



Flash Floppy Gotek and the Z-120

By Darrell Pelan

The Flash Floppy Gotek floppy emulator is a versatile solution for your Z-100 storage needs. You can easily emulate several different floppy drives by simply selecting the appropriate disk image. It allowed me to revive my H-89 and Z-120 by easily transferring applications and data from software repositories or stored floppy disks to a disk image for use in a Flash Floppy Gotek. This article discusses modifying the Gotek (as delivered from Amazon) and installing it in your Z-120. Then I'll discuss how to easily move files between computer systems using Disk Image Utility software.

The first step is to setup the Gotek drive with new firmware, add an Organic LED (OLED) screen to replace the seven-segment display, and a new case (or modify the original case). The second step is to use the USB port of a PC or other host computer to configure the Flash Floppy CFG files on a USB flash drive. The final step is to use my Disk Image Utility software to create blank disk images and transfer files. With this setup you can easily create a disk image for your Z-120 on a PC, add the appropriate files to the image, and then use the image on your Z-120.

Flashing the Gotek with Flash Floppy Firmware

Other “Z-100 LifeLine” articles covered the process to transform a Gotek from Amazon into a Flash Floppy Gotek. I’ve used both the serial flash method with HxC software and the USB cable method with the Flash Floppy. The USB method described in these articles is much easier in my opinion. Flash Floppy is also free. The HxC Floppy Emulator is the only choice if you need to support a hard sector disk system like the base H-89. Even then, only disk reads are supported. Once you have the Gotek flashed, you need to decide which physical options to add.

Future firmware updates are easy. Simply place the latest firmware update on a USB flash drive plugged into the USB port of your host computer, then place the USB drive in the Gotek and press both buttons when you power ON the unit. It will automatically update the firmware.

Gotek Case Modifications

I like to make three modifications: an OLED screen, speaker, and optionally a third button for selecting menu options. The OLED screen allows the Flash Floppy to display the name of each disk image file, let you know how many images are on the flash drive, if data is being written, and the track being accessed. The speaker gives you an audible indication the selected track is changing. The third button allows you to select Flash Floppy menu options. Sources for parts discussed in this article are listed at the end of the article in the Appendices.

You can modify the original case to accept the OLED screen by using a nibbler tool or file to enlarge the opening for the three-digit display. You will need to trim the two standoffs inside the lower case with an X-Acto knife to allow the OLED screen to be flush with the front of the case. If you're careful, you can leave 6 mm at the bottom to support the OLED display. I wasn't careful, so I 3D printed a 6 x 30 x 2 mm stand and glued it to the front bottom of the Gotek case. I used Gorilla tape to hold the OLED screen in place while replacing the case top (shown in the next picture).

Inside of modified Gotek case



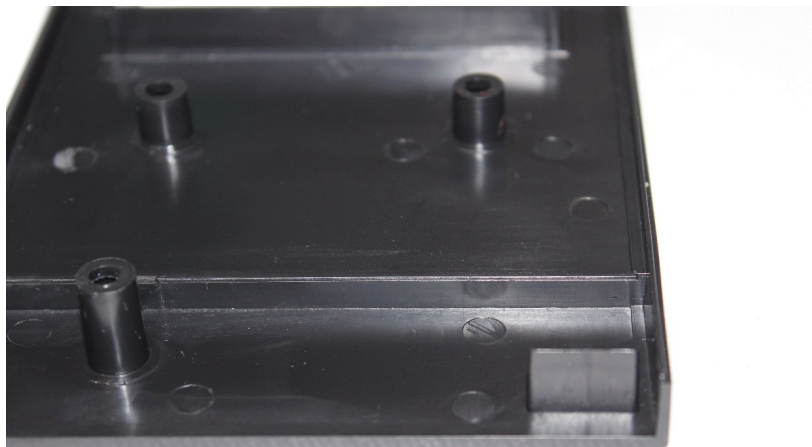
3D spacer under OLED display



I opted to not add the third button to select menu options in the Flash Floppy. My 3D printed mount required super glue. I confirmed my previous experience that super glue and a micro switch are not a good combination. The extra hole on the left was for my failed micro switch attempt.

The top also has a holder for the original 7 segment display that will need to be trimmed to allow for the OLED display (see next picture).

