



This article was first published in issue #76, August 2001



Teac FD-505  
Dual 3.5"/5.25"

## Teac FD-505 Dual Density Drive

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### Teac FD-505 Dual Density Drive

I had bought three TEAC FD-505 Dual-Density 5-1/4" and 3" Combination Drives some time ago at a computer fair. I had intended to remove the lowly 5-1/4" 360Kb drive in a few of my Z-100 workhorses, when I got the chance.

I finally got that chance on the Z-100 with the Scottie Board and CDR-317 Hard Drive Controller. Here's how it went.

I started with Bob Hassard's article "Two By Two In One" from issue #32, but it wasn't clear what model drive was being described and the jumpers being described did not correlate to what I had.

As usual, John Beyers came through with the documentation to share. Before getting into that, however, let me clear up a possible misconception that may exist about the drives.

The fancy dual density drives are **NOT** fully capable of replacing your lowly 360Kb 5-1/4" drives. This is because of the smaller heads and closer track spacing used in the new drives.

I thought that the drive manufacturers had taken care of the problem by using stronger signals, or writing consecutive tracks twice, but this is **NOT** true.

High density 5-1/4" drives fit 80 tracks in the same area that used to fit 40 tracks on low density media. So, high density drives can read 40 track media by skipping every other track and it does this quite well.

The problem arises when trying to write information. The smaller head does not cover the full width of the track of a 40 track media. Nor does it half step to make a second pass on the 40 track media to catch what's left. This leaves a mix of old and new data that will make the older 360K drive gag, and trash your disk!

The situation is not totally hopeless, however. If you have to bring home work from a high density 5-1/4" drive, use a new, clean, **unformatted** disk, format it in the high density drive to 40 tracks. Then copy your data to it. As it is the only information on the disk, your 360K drive will not know that it is only reading half a track.

**Note:** You cannot use a reformatted disk, because the old information would still remain on the disk formatted by the high density drive and formatting in the low density drive actually writes data to the disk that the high density drive can not change. The disk **MUST** be new and unformatted (rare these days) or requires bulk erasing.

**Note:** The 3-1/2" drives do not suffer from this problem because 3-1/2" drives all write tracks of the same width.

As we discuss these drives, some terms may be used that may be somewhat foreign to you. Please see the companion article, "Z-207 Floppy Controller Mods", also on this Website, for definitions of these terms.

**Power Requirements:**

The Z-100's power supply was designed to drive two Tandon TM100 5.25" full height floppy disk drives, with a current rating of 900 mA maximum at +12 Vdc +/-600 mV and 600 mA maximum at +5 Vdc +/-250 mV (<100 mV P-P ripple) for each drive.

These combination drive units require 430 mA at +12 Vdc maximum and 530 mA at +5 Vdc maximum (worst case = 3.5" drive writing (420 mA), and the 5.25" drive in standby (110 mA). (You can't read and write simultaneously).

These units draw less current than the drives they replace.

**User Selectable Straps (Jumpers):**

The Combination 3.5"/5.25" Floppy Drive is actually two separate drives attached to each other by a small ribbon cable. However, all the user selectable straps are located on the circuit board of the 5.25" drive.

The documentation for the drive discusses the use of "straps" which are short bar jumpers inserted on to "strap posts". But, we will also need to install wire jumpers across some small surface pads to select other functions.

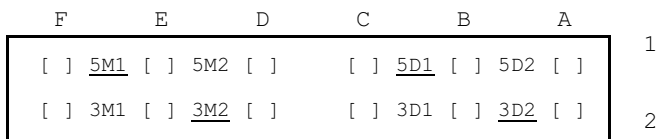
For consistency and to be perhaps more clear, I am going to use the terms "post jumper" for the push-on shorting plugs and "wire jumper" for the condition where we must solder a short piece of wire across two pads or between two locations.

As I mentioned, Mr. Hassard was discussing the FD505-100 in his article published in issue #32 of the "Z-100 LifeLine". My combination drive was the FD505-309 and I'll point out the differences as we go.

**CAUTION:** I do not recommend the FD505-309! While I understand that the FD505-100 had labeled pairs of pads "I" and "IS" for jumpers, my drive did not! In addition, to install the "IS" jumper on my drive, you had to tack-solder a wire to pin 29 of a large, 100-pin, surface mounted IC and attach the other end to ground! With all my soldering experience, this was still a giant pain in the buns. More on this later.

