



Z-100 Floppy Drives

Since the first single side, single density (SSSD), 8" floppy drives were placed in service for the early computers in the late-70s, there have been several advancements developed:

- Sside, Sdensity (SSSD), 48tpi 5.25"
- Dside, Ddensity (DSDD), 48tpi 5.25"
- Dside, Hdensity (DSHD), 96tpi 5.25"
- Dside, Ddensity (DSDD), 67tpi 3.5"
- Dside, Hdensity (DSHD), 135tpi 3.5"
- 2" microfloppy

and others, including optical drives. This article will concentrate on the most popular floppy drives used in the Z-100 computer series.

Note: For easier reading and simplicity, I'm going to refer to the drives and disks as 8", 5" and 3", omitting the decimals. I'm also going to refer to the Z-DOS operating system and monitor ROM (ZROM) versions as v2, v3, and v4, again dropping the decimal intermediate versions.

While the first floppy drives found within the Z-100 were the 5", 48tpi, single side, single density (SSSD), full height drives, within a short period, the most popular configuration of drives marketed in the Z-100 was a pair of double side, double density (DSDD) half height 5" drives or a single DSDD half height 5" drive with a "Winchester" 10Mb hard drive.

The 50-pin connector on the Z-207 Floppy Controller could also accommodate an external 8" drive.

The standard Z-100 Floppy Disk Controller could use up to four single or double density drives on the 34-pin connector and another four high density drives on the 50-pin connector. The Z-100 series computer could also use two floppy controllers, for up to 16 floppy drives!

However, the software of the period, Z-DOS and CP/M could only accommodate a limited number of drives at a time. As a default, the drive letters, A: and B: were assigned to the standard 5" floppy drives. The drive letters, C: and D: were assigned to the 8" variety of drives on the 50-pin connector. And the drive letters, E: through H: were assigned to any hard drive partitions, if installed.

In order to use other drives, the drive letters would have to be reassigned, using the ASSIGN command.

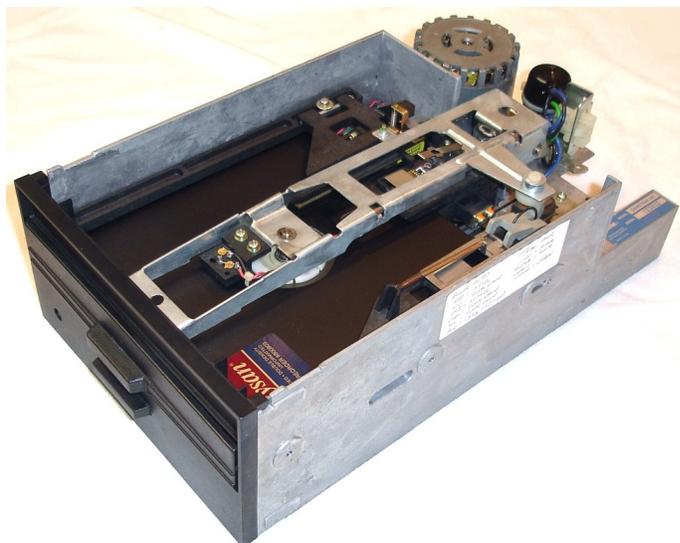
Note: With Z-DOS v4, the drive letters A:

through Z: could be assigned as desired through the DRIVECFG utility.

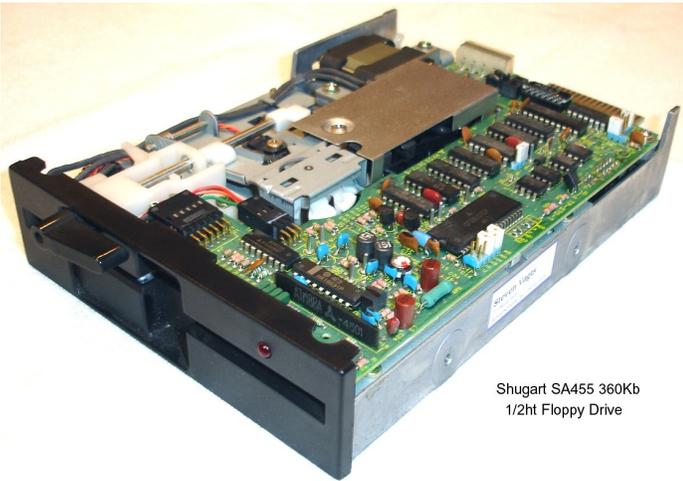
All in all, the Z-100 series computer was very flexible when it came to the use of floppy disk drives.

Note: In 1989 William E. Flanagan developed DiskPack, a Floppy Disk Device Driver for the Z-100 computer that changed everything. It was a software package, marketed by Paul Herman, which allowed the use of all popular 8", 5", and 3" floppy disk formats, including many strange formats used by other computer systems, and PC-compatible formats. Email "Z-100 LifeLine" for additional information.