Top of modified Gotek case



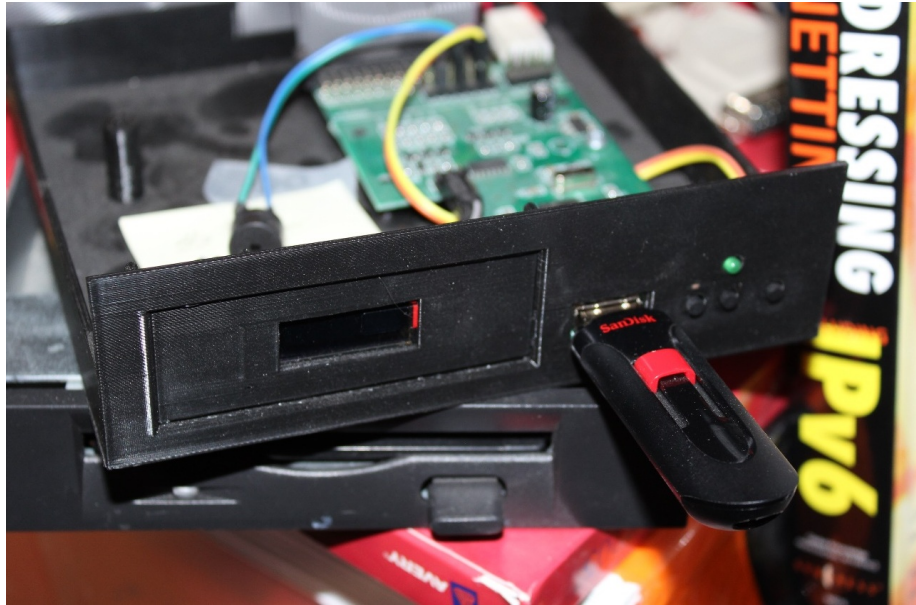
Tab to Trim

Front of modified Gotek case

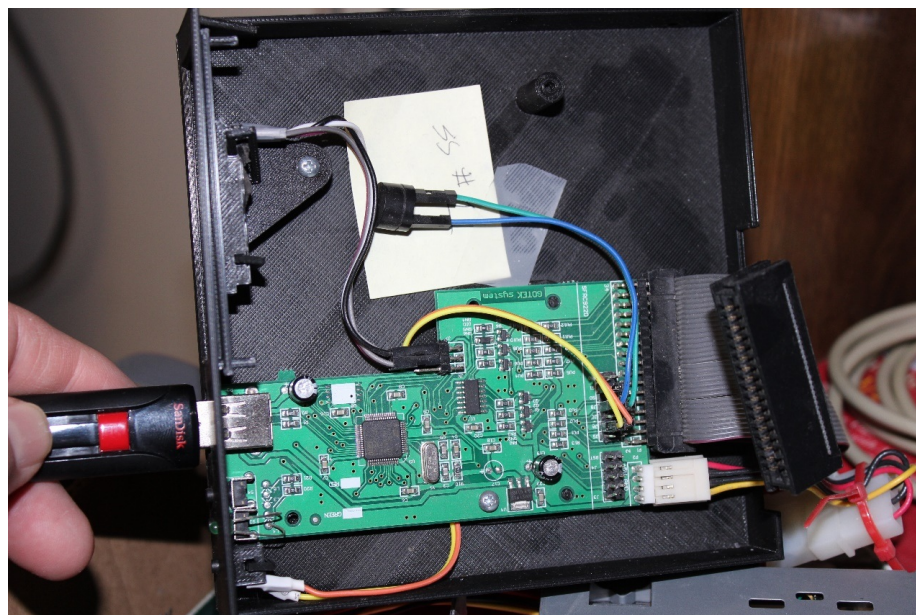


Another option is to use a 3D printed case. My designs for a 5.25" case and a 3.5" case are posted on Tinkercad (links are provided in Appendix B:). The 5.25" case supports both the smaller blue OLED screen and the larger LCD screen. I find the smaller OLED screen to be more readable than the larger LCD screen. Both cases have a mounting location for the third button micro switch. Both designs use a mechanical method to add the additional selection button, so no super glue required.

