand, creates this table in memory when needed.

Skewing

If you are beginning to grasp some of the difficulties involved in reading logically-different formats, you'll hate skew. Skewing is a way of logically renumbering the sectors on a track. The reasoning behind this is that the operating system won't be ready for the next sector immediately after reading the current sector. So, the operating system builds in a delay by calling some other sector further around the track the next sector. The number added by the operating system to space out the sectors is called the skew.

Some versions of operating systems don't use skewing, so physical sectors and logical sector numbers are identical. Other versions of the same operating system do use skewing. For example, an IBM PC CP/M diskette uses no skewing and a MicroDecesion CP/M diskette uses a skewing of 3:

| | MicroDecision | | | | | IBM PC | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Logical Sector | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Physical Sector | 1 | 4 | 2 | 5 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Thus, when CP/M asks for the third logical sector of a MicroDecesion diskette, it gets the second physical sector. The third logical sector and the third physical sector are identical on the IBM PC diskette.

## FORMATTING PROGRAMS

There are two formatting programs available for the DJ/DMA. The newer and more powerful of the two is called <u>fdj</u>. The fdj program can format both hard and soft sectored diskettes and comes with Micronix and CP/M 2.2, revision E4. The ~~older~~ program, <u>formatdj</u>, comes with CP/M 2.2, revision E3, and can't format soft sectored 5 1/4" diskettes. The fdj program is also much easier to use.

## FDJ

The fdj program offers two modes of operation, both menu driven. The first mode offers you a list of the eight different formats most commonly used on Morrow systems. The second mode is entered through the ninth menu selection, Other. If you select Other, you are required to specify all of the formatting parameters yourself. This allows you to produce a variety of soft-sectored formats.

We have reproduced betwo the menu provided by fdj, and written alongside of each selection exactly what format is produced.

DJDMA Formatter

| | |
|---|---|
| 5 inch soft sectored formats | |
| A) Morrow single sided | MicroDecision |
| B) Morrow double sided | formats. |
| 5 inch hard sectored formats | |
| C) Single sided | NorthStar CP/M |
| D) Double sided | formats, 35 tracks. |
| E) Morrow Micronix | NorthStar, 40 tracks. |
| 8 inch formats | |
| F) CP/M standard single density | IBM 3740 standard. |
| G) Morrow CP/M double density | System 34, 1024 sectors. |
| H) Morrow Micronix | System 34, 512 sectors. |
| Do it yourself | |
| I) Other | |

First we'll show you you how to use fdj's menu for 5 1/4 and 8 inch formats, then we'll explain fdj's command line options, for non-interactive use.

### FDJ's Menu Selections: 5 1/4" Drives

If you are using a 5 1/4 inch drive, you will be selecting one of the first five formats. These five formats are divided into soft and hard sectored types. Hard sectored means that there is a hole punched in the diskette material marking the beginning of each sector. There is also an extra hole that marks the first sector. Micro Decision diskettes are soft sectored. Soft sectored diskettes have only the single hole that marks the first sector.

You can check to see if a diskette is hard sectored or not by looking through the small hole in the diskette envelope (called the index hole) and rotating the disk material through the large hole in the middle and counting the holes. As soon as you have seen several holes, you know you've got a hard sectored diskette. Soft-sectored diskettes have a single index hole in them. Please be aware that there are also 16-sectored diskettes available which will not work with your system (you use 10), but these are rare.

If you are planning to use both sides of the diskettes for maximum capacity, buy diskettes certified as double-sided.

The first two format selections are for creating diskettes compatible with the Morrow Micro Decision. The Micro Decision format creates 1024 byte sectors on soft sectored diskettes. Obviously, you will want to select **A** for compatibility with single sided Micro Decisions, and **B** for double sided.

The next three format selections are for hard sectored diskettes. Selections **C** and **D** create formats compatible with North Star Computers hard sectored formats. The North Star format is 35 tracks of 512 byte sectors. You must, of course, select either single or double sided depending on the capability of the other systems drives.

The **E** selection is the one for use with Micronix systems. **E** selects double-sided, 512 bytes sectors and 40 tracks per side. This gives you the maximum storage capacity possible for 5 1/4" diskettes.

After selecting a format for 5 1/4 inch diskettes, you will be asked to choose a **drive number.** As far as the fdj program is concerned, your drives are numbered from 0 to 3. In single drive systems, the drive number will always be zero. (Confusion factor: some programs number drives 0-3, while others use letters a-d. There is a direct correlation between the two. The thing that determines the drive number is a jumper or switch inside the disk drive.)

Selection:
- A) drive 0
- B) drive 1
- C) drive 2
- D) drive 3

Selection: Drive 0.

```
Insert a write enabled diskette in 5 1/4 inch drive 0
Press <RETURN> to format, anything else to quit
```

Earlier in this Chapter, we discussed write-protection in the Floppy Diskette section. In brief, the write enabled diskette that you will be inserting will have the notch uncovered for 5 1/4 inch diskettes. Any new diskette that you buy will have the notch uncovered. When you have inserted the diskette, press the **RETURN** key to start formatting. After formatting is finished, you will asked (again) to insert a diskette and press return to format. Pressing any other key will return you to the operating system.

If the diskette you are formatting has any bad sectors, we advise you to throw it away (or return it to the vendor). Bad diskettes are not worth the risk of losing valuable data. If you want to make the newly formatted diskettes capable of booting CP/M or loading Micronix, you will also need to use the SYSGEN program.