Drive Types



8" drives were 48tpi (tracks per inch), had 77 cylinders or 77 tracks per side and could be single or double side, single (FM) density or double (MFM) density, and had to be connected to the 50-pin drive interface on the Z-207 Floppy Disk Controller Card. Single density could use a transfer rate of 250 Kbits per second and provided an unformatted capacity of 800 Kbytes. Double density must use 500 Kbits per second and provided an unformatted capacity of 1600 Kbytes. The huge drives ran at 360 RPM.



Shugart SA455 360Kb
1/2ht Floppy Drive



Sony MFD-17W-24
3.5\"/>

5" drives could be 48tpi or 96tpi, double side, and double or high density and ran at 300 RPM or 360 RPM. Single side drives could be used, but the BIOS assumes that all floppy drives are double side and would give an error unless special software was used (such as DiskPack).

Regarding the use of 48tpi or 96tpi floppy drives, the BIOS read a DIP (Dual Inline Pin) switch on the Z-207 Floppy Controller card to indicate 48tpi or 96tpi operation on the 34-pin connector. You could not mix these drives, except with special software, such as:

- DiskPack (mentioned above) is capable of assigning which drives are 48tpi and which are 96tpi.
- Z-DOS v4 has DRIVECFG which can define drive specifications, such as 48tpi or 96tpi.

There is one other element that is often neglected. One must also consider transfer rate, that is 250 or 500 kilobits per second offered by the 34-pin connector and 50-pin connector respectively.

On the 34-pin connector (250kbps), the 96tpi 300 RPM drive will provide 720Kb of storage. Any attempt at using a 96tpi, 360 RPM drive fails with lots of read/write/seek errors!

On the 50-pin connector (500kbps), the 96tpi, 360 RPM drive will provide 1.2Mb of storage.

Note: I believe the newer, dual density (two speed) 96tpi drives can only be set to one speed and must be used on whichever connector is appropriate for the drive speed to be set.

Under Z-DOS v4.x, life on the 34-pin connector has changed dramatically. However, it does require modification to the Z-207 Floppy Controller (See the Barfield Z-207 modification described on the "Z-100 LifeLine" Website). Z-DOS v4.x uses the DRIVECFG utility to allow those newer 96tpi drives with dual density capability to be used on the 34-pin Z-207 connector.

3" drives require special software, either DiskPack or Z-DOS v4, and hardware modifications to be used. Either software route supports the standard 67tpi or 135tpi, 8 or 9 sectors/track, 80 track, single or double side, double density (720Kb) or high density (1.44Mb) capacity drives. These drives spin at 300 RPM.

A Floppy Drive Primer

As I already mentioned, floppy disk drives came in varying sizes, but most common were 8", 5" and 3", in that chronological order. In order to understand the differences between these drive types and storage capacities, some knowledge of the hardware is necessary. Please refer to the article, "A Floppy Drive Primer", originally published in issue #76 of the "Z-100 LifeLine" to review this information. This was an updated article based upon the topic "A Primer on Floppy Disk Technology" written by William E. Flanagan and published in his DiskPack Manual (C)1989.

To summarize the article, here are a few thoughts to consider:

- Never try to use double density 5" media in high density drives or high density 5" media in double density drives. Always use the correct media for the drive in use.
- Since it is so difficult to tell the different 5" media apart, to eliminate the possibility of accidentally over-writing data on the wrong media, stick with either all 48tpi drives or all 96tpi drives. Do not mix 48tpi and 96tpi drives.
- The File Allocation Table (FAT) is created by the FORMAT utility and is written to the disk twice in the standard DOS format. Only one table is actually required. The other table is presumably a backup copy which is maintained in case the first table becomes corrupt. It is questionable if DOS ever actually consults this second table in the event of a corrupt original FAT table, but nevertheless it remains a DOS requirement to have both copies.

- Contiguous files can be read faster. So, beginning with Microsoft's MS-DOS v6 for the PC or Z-100 LifeLine's Z-DOS v4, attempts are made to store files in contiguous memory on storage media. Only if a large enough hole cannot be found, does the storage revert back to the original method of cluster allocation - storing files in pieces.

Hardware Installation

The Z-207 Floppy Disk Controller Card has two interface connectors used to attach floppy disk drives. The 34-pin interface connector is used to connect disk drives with an MFM recording mode transfer rate of 250 kilobits per second. The 50-pin interface connector is used to connect disk drives with an MFM recording mode transfer rate of 500 kilobits per second.

This controller will support up to four disks through each interface.