Front of the 5.25" 3D printed case



Inside of the 5.25" 3D printed case

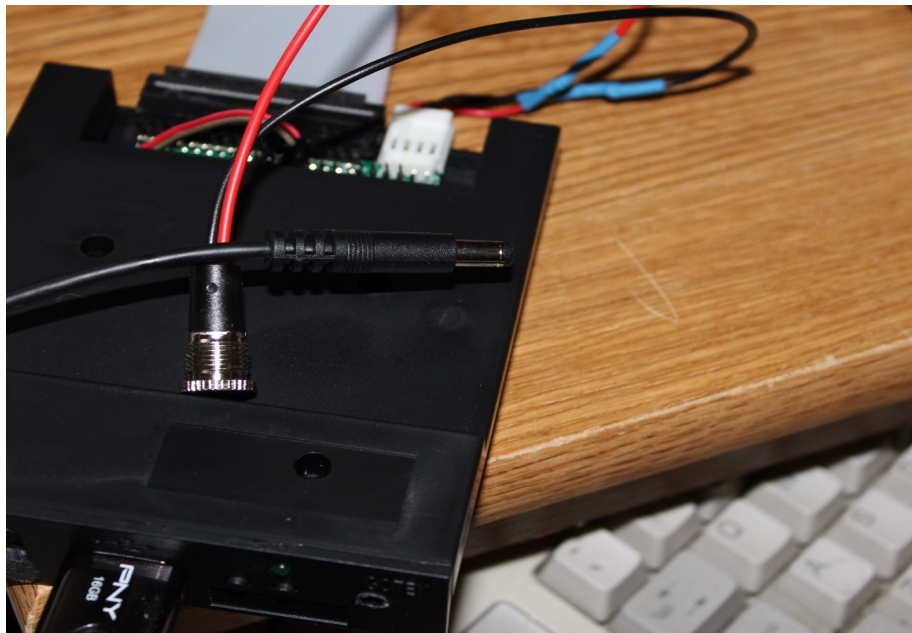


Warning: When connecting the OLED screen, pay attention to the wiring, especially the power and ground. Reversing power and ground will let the magic smoke out of the OLED preceded by a burning smell.

The speaker is connected to jumper JB. I used a small piezo speaker and two female to female breadboard jumper wires. The speaker can be left loose inside the case (see the above picture).

Gotek Power

If you are using the Flash Floppy Gotek externally to your system, you can power it with a USB wall wart as the Gotek only needs 5v (parts are listed in Appendix C:). The picture shows the USB cable unplugged from the Gotek power adaptor for illustration purposes. I soldered a 3.5" floppy drive connector to a barrel adaptor. A USB cable with a barrel plug is connected to this barrel adaptor to power the Gotek.



Installation in Your Z-100

If you use the original Gotek case, you will need a 3.5" to 5.25" adaptor to mount the unit in your computer. The 3D printed 5.25" case mounts like any other floppy disk.

My system is running Zenith's MS-DOS (Z-DOS) version 3, so I either needed to run 48 tpi or 96 tpi floppy drives; not a mix. Since I wanted to keep the original 48 tpi, 360K floppy drive, this DOS only supports a 360k disk image. As mentioned in the earlier articles, you can use Disk Pack or upgrade to Z-DOS version 4 for increased disk capacity.

The Flash Floppy Gotek can be installed in your Z-100 with a straight 34-pin cable, but since the Gotek has a dual row 34-pin connector you will most likely need to modify the existing cable or build a new one. The cable will need two 34-pin IDC female connectors and a 34-pin edge connector for your existing floppy drive. In my case, I removed the middle 34-pin card edge connector and replaced it with a 34-pin IDC female header. If you leave the existing floppy in your system, leave the Gotek jumpered for S1.

USB Drive for File Images

The Flash Floppy Gotek uses a USB flash drive for storage, usually a 16 GB unit with a standard FAT32 format. However, initial preparation of the USB flash drive must be completed while plugged into the USB port of your PC or other host computer. You will need to add two configuration files to the flash drive:

- The first is the system configuration file, FF.CFG, which sets up the Flash Floppy system. This has been discussed at length in the earlier articles. Changing the font size and display timeout in the FF.CFG file is a good idea.
- Flash Floppy uses IMG format files. So the image configuration file, IMG.CFG, tells Flash Floppy how to handle the IMG image file based on size and the file name's specific text. Appendix F: contains an additional explanation on the changes that are necessary for our use.

