

H-17/H-37

Dual Controller

Modification

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Introduction

The H-17/H-37 dual disk controller modification is a modification to the H/Z-89 disk drive controllers which allows use of both hard sector and soft sector disks in the same set of drives. As presented here, this article assumes the user has up to three disk drives and both the H-17 and H-37 disk drive controllers.

Hardware modifications require several pins bent out and jumpers installed on the H-37 disk controller card only. Software modifications require minor modification to the CP/M BIOS for CP/M operation and a SET option for HDOS operation. Note that Heath/Zenith does not support hardware modifications on Heath/Zenith parts. You install this modification on your H-37 disk controller card at your own risk.

These modifications are based upon modifications defined by David Granz and modified by George Deffendall. David Granz owns Sterling Software and is the author of the public domain improved H-37 soft sector device driver for HDOS and its improved follow-on, the Super-37 Device Driver, currently offered by Extended Technology Systems. George Deffendall is an officer of Extended Technology Systems.

Modification Discussion

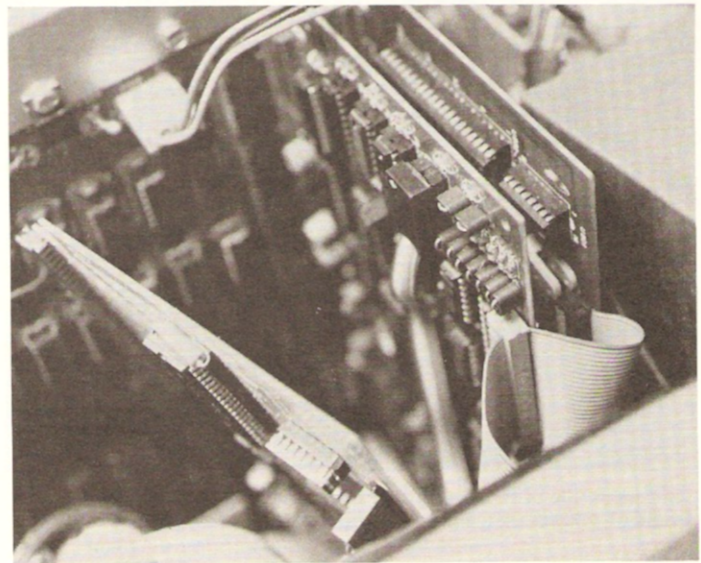
This modification is designed to allow the user to use a single cable to connect both disk controllers with up to three disk drives. Both controllers can access the same disk drives only if they do not interfere with each other electrically. Therefore, hardware and software modifications must be designed to assure there is no chance that interference can happen.

To understand how this controller card modification works, let's look at the drives and cables to see how disk drives get information.

First, disk drives don't care what kind of disks are inserted; they just attempt to read or write what the disk controller tells them to. They also report other events such as track 00, door open, and the presence of an index or sector hole. It is up to the disk drive controller to make sense of what the disk drive is trying to say.

The disk drive cable is the pipeline through which the data passes. Popularly, flat cables are used with every other line on the cable tied to ground to reduce the chance of cross talk or interference in the signals being passed back and forth between the disk drives and the disk drive controllers.

The information passing through the remaining wires in the cable



The H-17 and H-37 controller boards installed in an H-89. Notice that the drive cable starts on the H-17 board and jumps to the H-37 board, then on to the drives.

consists of control signals and data sent to the disk from the disk controller and status signals and data sent from the disk to the disk controller. Signals sent are said to use negative logic. That is: a zero (0) signal is indicated by high voltage (+5 volts) and a one (1) signal is indicated by low voltage (0 volts). Negative logic is used because it is easier and requires less logic to connect more than one device to the same line.

What is necessary, then, to prevent the two controllers from conflicting with each other, is (1) to make sure that a controller is prevented from sending a signal while the other is in operation, and (2) that the control signals are always off (high) when not in use. The first requirement will be accomplished via a software change, and the second requirement will be accomplished via a hardware change.

The disk drive status signals and data lines do not have to be modified. This is because both controllers simply read what is on these lines and do not try to modify these lines at any time. Similarly, the signal write data line through which the disk drives receive data from the controllers is only pulled low when the appropriate controller is writing data. Therefore, we can leave this signal alone.

The disk control signals from the disk drive controllers, which must be tied high when not in operation, consist of the disk drive select lines, the write enable line, the head step and direction lines, and the side select line. We will steal some logic on the H-37 controller card to make sure that these lines are pulled high (+5 volts) or turned off when not in use.

A side effect of this modification will be the disabling of the lower plug (P4) of the H-37 card. Since this drive modification requires all drives to be connected to the same cable, this should cause no major difficulty. We will get our extra signals necessary to tie the disk drive control lines high from the logic which formerly was connected to this drive cable plug.

The software modifications to prevent the two controllers from interfering with each other are fairly simple. For HDOS, a set option is necessary to force each disk controller to reset itself when the other controller is in operation. For CP/M, the BIOS is modified to include a call to a controller reset routine when the opposing controller is in operation.