

Chaining Disk Drives – Part II

Different drives call for different configurations

By MERLE VOGT

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

STRAIGHT ACROSS CONFIGURATIONS

In this one the resistors go across the unit, Pin 1 to Pin 14, Pin 7 to Pin 8, etc. (See Fig. 4C.) Except, watch out for the 16-pin units where the pin numbers advance by one position. The resistors are nominally 150 ohms, but it does not seem to be very critical as some drives use 200 ohm packs.

Here is a list of parts found in this type: AB 314B150, Bourns 4114-R-001-150, 4116-R-001-150, CTS 760-3-R150, Beckman 899-3-R150.

These types have been found in these drives: Mitsubishi M4851-362U, MPI 51 and 52, Panasonic JU-455-5AAG, QumeTrak 142, Shugart 400L, Shugart 450 (16-pin), Tandon TM 100-4 and TM 65-2.

DOUBLE SERIES CONNECTIONS

This configuration contains 13 or 15 resistors. Only Pin 14 (Pin 16) connects to the +5 volts. Many of the resistors do not connect to any circuit.

Part numbers for these include: Bourns 4114R-002-150 and Bourns 4116R-002-150.

This type has been found in the following drives: CDC BR8B1A, Magnetic Peripherals BR8b1A, Pertec FD 200 and Siemens 82.

SHUNT OR LINE TERMINATION TYPE

This unit uses two resistors in a series shunt connection to feed the pins. (See Fig. 4E.) The top resistor is 220 ohms, to +5 volts, and the bottom resistor is 330 ohms to Ground, 0 volts. The tap point feeds the pins and there is nominally +3 volts on each pin. Note that only Pin 14 (Pin 16) goes to +5 volts, and Pin 7 (Pin 8) must go to Ground, 0 volts.

Part numbers on this are AB 314E221331 and Bourns 4116-03-221/331.

This type has been found in these drives: Remex RFD 480, Siemens FDD-100-5 and Wangco 82.

There is a superficial similarity between drives that use the double series connections and those that use the shunt termination type. I think these could be substituted but I have not had time to work out the possibilities. Note that purchase of correct resistor packs is impossible in my area.

I have had to use 14- or 16-pin DIP headers and single resistors or SIP resistor packs. CTS-750-81-R150, or CTS 770-105R221/331 and fabricate units as needed.

APPLICATION OF RESISTOR PACKS

All of the above configurations energize the control circuits through a rather low value resistance, 150 ohms or so. This value is the absolute limit of current to these control lines as it forces the disk control board to sink about 32 milliamperes. Any heavier load may damage the control board driver chips. The current was engineered at this somewhat high value to increase circuit response speed.

This means there must not be more than one resistor pack in a system chain. Standard practice is to pull the packs from all lower-numbered units, leaving the pack in the last, highest numbered, drive unit.

Generally this is satisfactory. But, as usual, there are exceptions.

NOTES ON SPECIFIC DRIVES

Shugart 400L: This one has its own peculiar tricks in its connections to the resistor pack. As Larry Thompson noted, the drive select lines are enabled by one resistor in the pack. (See MICROpendium December 1988.) So, if you try to use this unit any place except stand alone or as last unit, then drive select gets disabled when the pack is pulled, and the drive will not work. So you will usually see that this unit is recommended as last unit and that only one be used in a chain.

In addition, when I got a Shugart manual, I discovered that the manufacturer had tied a resistor to chip 4A-9, which enabled the side 0 select pin.

Now that I have just told you why not to chain this Shugart drive, I will show how to defeat it. Get a 14-pin DIP header and two 150 ohm one-quarter watt resistors. Solder one across Pin 5 to Pin 10, and the other across Pin 6 to Pin 9. That Pin 5 resistor will enable the drive select, as Thompson noted. Then this is the new trick the Pin 6 resistor enables what is called the side 0 select circuit. I discovered this last item by studying the Shugart service manual. Install this kludge pack in the resistor pack socket. Now you can position that drive at location No. 1 or No. 2 in a chain. Note that the regular resistor pack must still be used in the last unit.

I believe that last item solved some very erratic problems in our user group system. We are using a Shugart 400L in drive No. 1 with a kludge resistor pack in place having only a resistor between pins 5 and 10. Adding the resistor from Pin 6 to Pin 9 cleared the problem.

Shugart 450: This drive has some circuits shifted from standard, and differently from the 400L, plus it uses a 16-pin pack. Use one resistor, Pin 5 to Pin 12, for device select.

I will say that it seems feasible to connect, in chain, a wide mixture of different drives. Extreme care about massaging the signal control lines is required. Note that you can even get into trouble trying to use two or three units of the same model of some brands.

Wangco 82: I discuss this one next because, like the Shugart, it plays a trick, also, and does not readily fit any place except as the last unit. Again it is the drive select line problem. But this time the extra resistor must be patched from Pin 14 to Pin 13 of the pack socket. Then you can use this drive at lower-numbered positions.

Here is a list of drives that were tested that worked normally:

- Magnetic Peripherals BR8B1A
- Mitsubishi M4851-362U
- MP1 51 and 52
- Pertec FD 200
- QumeTrak 142
- Remex RFD 480
- Shugart 400L (per above-)
- Shugart 450 (per above)
- Siemens 82 and FDD 100-5
- Tandon TM 65-2 and TM 100-2A
- Wangeo 82 (per above.)

I have had my hands on all of these drives. All seem to be internally wired in the standard manner. To chain units it is necessary only to:

Configure the shunt pack to select either DS1, DS2 or DS3; and enable the HS line.

Remove resistor pack from all but the last unit in the chain. Install the kludge pack in Shugart 400L or 450, or in Wangco 82, if not the last drive in the chain. The easier way is to place these type drives at the last position, with their normal resistor pack installed.

I have tested a variety of these drives in chain setup, without having any problems. Also, I have made the Shugart and Wangeo drives mix with any other type by cobbling the resistors as described above.

Again, as pointed out by Thompson, Teac drives take a totally different approach. The resistor packs are 500 ohm links. Thus, for one to three units, there will not be any overload to the disk control unit. All that is needed is to place the shunt pack to enable DS1, DS2 or DS3, as needed.

Warning: Generally on the TI99/4A disk system, the unit in the Peripheral Expansion Box will be set up as drive No. 1. The added drives, No. 2 or No. 3, will be in a separate external enclosure with power supply. Since the system enabling the resistor pack is "out there," that external enclosure must be powered-up to get the internal drive to run.

TWO HALF -HEIGHT DRIVES IN THE PEB

The rules still apply. Unit No. 2 will retain the resistor pack and unit No. 1 must not. The shunt packs must be configured to conform to position.

OTHER BRANDS

I have had hands-on for all of the above discussed units, and have tested them as stand-alone and as No. 1 in a chain.

OKI GM-3315B: This one runs from DIP switch configuration. It appears to have the standard wiring, per above. I have not had an operable unit to test.

Here is a list of compatible drives: CDC 9409, Epson SD521, Shugart SA455, Tandon TM 100-2 and TM 100-4, and TEC FB503.

All of these drives have been mentioned in publications as compatible on the TI99/4A disk drive system. I have not yet had any to examine, or to make test runs on.