In my case I end file images for DOS with DOS.IMG and for CP/M disks, I simply end the file name with .IMG. This convention allows support for both DOS and CP/M disks with the same physical size. The one exception is for 320k CP/M disks. The Z-100 uses 8 sectors per track with 512 byte sectors. The H-89 uses 16 sectors per track with 256 byte sectors. For a Z-100 image, simply use the IMG extension. For an H-89 image use H37.IMG. A even simpler solution is to only use the Z-100 format. The H-89 will read either format and the disk size is the same.

Disk Image Utility

The last step is to create disk images to use with your Z-120 with the Disk Image Utility. The Disk Image Utility (DIU) can be downloaded from my website along with documentation (the link is in Appendix D:). DIU runs on Windows PCs. DIU provides complete disk image management with the exception of deleting files from an image. You are able to list the files in each disk image selected, choose which ones to extract, add files to an disk image, and create blank disk images. First, let's discuss disk image formats.

Disk Image Background

If you look on the internet, there are numerous methods and programs for creating and changing disk images. These disk images can then be used to recreate exact copies of the original disks, including system boot disks. My favorite is a set of utilities written by Dave Dunfield. These can be downloaded from Dave's website (link provided in Appendix E:).

Once on the website, download ImageDisk 1.18. The main program for our purposes is IMD.COM. It runs on older PC's when floppy disk controllers were common. My Windows 95 system hits a sweet spot of having an appropriate floppy disk controller and network capability to store the files on my network drive.

An IMD format is created from a physical floppy disk using Dave Dunfield's IMD program on a Windows 95 system in DOS mode. The IMD software depends on a floppy disk controller chip from that era. Using Windows 95 allows me to easily save the IMD images on my network drive so my Windows 10 system can access them. The IMD image lists track and sector information for every track in the image and will tell you the recording format of the original disk. Each sector in the image has a start marker that indicates if the sector is stored byte for byte or compressed into a single byte. For example, a newly formatted image will have many sectors stored as 0x02 0xE5. This requires two bytes in the image instead of 512 plus the marker byte. This format is great for recovering data from floppy disks, but it is not used in the Flash Floppy Gotek. My Disk Image Utility (DIU) will convert this format into an IMG file, which is used in the Flash Floppy Gotek.

An IMG file is a byte for byte copy of each sector on a floppy disk. The file does not contain any information about track or sector size. The target system is expected to know how to deal with the data. The IMG file can be created by converting an IMD file using DIU. DIU also currently creates blank DOS 360k, 720k, and 1,440k images. It will also read DOS 320k images. DIU also supports CP/M images in 100k, 360k, 640k, and 800k sizes.