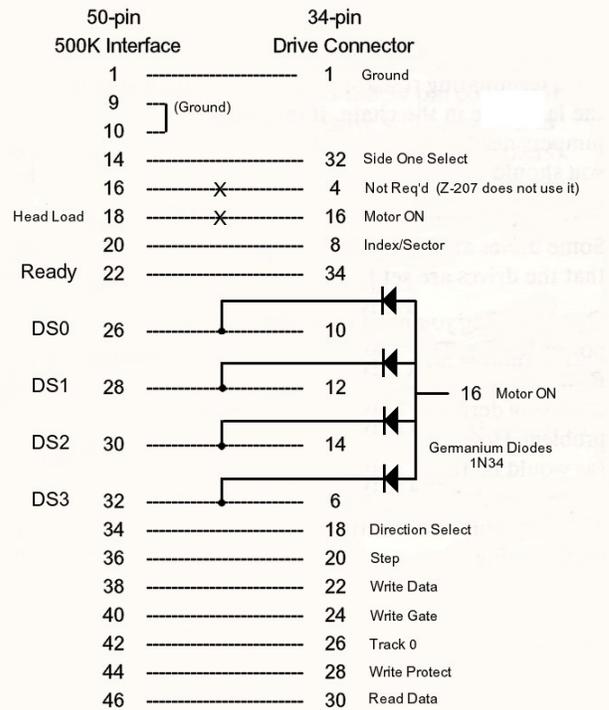
Cabling

The cabling required to connect drives to the controller is straight through ribbon cable if you are taking a 34-pin to 34-pin or 50-pin to 50-pin connector.

However, if you are connecting a drive with a 34-pin drive connector, such as a high density 5", 96tpi drive, to the 50-pin connector on the Z-207 Floppy Controller card, a modified cable will be required (See Figure 1).

Note: Many drives (especially older ones) are jumper configurable to turn the Motor ON when the drive is selected. If you have one of these drives, you are in good shape. But most newer drives do not have this option, and MUST have a Motor ON signal. Experimenting with different combinations of drives, Paul Herman had also found that the Head Load signal (from pin 18 on the 50-pin connector) may not be active at all times in the Z-100 environment. However, I found that the Head Load signal only seemed to fail during the DIAG Disk-Based Floppy Diagnostics Tests during the rotational speed test and subsequent tests. I suspect it is a bug in DIAG, which was programmed for use with 8" drives.

Figure 1. also shows germanium diodes that can be used to improvise a Motor ON signal to the floppy drive, if needed. With the diodes, the motor will come ON when the drive is selected. If there are no plans to use DS2 or DS3, the diodes can be omitted for those pins. Using diodes, instead of just jumpering it, keeps the drive selects for other drives from being shorted together.



All odd number pins on both connectors are assumed to be ground. Other pins not shown are no-connection.

Figure 1.

Note: Some drives do not provide a READY signal on pin 34 of the drive, as required for use on the 50-pin connector. If your drive has a jumper to select DISK CHANGE or READY on pin 34, put it in the READY position. If your drive does not have this option, the solution is to use a 1N34 diode (similar to the diode arrangement shown above) to jump from pin 34 to the drive select line. Again, make sure the banded end of the diode faces the drive select line. Doing this will force a READY status whenever the drive is selected.

Note: The use of 3" drives would require the DiskPack Driver software package or Z-DOS v4, using the modified cable shown in Figure 1. But, no cable modification is required under Z-DOS v4 **if** you use the Z-207's 34-pin connector **AND** a modification is made to the Z-207 Floppy Disk Controller. Please refer to the article, "Z-207 Floppy Controller Mods", originally published in issue #76 of the "Z-100 LifeLine", for specific information.

Terminating Resistor

Disk drives connected to the controller on the same interface are said to be daisy chained together. That is, the cable comes off the controller and connects to the first drive, then on to the next drive, until all drives (up to four) are connected to the controller.

The **last** physical drive in the chain must have a terminating resistor installed. All other drives must have the terminating resistor removed.

The termination method varies among manufacturers. Some will use a terminating resistor pack which will need to be removed from all but the last drive in the chain. Others use a jumper block. If the drive uses a jumper block, all the jumpers need to be removed to remove the terminating resistance.

Caution: One last thing to consider is the power source of this last drive. The last drive will have the termination resistor and needs to be ON in order for the string to be properly terminated. If all drives in the string derive their power from the same source (i.e., internal or external), then there is no problem. However, if the drives are split between separate power sources (such as the last drive in an external case), then the string will not be properly terminated when the last drive is OFF. This may cause intermittent I/O failures due to no terminator being found on the string.

I have had good luck routing the cable from the controller to the back panel (for attaching any external drives), then continuing to the internal drives, with the last internal drive having the terminating resistor. If you have issues, try terminating the last external drive also.

Later drives, especially the 3.5" drives, have internal circuitry that eliminate the need for terminating resistors, and you may not find a terminating resistor pack to remove. If you experience a problem, either move that drive to last, or move it up the chain and make a drive with a resistor pack last.

Drive Select Address

Each disk drive must have a unique address, and most floppy disk drives have a method of setting the disk drive address. The drive address may be 0 to 3 or 1 to 4, depending on whether they set the address relative to 0 or 1. The Z-207 controller documentation specifies drive addresses relative to 0. The method used to set the drive select (DS) address will vary by manufacturer. Some use jumper blocks, while others may use an address block strapping chip or DIP switch.

Note: The popular IBM PC and clones dominated the market in the late 80's and, to reduce costs, used a twisted cable to eliminate the need to use jumpers for drive select. All drives manufactured for the PC-clones were drive select 1 and a twist in the cable would switch the drive select lines for the second drive. If you find a drive that appears to have no drive select capability, try it out using the command DIR A: or DIR B: to figure out which it is.