FDJ's Menu Selections: 8" Drives

IBM 3740 format is the accepted standard for 8" diskettes. There are also many variations of System 34 formats in use. The variations involve differences in the sector size, and minute differences in the patterns that separate sectors. IBM 8" formats are soft sectored, meaning that the software must determine where the sector boundaries are and the identity of the sectors. This is where there are differences in some of the "standard" formats. If you are trying to make a diskette readable on other "standard" 8" disk systems, choose **F** for single density CP/M format with 128 byte sectors.

If you are formatting 8" diskettes for use with Micronix or CP/M, you will be selecting **G** or **H**. Micronix uses a block size of 512 bytes and this is the sector size you choose by selecting **H** for diskettes used on Micronix. If you are creating diskettes that will be shared with a Morrow 8" CP/M system, rather than exclusively with Micronix, use the **G** selection for 1024 byte sectors instead. Using 1k sectors will work with Micronix, but will result in somewhat slower writing, slightly faster reading and about a 7% increase in storage capacity over 512 byte sectors.

There is a physical difference between single and double sided 8" diskettes. On single sided diskettes, the index hole, a small hole used in determining the beginning of the first sector, is almost directly opposite the oblong slot used for reading and writing. On double sided diskettes, the index hole has been punched more to the side (about one o'clock, looked at label side up). The disk drive will determine which type of diskette you have inserted, and fdj will behave accordingly.

Select one of the 8" menu selections and insert a write-enabled diskette. Write enabled 8" diskettes have the notch on the edge opposite the label <u>covered</u>. Press the **RETURN** key when you are ready to begin formatting.

After formatting is completed the program starts over. If you want to format more diskettes, insert another diskette and press return. Otherwise, type anything else to return to the operating system. If you wish to make a diskette capable of booting CP/M or loading Micronix, use the SYSGEN program under CP/M.

FDJ's Other Selection

The last of fdj's format selections is called "Other", the **I** selection. Other actually includes all of the formats previously mentioned. When you select **I**, you will be able to choose all of the parameters used by the formatting program, instead of selecting a particular subset of them, for example, double sided MicroDecision.

The Other selection is for those who <u>know</u> which format parameters they wish to select. You need to know, for instance, not only the sector size you want, but also the number of sectors per track. And, if you choose an impossible combination of sector size and sectors per track, your formatting will fail. If none of the first eight selections will work for your particular application, you may be able to use the Other selection. Other is intended to give you the maximum control over formatting for unusual circumstances. For normal formatting, do yourself a favor and stick to the first eight selections.

If you do choose Other (I), here is a list of parameters you may choose from:

- 5 1/4" or 8" diskettes
- 35, 40, 77 or 80 tracks
- single or double sided
- 128, 256, 512 or 1024 byte sectors
- single or double density
- soft or hard sectored
- 0 or 1 origin sectors
- 5, 8, 9, 10, 15, 18 or 26 sectors per track

If you attempt to use impossible combinations, for example 26 1024 byte sectors, the fdj program will simply not work correctly. A list of correct combinations is presented in the next section.

Format Specifications

The following table presents a list of diskette format specifications. There is no guarantee that diskettes that you format using fdj's general purpose Other selection will work in someone else's computer; we've haven't tried them ourselves. This information is provided as a guide to you in case you want to try them. Generally speaking, it is best to start with a diskette formatted by someone else's computer, and work from there.

| Description | Size | Density | Sector Size | Sectors/Trk | First |
|---|---|---|---|---|---|
| IBM 3740 | 8 | S | 128 | 26 | 1 |
| IBM System 34 | 8 | D | 256 | 26 | 1 |
| Micronix | 8 | D | 512 | 15 | 1 |
| Morrow CP/M | 8 | D | 1024 | 8 | 1 |
| NorthStar | 5 | S | 256 | 10 | 0 |
| | 5 | D | 512 | 10 | 0 |
| MicroDecision | 5 | D | 1024 | 5 | 1 |
| IBM PC (1.0) | 5 | D | 512 | 8 | 1 |
| Osborne | 5 | S | 256 | 10 | 1 |
| | 5 | D | 1024 | 5 | 1 |
| Xerox | 5 | S | 128 | 18 | 1 |
| | 5 | D | 256 | 17 | 1 |
| KayPro | 5 | D | 512 | 10 | 0 |
| Hewlett-Packard | 5 | D | 256 | 16 | 0 |
| Televideo | 5 | D | 256 | 10 | 1 |

The heading "First" in our table stands for first sector number. Please recall that soft-sectored diskettes include the sector number in the sector ID. The KayPro and Hewlett-Packard formats specify that the first sector is numbered 0.

The only hard-sectored format shown is the North Star. Although it's first sector is named 0, this information is not used while formatting. IBM 3740 and System 34 use a skew of 6. Also, the MicroDecision CP/M uses a skew of 3, Osborne single density uses a skew of 2, and Xerox single density uses a skew of 5. The rest of these systems do not use skewing to our knowledge. Remember that skewing is a logical mapping not used while formatting. Skew values are provided here for your information only.

FORMATDJ

The formatdj program was the predecessor to fdj. Since formatdj is actually an ancestor to fdj, you will notice a similarity between fdj's Other menu and the way in which formatdj works. Essentially, formatdj provides you with a list of choices similar to the choices in the Other menu, with the exception of 5 1/4" soft sectored formats. To use formatdj, please make your menu selections based on the information provided in the table above. Thank you.