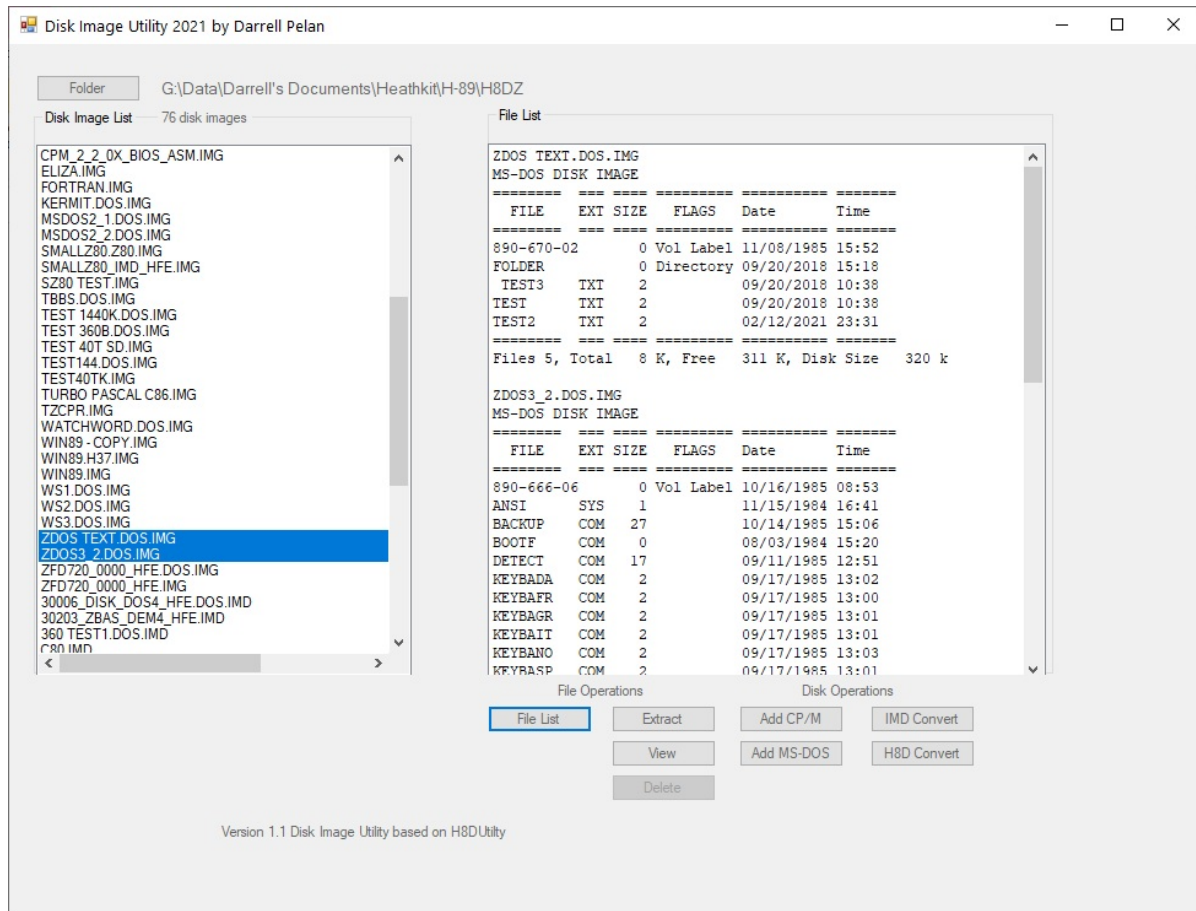
An H8D file is a byte for byte image of a hard sector disk. In reality, it is no different than an IMG file.

An H37 file is a byte for byte image of a H-89/H-8 soft sector disk. Unlike an IMG file, the image maintains the disk skew of the physical disk. You can ignore this file type for all practical purposes.

Note: Floppy disks often have a disk skew factor. Early computer systems were not fast enough to read disk sectors sequentially. CP/M disks will have a skew factor of 3, meaning there is a gap of three sectors between physical sectors. The disk has an index hole that tells the computer when the track starts. Each sector has encoding telling the computer which sector it is reading. For example, a CP/M disk with 5 sectors per track will have the physical order of the sectors be 3, 5, 2, 4, 1. The computer will look for sector 1 once it sees the index hole. The skew factor causes the system to skip sectors 3 and 5, before reading sector 2. MS-DOS disks have a skew factor of one, meaning the physical sectors are the same as the logical sectors. On the disk, the sectors are in numerical order (1,2,3,4,5,6,7,8,9).

Disk Image Utility (DIU) Overview

The DIU screen shot below shows the main application screen. The left window lists the disk image files in the selected folder. The right window lists the disk image contents in the files selected in the left window.



Select File Images to Manage

The Folder button selects the disk folder DIU searches. It will look for files ending in H8D, IMD, IMG, and H37. You can select any of the file images and click File List. It will list the disk contents in the right window.

You can convert an IMD file to an IMG file by selecting it and then clicking IMD Convert. There is no real need to convert an IMG file to an IMD file unless you intend to create a physical floppy using the Dave Dunfield utilities.

The H8D Convert button is used to convert H8D file to IMG files.