Motor ON

The Motor ON with Drive Select Jumper (MS) causes the drive motor to be turned ON when the drive is selected. Seen mostly on 8" drives, newer drives may do this automatically.

Ready or Disk Change

In addition to the elimination of drive select jumpers, drive manufacturers also eliminated jumpers that used to select READY or Disk Change signals. These signals were critical with 8" drives, less so with 5" drives, and were eliminated on most 3" drives.

However, while Zenith liked to use the READY (may be shown as RDY or RY) signal, the IBM PC and clones liked to use the Disk Change (DC) signal to tell the computer if a disk in the system had been changed and the directory had to be updated. Newer drives were set to use the PC's Disk Change signal by default.

The Z-207 Floppy Controller Card only uses the READY Signal on the 50-pin connector. When the Ready line is at logical "1" (not Ready), the door is open or the diskette is not inserted in the drive. A logical "0" (Ready) only occurs when all of the following has been completed:

- The diskette is inserted in the drive
- The door is closed
- DC power is ON
- The index hole is correctly detected
- The index is detected two or more times

The 34-pin connector does not use a READY Signal, and in the Z-100 pin 34 (READY) is actually not connected, relying on other means to detect a disk is ready.

In order to attach a high density 5" drive (96tpi, 360 RPM) to the 50-pin connector, there must be a READY signal indicating when the drive is Ready. This signal can be generated by most drives on pin 34 of the 34-pin connector. This pin is then mapped to the READY line (pin 22) of the 50-pin connector.

If the drive does not have a "Ready" jumper, you still have a couple of options. The best way to handle the situation is by using a diode to synthesize a READY signal. This is done by connecting a germanium 1N34 from the drive select pin to pin 34, with the banded end toward the drive select. This causes pin 34 to be driven low (active) whenever the drive is selected.

I had an ALPS 5" 96tpi 360 RPM floppy drive that was built specifically for the IBM-PC. The only jumpers found were the DS0-DS3 jumpers. I had to cut the trace where the Disk Change signal was coming from pin 3 of IC1 on the drive's controller board and rigged a diode from pin 34 to the Drive Select jumper so that wherever I placed the jumper, it would still provide a Ready signal to pin 34. It worked well, but the drive had other issues, and was discarded.

This solution may not work reliably with all drives. Since the READY signal is generated at the same time the motor is turned ON (when the drive is selected), the drive obviously cannot be ready yet. Fortunately, this is not an issue if you are using the drive under DiskPack control, since DiskPack looks for a moving index hole to determine whether the disk is ready.

Density/Speed Select

Found only in dual density drives, this is usually a suite of several jumpers which tell the drive how to determine if the desired format is double density or high density. Dual density 5" drives will also have a jumper to tell the drive which speed (300 or 360 RPM) to use. The letter designations and exact functions of these jumpers vary considerably between manufacturers.

Usually the drive can be jumpered to determine density and speed from the level of pin 2 on the 34-pin cable. 3" drives may also allow density selection based on the media which is inserted.

In the Z-100, pin 2 on the 34-pin connector is not connected at the controller end. Using a dual density drive for both densities will require that the controller be modified so that a density select signal appears at pin 2 (the Barfield modification mentioned earlier). If the drive will be used for only one density, you should tie pin 2 to ground at the controller, although usually the no connection status will be interpreted by the drive as a low signal anyway. Once the pin 2 status has been determined, the drive may be configured to select densities based on that status.

Floppy Drive Operation

By now everyone probably understands 5" and 8" Floppy Drive operation on the Z-100 series computer. However, the use of 96tpi drives tends to cause a lot of confusion as it was handled almost as an afterthought by Zenith Data Systems (ZDS). Additional changes as we went from ZROM v2 to ZROM v3 and finally to ZROM v4 complicated the issues.

Let me see if I can help.

To begin, let's assume operation under ZROM v2. The three primary versions were versions 2.5 (most popular), 2.8 and 2.9. The last two had very minor changes that had no impact that I could find in normal operation of the Z-100.

Standard 5", 48tpi, 40 track, 300 RPM, 360Kb drives were the default drives shipped in the Z-100. However, along came 5", 96tpi, 80 track, 300 RPM, 720Kb drives and people wanted the higher capacity, so ZDS accommodated. But the high density drives were not "plug and play", by today's standards. Changes to hardware needed to be made so that they could be recognized and used properly.

Note: I highlighted the 300 RPM drive to stress that it is **not** the next generation and more common 360 RPM, 1.2Mb drive.

The primary change was simple - To use 96tpi drives, just change section 0 of the DS1 DIP (Dual Inline Pin) switches on the Z-207 Floppy Controller Card to a 1 (ON) position. The default of section 0 was a zero (OFF), to use the standard 48tpi drives.

However, the only change made in the Disk-based Diagnostics Program, DIAG, was for you to change the entry for each 96tpi floppy drive from 48tpi to 96tpi. In my testing, I could find no change made for the difference in RPM, and indeed, the user receives an Disk Rotation Error from DIAG if you try a 360 RPM drive.

