Chaining Disk Drives – Part I
Tips on adding external floppy drives to your system

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This is the first of a two-part series on connecting external floppy disk drives to the TI.

The TI99/4A Peripheral Expansion Box usually came with only one disk drive unit installed in it. That unit was configured to operate in the standalone mode. The TI disk control system controller board, PHPl240, was capable of managing three disk drive units. TI had anticipated expansion to include more drives and had started producing external hardware to carry the added drives, but not much had come onto the market at the collapse.

There are two key factors about disk drive control that must be set up to use a drive as standalone or as a unit in a chain connection, with drive No. 2 or drive No. 3.

For introduction, I recommend that you review an article about chaining drives that appeared in the December 1988 MICROpendium (Pages 27-30, by Larry Thompson). He introduces the types of problems on connecting extra drives. He covers very well material on Shugart and Teac units. However, note that he overlooked one item about the Shugart resistor pack, which I only discovered when I got a factory manual on this drive. (This will be considered in next month's installment in a discussion about the Side 0 Select signal.)

SHUNT PACK DISCUSSION
Most drives have a DIP socket (dual in-line package) wherein is plugged a jumper header called the shunt pack. On many drive boards there is printed, near this socket, some data about the function of each jumper. However, the data differs widely, in a manner to confuse you, between the various drive makers. Also, the socket may have 14 or 16 pins.

A disk drive could not easily be built so that it could be plugged into the system in turnkey fashion. There are a number of operating options that must be programmed on a drive to make it fit electrically, and the shunt pack is the programming device.

I will run down the most common labeling schemes and try to clarify some of the mess that you will find. Note that the various drive builders have not conformed too well to a neat system of naming and locating the control signals on the DIP socket pins.

Pin 1: May be called HL, or HS, or H. This circuit programs for the head load by control of the drive select signal. (See pins 2, 3, 4 and 6 below.) Jumper connects Pin l to Pin 14, or Pin 16.

WARNING: The confusion goes all the way on the labels, as you will see. Watch out for the differences between 14- and 16-pin models.

Pin 2: May be called DSO or DS1. This is drive select for the first drive unit in the system. The jumper connects Pin 2 to Pin 13, or Pin 15. Do not put a jumper on pins 3, 4 or 6 of that drive.

Pin 3: May be DSl or DS2. This is drive select for the second unit in the chain. Jumper is Pin 3 to Pin 12, or Pin 14. No jumper on pins 2, 4 or 6.

Pin 4: May be DS2 or DS3. Drive select for the third drive unit in the system chain. Jumper Pin 4 to Pin 11, or Pin 13. No jumper to pins 2, 3 or 6.

Pin 5: Labeled MX or X. Meaning multiplex, but usage is not known to me. Do not jumper it.

Pin 6: May be DS3 or DS4. Drive select for fourth unit in chain. Jumper is Pin 6 to Pin 9, or Pin 11. No jumpers to pins 2, 3 or 4.

WARNING: Watch out on pins 5 and 6. On some drives these functions are reversed. Pin 5 becomes select No. 4 and Pin 6 becomes MX. This flipping is not important if you use one to three drives. The Shugart 450, Tandon TM100-2A, and Tandon TM100-4 are all so connected. I believe that the rest of the drives I tested are standard. (See Fig. 1.)

Pin 7: Labeled MH, or HM or M. This is for head load by the motor on signal. This is an option to use instead of head load by drive select, per Pin 1, above. Jumper is Pin 7 to Pin 8.

WARNING: Do not use both Pin 1 and Pin 7, only one should be connected. (On drives with a 16-pin DIP socket this MH signal is usually placed at Pin 8, and Pin 7 is not connected, so the jumper will be on Pin 8 to Pin 9. Further, all those numbers for pins l - 6 will connect to pins 16, 15, 14, 13, 12, 11, etc, as noted above. Watch out!)

I have no idea about the best choice for using the Pin 1 jumper HL; or the Pin 7 jumper, HM; for the head load. I have observed that almost every used drive coming in my hands has been jumpered for Pin 1, HS. This has seemed to work okay on every drive I have run.

The Pertec FD200 drive does not have a shunt pack socket; rather is Switch S-1, called unit Select, which must be set to enable drive No 1, or whatever.

On many of the newer, double-sided drives, the manufacturers may scatter these control signals all around the circuit boards instead of locating them in one convenient spot. Beware of Panasonic and Mitsubishi, for example, I have been able to get a Mitsubishi to run. I have never been able to decode the mess presented by Panasonic.

The OKI GM-3315 seems to have normal labels but it is all placed on DIP switches to configure the options.

VARIATIONS
Here I must warn you that all this nice stuff about the shunt only applies to some drives. Notes that Mitsubishi, Panasonic, Pertec, QumeTrak, Remex, and Tandon TX-65 and Teac do not use a DIP socketed shunt. Rather, the signals are scattered around on the drives PC board as groups of

little pins sticking up and are patched with tiny individual jumpers that each fit over just two pins.

RESISTOR PACKS
The disk control hoard in the PEB is constructed in such way that the disk drives must energize several signal control lines to enable them for the control board. The earliest, and best, scheme was to feed each with +5 volts through a 150-ohm series resistor. The specific circuits involved were: Write Gate, Write Data, Step, Direction, Motor On, plus Side Select on double-sided drives. Some drives also had door detect. But in this area, also, there is what I call total disorganization. There are at least three different internal configurations of resistor packs, which also be found in 14 and 16-pin versions. Next month I will examine this mess, and note which drives used each, and try to untangle it; at least as far as I can from the drives I have been able to get my hands on.