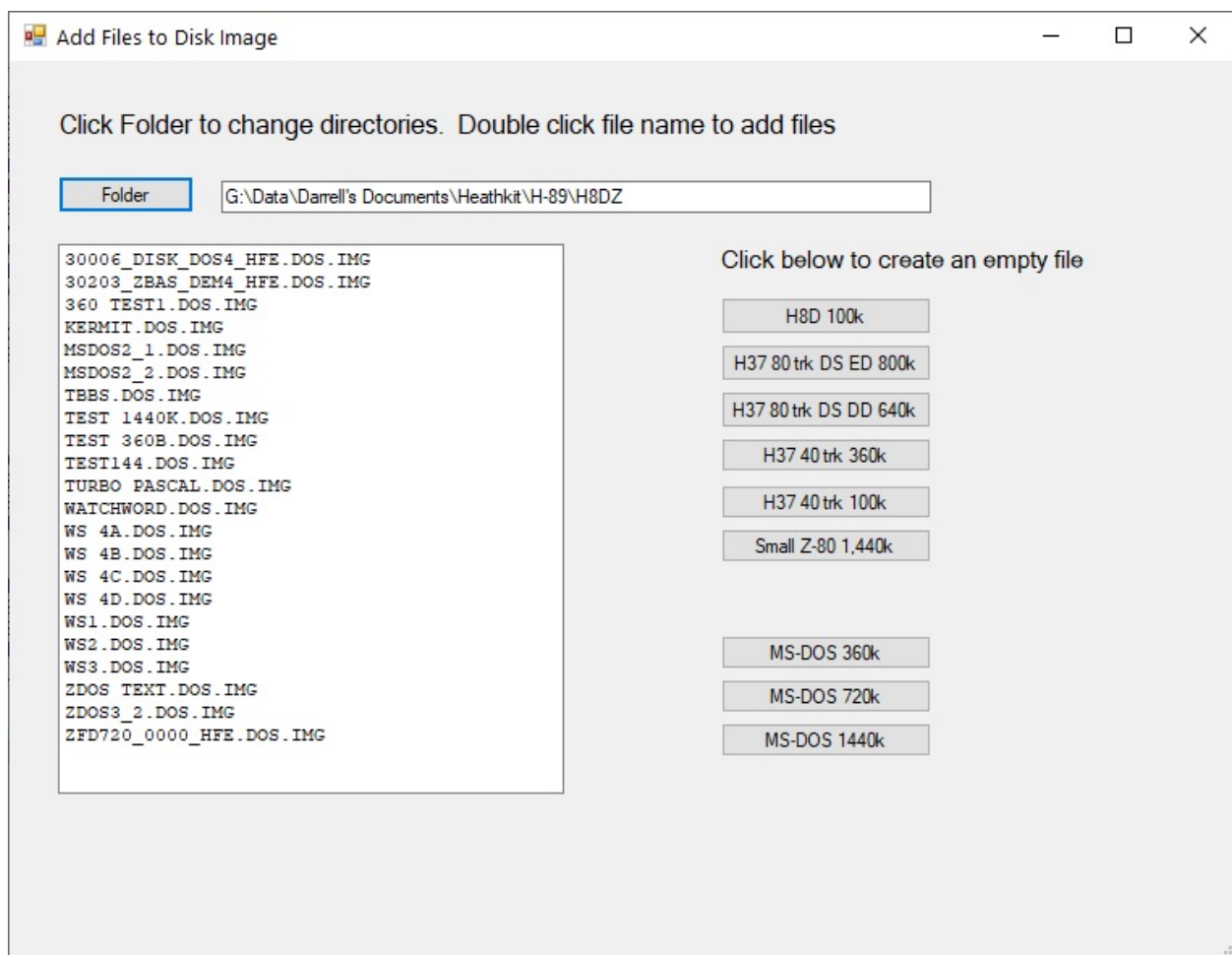
Manage File Contents

You can select any of the files in the right window to extract. Clicking the Extract button will cause DIU to create a new folder with the file image name plus “_Files”. Selected files will be placed in the new folder. You will be asked if you want to overwrite an existing file.

Left clicking in the right window copies the window content, including the area past the scroll window. You can then paste the file listing into a word processor or other application on your PC if you simply want a listing of the disk image contents.

Create a Blank Image

You can create a blank CP/M or DOS image using the Add CP/M or Add MS-DOS button. DIU searches the current working directory for CP/M or DOS files depending on which type of image you want to create. Once the Add Files to Disk Image form (next image) opens, you can double click on a file name to add files or create a new image using one of the disk types listed on the buttons on the right side of the form. A new dialog box opens for you to type the file name for the disk image. Then a second dialog box opens for you to select the files to add to the new image. If you simply want a blank image, click Cancel.