NOTE: Further testing confirmed that DIAG was only intended for 300 RPM, 96tpi drives, which provide 729Kb of storage capacity. The use of 360 RPM, 96tpi, 1.5Mb drives on the 34-pin connector will cause numerous data and seek errors. These drives MUST be attached to the 50-pin connector to make use of the higher transfer rate.

Dual density drives also presented a problem, but as I want to keep this article as short as possible, with minimal confusion, let me refer you to another article from the past, "Teac FD-505 Dual Density Drive", also from "Z-100 LifeLine", issue #76.

Write Precompensation

Write Precompensation is used to adjust the write signal to accommodate the lower density of data on the larger size, outer cylinders of a media.

According to the Z-100 Hardware Manual, section 1 of the DS1 DIP switches on the Z-207 Card was also intended to be used to adjust the necessary Precompensation needed for various drive types:

- If section 1 was set zero (0=ON), Precomp was set for tracks 23-40 on 5" 40 track media, and Precomp was set for ALL tracks on 8" Double Density (DDEN) media.
- If section 1 was set 1 (1=OFF), Precomp was OFF for 5" 40 track media, and Precomp was only used on tracks 44-76 on 8" DDEN Density media.

However, section 1 of the DIP switch was NOT used by any standard Heath or Zenith Operating Systems on 48tpi media.

Write Precompensation was Operating System (BIOS) controlled as follows:

On the 34-pin Connector:

- 48tpi DDEN media has Write Precomp used on tracks >22 via software (IO.SYS).
- 96/135tpi DDEN media has Write Precomp used on tracks >43 via Z-207 hardware.

On the 50-pin Connector:

- 96/135tpi DDEN media has Write Precomp used on tracks >43 via Z-207 hardware.

Note: Not presently used (left open): If a jumper is installed at J0 on the Z-207 Controller, 96/135tpi drives on the 34-pin connector will have NO precompensation applied, but it could be placed under software control, using the DIP switch.

Note: Write Precompensation is automatically disabled for all single density media. There was also no means to mix 48 and 96tpi drives under ZROM v2.

Mixing 48/96tpi Drives

ZROM v3 and Z-DOS v4 tried to accommodate the mixing of 48 and 96tpi drives by using the DS1 DIP switches on the Z-207 Floppy Controller Card and this operated well, except when using the older operating systems.

Sections 0 and 1 were set for the number of high density drives attached as follows:

<u>Sec1</u>	<u>Sec0</u>	<u>Drive Types Connected:</u>
0 (ON)	0 (ON)	4-std 48tpi, 360Kb drives (DS0-DS3)
0 (ON)	1 (OFF)	1-96tpi (DS0), 3-48tpi (DS1-DS3)
1 (OFF)	0 (ON)	2-96tpi (DS0,DS1), 2-48tpi (DS2,DS3)
1 (OFF)	1 (OFF)	3-96tpi (DS0-DS2), 1-48tpi (DS3)

Z-DOS v4 also introduced us to an entirely new method, using a DRIVECFG utility, to define the types of drives attached.

Note: Use of ZROM v3 is no longer supported, nor recommended. Please contact the "Z-100 LifeLine" staff (me) for an upgrade to ZROM v4.

Note: With ZROM v4, the DS1 switch setting also reverted back to those originally defined to alleviate any difficulties with the older operating systems.

With ZROM v4 and Z-DOS v4, the Z-100's drive flexibility improved dramatically. Let's see if I can map this all out for you.

The DRIVECFG Utility

The DRIVECFG Utility was introduced to us way back in 1994 and was fully discussed in issue #34 of the "Z-100 LifeLine".

As we are only interested in Floppy Drives in this issue, we will only discuss our options of floppy drives that we can use and configure. Also, as we are only using a few drives, I'll limit the normal DRIVECFG screen to show the left side to fit better in this column format.

After booting to Z-DOS v4, if you type DRIVECFG you should see something similar to:

<u>DRIVE</u>	<u>TYPE</u>	<u>PIN</u>	<u>CARD</u>	<u>UNIT</u>
A: LowDen.	48tpi 5 1/4"	34	Z207p	0
B: LowDen.	48tpi 5 1/4"	34	Z207p	1
C: LowDen.	48tpi 5 1/4"	34	Z207p	2
D: LowDen.	48tpi 5 1/4"	34	Z207p	3
E: LowDen.	48tpi 5 1/4"	34	Z207s	0
F: LowDen.	48tpi 5 1/4"	34	Z207s	1
G: LowDen.	48tpi 5 1/4"	34	Z207s	2
H: LowDen.	48tpi 5 1/4"	34	Z207s	3
I: EEPROM Device	on the SCSI Board			
J: Fixed Disk Partition	Z217p			
K: Fixed Disk Partition	Z217s			
L: Imaginary Drive	mapped to A:			
M: **Next available Drive to Assign**				
<u>MTR ROM v4.3 768K RAM 64K COLOR Video</u>				

As shipped, the configuration was used as an example to show the various data devices and attributes that are at your control. The first eight drives listed are low density, 48tpi, 5" drives, four on the primary Z-207 controller and four on a secondary Z-207 controller. The as-shipped default is now slightly different from this 1994 version, but you get the point.