You can do these file operations on your PC hard disk and then copy the disk image file to the USB flash drive or perform the operations on the USB drive itself. I would recommend using your hard drive and then copying the disk image to the USB flash drive.

Flash Floppy Use in the Z-120

Once you have your USB set up, you are ready to use in the Z-100. The next picture below shows an installed Flash Floppy Gotek in a Z-120. The USB flash drive has 36 files of which number 2 is selected. The Flash Floppy Gotek displays the current disk image name on the screen. You can navigate with the two original Gotek buttons through the file list. There is no need for the third button unless you want to access the disk menu to eject, copy, or delete the image.

Please note the rise on the lower right of the Gotek case is a 3D print issue where the print lifted from the plate, and is not part of the design.



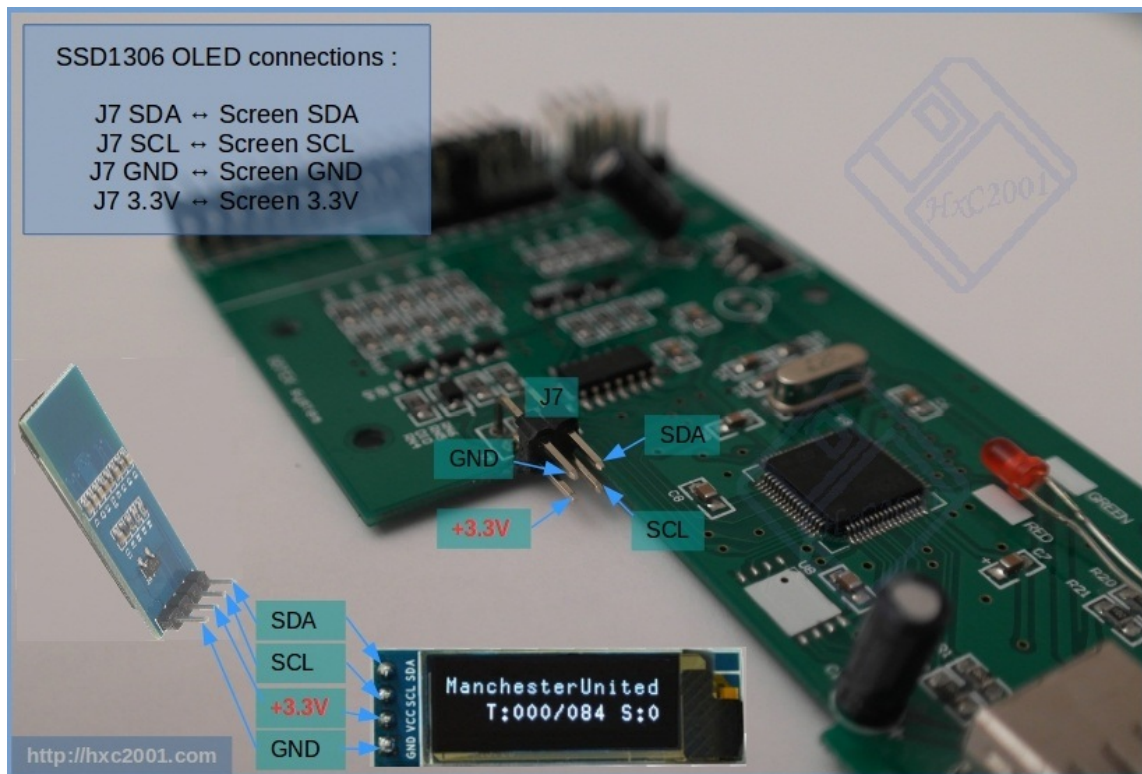
Summary

The Flash Floppy Gotek and Disk Image Utility combination provides you with an easy way to move files between Heathkit systems, load files from the web, and move files between different size disks. You are able to move text and document files between different operating systems like DOS and CP/M.