Next, the EEPROM/SCSI device is shown as drive I:. The hard drive is configured as drives J: and K:, which explains why our hard drive is currently assigned as the J: drive. Drive L: is an imaginary drive mapped to drive A:.

Using the cursor keys to move a highlighted bar or by typing the drive letter directly, you can change any drive letter to any physical or imaginary drive, demonstrating just how powerful and flexible this program is.

The first step is to eliminate any drives that are either not presently installed, or to be installed in the future. If you are planning to install certain drives in the future, you can elect to reserve the desired drive letters by configuring that drive now. It does not need to be physically present.

Select any drive letter you wish to eliminate. For example, I wanted to delete the configuration for drive E:; therefore, I pressed {E}. This added a new window, listing our options, to the present display:

- (F0) Imaginary Drive
- (F1) LD 48tpi 5" 34Pin
- (F2) LD 96tpi 5" 34Pin
- (F3) LD 135tpi 3" 34Pin
- (F4) HD 135tpi 3" 34Pin
- (F5) DD 96tpi 5" 34Pin
- (F6) DD 135tpi 3" 34Pin
- (F7) HD 135tpi 3" 50Pin
- (F8) HD 96tpi 5" 50Pin
- (F9) DD 135tpi 8" 50Pin
- (F10) Fixed Disk Partition
- (F11) EPROM SCSI Device
- (F12) Z205 Memory Disk
- (DELETE) Unassign Drive

Pressing the {DELETE} key deletes that drive and replaces that drive's definition with the phrase "Unassigned Drive". Do the same to any other drives that you will not be using.

I like the default partition of the hard drive to be drive E: on all my computers. To make it so, press {E} and again the new window appears. Press {F10} and (F10) is highlighted. On line 25, the display shows:

Select (P)rimary or (S)econdary Controller Card
[CR = Primary]...

Note: The secondary controller card is another Z-217 controller card installed in the card cage and configured to control another physical hard drive. However, the Z-217 Controller has no easy means to select an address for a second card and would require a hardware modification! Unless you have a second card installed, press {P} or {RETURN} to select the primary controller.

You are now returned to the original screen with drive E: now showing:

```
"Fixed Disk Partition      Z-217p"
```

As a further example of this program's power, back in 1994 I had wanted to use the high density drives that I had been using on another Z-100 using Paul Herman's "DiskPack" and the 50-pin connector on the Z-207 controller board.

I made the changes to a second Z-207 Floppy Controller board according to the instructions that came with MS-DOS v4.01. Though not required, I wanted to use a separate cable and controller board for these high density drives because I was still using the drives on another computer that required a separate cable to the 50-pin connector on the Z-207 board.

But with the changes to the Z-207 board, this was no longer necessary! You can now use the same 34-conductor cable for both your high and low density drives, up to a total of four drives on one board!

Note: For those wishing to use a second, separate Z-207 controller, the second board needs to have a separate address. If you look at the Z-207 Floppy Controller Board, Dip Switch 1 (DS1) is normally configured as "B0", with sections 7, 5, and 4 in the UP position. The others are all in the "ON" or DOWN position. The secondary board's address needs to be "B1", where Dip Switch 1 (DS1) has sections 7, 5, 4, and 3 in the UP position. The others remain in the "ON" or DOWN position.

Returning to our DRIVECFG screen, if you want to configure a drive letter as a 48tpi drive, by selecting {F1} , you will be asked on line 25:

```
Select (P)rimary or (S)econdary Controller Card  
[CR = Primary]...
```

And when that selection is made, then:

```
Select Unit (0-3) [CR = 0]...
```

After you select the unit number, another window is displayed, this time to the left side, that shows the choice of Step Rates:

```
48 tpi STEP RATES  
(0) - 6 clock tics delay  
(1) - 12 clock tics delay  
(2) - 20 clock tics delay  
(3) - 30 clock tics delay
```

If you had selected {F5} for a Dual Density (DD) 96tpi drive, you get a window similar to the last, but entitled "Fast Step Rates", and giving a choice of 3, 6, 10, or 15 clock tics delay.

Just pressing {RETURN} selects the fastest setting.

The next question on line 25 is:

```
Drive require additional Wait on head load  
[CR = NO]?
```

This question is asked because a motor ON signal does not exist on the 50-pin connector. Also, most drives have a jumper to enable the motor ON signal to be provided from the controller via the MM jumper or from the drive select signal via the DS jumper. In the MM position, a 10 second delay is automatically provided by the controller to allow the drive to spin an additional 10 seconds. In the DS position, the BIOS must provide this delay. The default is NO. Press {RETURN}.

The next question on line 25 is:

```
Does Drive require Double Restore [CR = NO]?
```

Double Restore again comes from the older 8" drives. According to John Beyers, my Guru for all these matters, the 8" drives occasionally needed to do a restore by seeking out track 0, stepping in a few tracks, then back to track 0. It is only needed for 8" drives, so the default answer is No.

Answering and pressing {RETURN} clears up the screen and brings us back to the first screen and the next Unassigned Drive is highlighted.

If we had selected {F5}, {F6}, or {F9} in our example regarding dual density drives, one additional question is posed on line 25:

```
Drive jumpered for 360 RPM in low density mode  
[CR = No]?
```

This question was the result of attempting to support various combinations of data transfer rates and disk rotation rates to best match the PC world, which supported 250K, 300K, and 500K transfer rates. Only 250K and 500K are available on ours. Anyone using a dual density drive must select the proper jumper arrangement to have the drive do 300 RPM in low density and 360 RPM for high density. Just press {RETURN} for No.

Floppy Drives Supported

Let us address each of the drives supported in BIOS v4:

(F1) LD 48tpi 5" 34Pin

This is our standard low density, 5", 40 track (48tpi), 300 RPM, 360Kb drive. It is bootable and must use the 34-pin connector. Set section 0 of DS1 on the Z-207 Floppy Controller DOWN to 0. If the drive is the only drive (or last in a chain), install the terminating resistor. Set the Drive Select as appropriate.

(F2) LD 96tpi 5" 34Pin

This is our low density, 5", 80 track (96tpi), 300 RPM, 720Kb drive. It is bootable and must use the 34-pin connector. Under ZDOS v4, section 0 of DS1 on the Z-207 Floppy Controller is not used, but for other operating systems, set it to 1 (UP). If the drive is the only drive (or last in a chain), install the terminating resistor. Set the Drive Select as appropriate.

(F3) LD 135tpi 3" 34Pin

This is our low density, 3", 80 track (67tpi), 300 RPM, 720Kb drive. It is bootable and must use the 34-pin connector. Set section 0 of DS1 on the Z-207 Floppy Controller DOWN to 0. While the drive is bootable, it cannot be the only drive. Drive A: or B: must be a standard 40 track drive to maintain boot capability with an older Operating System. This drive is NOT usable by any other OS. The Z-207 Floppy Controller Card MUST BE modified - the Barfield Mod is recommended. If the 3" drive is the last drive, install the terminating resistor if it is capable (most do not have one). Set the Drive Select as appropriate.

(F4) HD 135tpi 3" 34Pin

This is our high density, 3", 80 track (135tpi), 300 RPM, 1.4Mb drive. It is bootable and must use the 34-pin connector. Set section 0 of DS1 on the Z-207 Floppy Controller DOWN to 0. While the drive is bootable, it cannot be the only drive. Drive A: or B: must be a standard 40 track drive to maintain boot capability with an older Operating System. This drive is NOT usable by any other OS. The Z-207 Floppy Controller Card MUST BE modified - the Barfield Mod is recommended. If the 3" drive is the last drive, install the terminating resistor if it is capable (most do not have one). Set the Drive Select as appropriate.

(F5) DD 96tpi 5" 34Pin

This is our dual density, 5", 80 track (96tpi), 300/360 RPM, 720Kb/1.2Mb drive. It is bootable. Under ZDOS v4, section 0 of DS1 on the Z-207 Floppy Controller is not used, but for other operating systems, set it to 1 (UP). If the drive is the only drive (or last in a chain), install the terminating resistor. Set the Drive Select as appropriate.

(F6) DD 135tpi 3" 34Pin

This is our dual density, 3", 80 track (67/135tpi), 300 RPM, 720Kb/1.4Mb drive. It is bootable and must use the 34-pin connector. While the drive is bootable, it cannot be the only drive. Drive A: or B: must be a standard 40 track drive to maintain boot capability with an older Operating System. This drive is NOT usable by any other OS. The Z-207 Floppy Controller Card MUST BE modified - the Barfield Mod is recommended. If the 3" drive is the last drive, install the terminating resistor if it is capable (most do not have one). Set the Drive Select as appropriate.

(F7) HD 135tpi 3" 50Pin

This is our high density, 3", 80 track (135tpi), 300 RPM, 1.4Mb drive. It is bootable and must use the 50-pin connector. Drive C: or D: must be a standard 8" drive to maintain boot capability with an older Operating System or use a standard 40 track drive as A: or B: on the 34-pin connector. The Z-207 Floppy Controller Card does NOT require modification. If the 3" drive is the last drive, install the terminating resistor if

it is capable (most do not have one). Set the Drive Select as appropriate.

(F8) HD 96tpi 5" 50Pin

This is our high density, 5", 80 track (96tpi), 360 RPM, 1.2Mb drive. It is bootable and must use the 50-pin connector. If the drive is only drive (or last in a chain), install the terminating resistor. Set the Drive Select as appropriate.