Appendix A: Gotek Updates

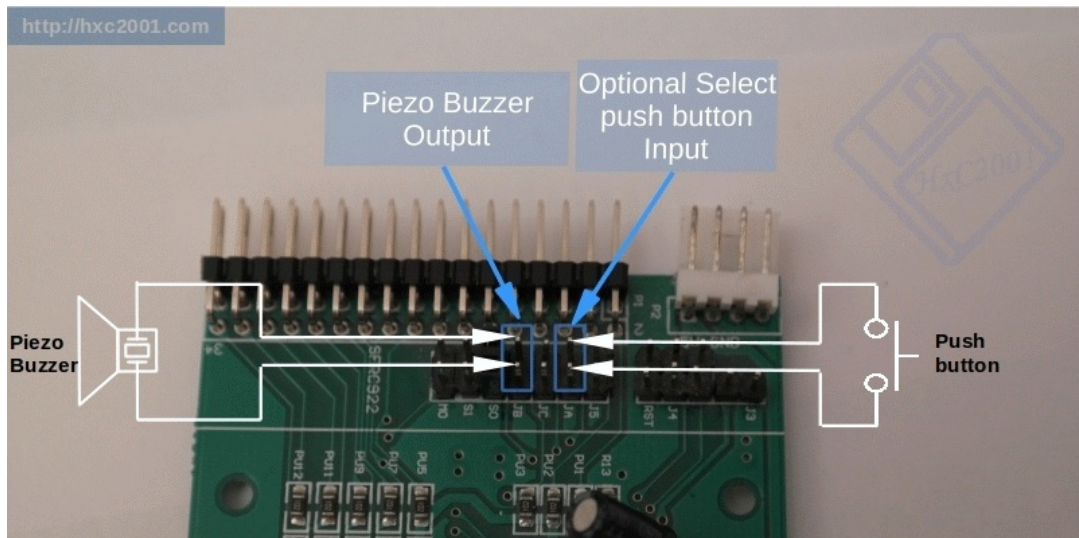
LCD Screen

- Purchase LCD screen from ebay
 - 0.91" 128x32 I2C IIC Serial Blue OLED LCD LED Display Module 12832 SSD1306
 - New Blue IIC I2C TWI 1602 16x2 Serial LCD Module Display for Arduino
- You can connect the screen directly to the J7 connector (additional pull-up resistors NOT required).



Select Switch/Speaker

- The 3D printed case has space to add a select button. The jumpers are connected to pins JA
 - There are several sources: Amazon, Digikey, Mouser. Look for a 6x6x8mm Panel Mini/Micro/Small PCB Momentary Tactile Tact Push Button Switch
- Speaker connects to jumper JB
 - Several sources: Amazon, Digikey, eBay. Look for a Piezo Sounders Passive Buzzer Component for Speaker



Appendix B: 3D Print Case

- 5.25" <https://www.thingiverse.com/thing:3433333>
- 3.5" <https://www.thingiverse.com/thing:3433312>

Appendix C: USB Power Cable

- [3 ft USB to Type M Barrel 5V DC Power Cable - Power Cable - USB \(Power Only\) \(M\) to DC Jack 5.5 mm](#)
- [Cables To Go C2G 03165 One 5.25 Inch to Two 3.5 Inch Internal Power Y-Cable, Multi-Color \(10 Inch\)](#)
- [DC Female Panel Mount Charging Wire Threaded Socket Jack Connector](#)

Appendix D: Disk Image Utility

- <https://ohioadventurescuba.com/heathkit/>

Appendix E: Dave Dunfield Website

- <http://dunfield.classiccmp.org/img/index.htm>

Appendix F: IMG.CFG File Explanation

The IMG.CFG file contains information the Flash Floppy uses to manage each image on the USB flash drive. The file contains a fairly good description of each parameter at the end of the file.

Things to know:

- A line that starts with a '#' (pound sign or hashtag) is a comment.
- Use the minimum number parameters needed to define the disk format.
- Disk size is the exact size of the image file in bytes. It should match the number of heads * number of tracks * sectors per track * sector size. It is on the first line of the description in the square brackets, e.g. [text::size]. The text is optional, but I used it to distinguish between DOS and CP/M format disks that are the same size.
- **NOTE:** DIU currently supports DOS formats of 360k, 720k, and 1440k; and CP/M format of 320k for the Z-100 series computer.
- DOS Example:

[DOS::368640]
cyls = 40
heads = 2
interleave = 1
secs = 9
bps = 512
- CP/M Example:

[::327680]
cyls = 40
heads = 2
interleave = 1
secs = 8
bps = 512
- The latest versions of the FF.CFG and IMG.CFG configuration files are included in the Disk Image Utility .ZIP file available from my website (Appendix D).