(F9) DD 135tpi 8" 50Pin

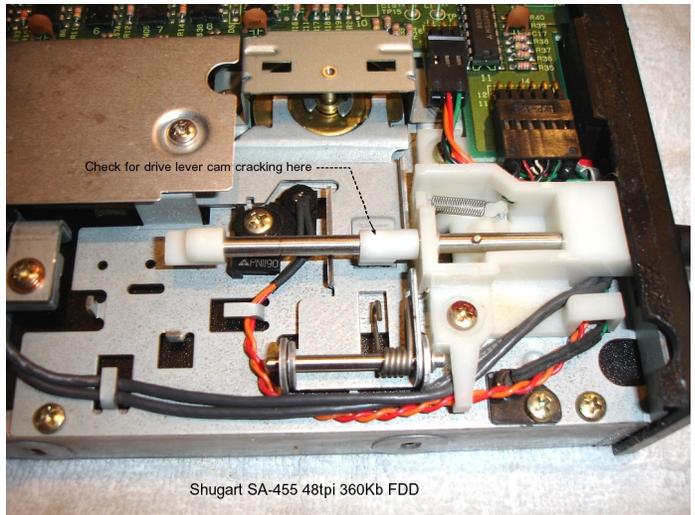
This is our dual density, 8", 77 track (96tpi), 360 RPM, 0.6Mb/1.2Mb drive. It is bootable and must use the 50-pin connector. If the drive is only drive (or last in a chain), install the terminating resistor. Set the Drive Select as appropriate.

Floppy Drive Testing Notes

As a mature floppy drive system before the Z-100 came out, 8" drives were easy to connect and had all the jumpers ever thought necessary to work with anything. So I did not mess with them for this article. Just remember that they must only be used on the 50-pin connector.

The low density, 5", 300 RPM, 48tpi drives all worked as advertised and I found no special difficulties in getting them to work. The most popular drives found were the Shugart SA455 series and its close cousin, the Matsushita JA-551 (they look identical). One issue common to both is a crack developing in the cam of the disk handle.

Inspect these drives whenever you have them out and before reinstallation. They may need to be replaced.



Before going further, let me explain my testing setup...

I use the Zenith DIAG disk-based diagnostics for all my testing, but DIAG must be configured for the drives to be installed in order to test them properly. Remember also that each controller can use up to 4 drives on each connector, drive units 0-3 on the 34-pin, then drive units 4-7 on the 50-pin.

You may recall, the configuration menu of DIAG will list the floppy drives configured as:

```
Controller 0
Drive  Type
0(A)   5 1/4", DS, DD, 48tpi
1(B)   5 1/4", DS, DD, 96tpi
2(E)   Not Configured
3(F)   Not Configured
4(C)   8", DS, DD, 48tpi
5(D)   Not Configured
6(G)   Not Configured
7(H)   Not Configured
```

Therefore, for my testing, I selected Controller 0 and drive unit 1(B) to test my 5", 96tpi, 300 RPM drives. When you select the drive unit and respond NO to "Configuration correct?", you can only set the number of sides (2) and the Tracks/Inch (96).

Similarly, to configure the drives on the 50-pin connector, you must select the first 8" drive, which is drive unit 4(C). And when you select the drive unit and respond NO to "Configuration correct?", you can only set the number of sides (2). The Tracks/Inch defaults to 48.

Of interest to us, DIAG actually works with the 5", 96tpi, 360 RPM drive on the 50-pin connector configured as an 8" drive!

I started with the high density, 5", 360 RPM, 96tpi drives configured to work on the 34-pin connector, but all failed to work! It seems that I had forgotten to note the difference in the standard 5", 96tpi drives that operated at 300 RPM (720Kb), and the high density 96tpi drives that operated at 360 RPM (1.2Mb)! These high density drives required a 500 kilobits/second transfer rate (50-pin connector).

On the 34-pin connector (250k transfer rate), I always got a Rotational Speed Error, and had huge numbers of data, read and write, and seek errors during DIAG and while FORMAT appeared to work, it would fail during Verify.

So I rigged up both versions of the 50-pin to 34-pin adaptor cable shown above (one with and one without diodes) and tried again.

In general, the cable with the diodes did better on all drives that I tried. However, the cable using Head Load to provide the Motor ON signal worked for everything except the DIAG tests! In every case, DIAG would turn off the Head Load signal just as the Rotational Speed Test reported the RPM, and the drive motor stopped!

There is one drive that I have not mentioned, but feel I should in the remaining space - the combo 3"/5" dual density drive:



The Teac FD-505 drive is a dual density 3.5/5.25" combination drive that is actually two separate drives in one chassis. For a complete description of its capabilities, please refer to another "Z-100 LifeLine" article from the past, "Teac FD-505 Dual Density Drive", in issue #76.

While each drive within should be prepared as shown above for each individual drive, in spite of all my efforts, I could not get the 3" drive to work. As the 3" drive plugs physically into the 5" drive, I scrapped the combination.

I hope this helps clarify the use of Z-100 floppy drives.

Closing

Once more, the Z-100 LifeLine website is at:

**z100lifeline.swvagts.com or
swvagts.com/z100lifeline**

Check out the What's New page. It has access to a new Z-100 Index that includes all three major publications, Z-100 LifeLine, Sextant, and REMark.

Check out the new Website often. I think you will like it.

'Til next time,
STAY SAFE, and
happy computing!

Cheers!!!



Steven

My new Z-100 LifeLine email address is:
z100lifeline@swvagts.com