The drive came with post jumpers to select Motor On and Drive Select for units 1 and 2 at the rear, center of the 5.25" drive circuit board.

It looks like:



The jumpers are defined as:

Jumper:	Function:
5M1	Pin 16: 5.25" Motor On 1 input
5M2	Pin 10: 5.25" Motor On 2 input
5D1	Pin 12: 5.25" Drive Select 1 input
5D2	Pin 14: 5.25" Drive Select 2 input
3M1	Pin 16: 3.5" Motor On 1 input
3M2	Pin 10: 3.5" Motor On 2 input
3D1	Pin 12: 3.5" Drive Select 1 input
3D2	Pin 14: 3.5" Drive Select 2 input

Where:

- 5 = 5.25" drive
- 3 = 3.5" drive
- M = Motor On/Off
- D = Drive Select
- 1 = Drive Unit #1
- 2 = Drive Unit #2

The default position, and the position I found when I bought my drives, of the post jumpers were: 5D1, 3D2, 5M1 and 3M2. This selects the 5.25" drive as unit #1 with the Motor On #1 signal selected, and the 3.5" drive as unit #2 with the Motor On #2 signal selected.

Apparently, on a normal PC, this is all that is needed. I guess they figure that the normal 3.25" drive in a PC is drive 0 and this combination unit would just supplement that drive nicely.

However, it is NOT that easy on the Z-100.

Our BIOS requires that dual density drive unit numbers be 0 and 1, before our normal 360 Kb drives.

Fortunately, the drive does have jumper pads for unit number 0 and 3, if needed. This requires installing wire jumpers across the pairs of pads, however.

The FD505-100 and -309 have different pad labels. On the FD505-100, the respective pads are labeled as follows (with the FD505-309's labels given in parenthesis):

S6 (S8)	-	3.5"	Drive Select 3
S7 (S9)	-	5.25"	Drive Select 3
S8 (S10)	-	3.5"	Drive Select 0
S9 (S11)	-	5.25"	Drive Select 0

So for my drive to have the 5" drive as unit 0 and the 3" drive to be unit 1, I had to jumper S11 and 3D1.

Also, both the drives needed to have the Motor On signal come from pin 16 of the 34-pin connector. This required post jumpers be installed at 5M1 and 3M1.

The drive also has pads for jumpers for the RDY (Ready) and DC (Disk Change) option. While the FD505-100 may have the pads labeled RDY and DC, mine had the "S4" and "S5" labels. On both models, the switches were the same:

- DC or S4 - Disk Change selected
- RDY or S5 - Ready Signal selected

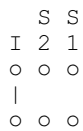
My drive came configured with S4 jumpered with a surface mounted shorting block and I left it in that position. **Caution:** Never jumper both at the same time.

Finally, we end up with the "I" and "IS" jumpers. I believe they are labeled that way on the FD505-100 model. Mine had NO labels, and, worse, as I cautioned earlier, my drive did not even have an "IS" jumper position - pin 29 of the IC U1 was not connected to anything and left floating! The drive was very flaky (plagued with numerous read/write errors without this pin grounded).

- I - Select Speed modes
- IS - Select Speed modes
  - I = Off and IS = Off
  - Set Single Speed (360 rpm)
  - I = On and IS = On
  - Set dual Speed (300/360 rpm)

**Note:** The speed automatically changes when the drive density changes on dual speed selections.

I am told that both "I" and "IS" require wire jumpers on the FD505-100. On the FD505-309, the "I" pads are located beside the "S1" and "S2" pads, as thus:



The "I" is not labeled and the "S2" is printed well off to the side with a line drawn to the correct pair of pads. Install a wire jumper across the "I" pads.

The "IS" jumper is simulated on the FD505-309 by shorting pin 29 of 100-pin IC labeled 2207-80 or IR4N171 to ground. It involves tack soldering a very fine wire to this pin! Ensure that no solder bridges occur by checking the adjacent pins with an ohmmeter.

That completes the jumper modifications.

So, why doesn't the PC require "I" and "IS" jumpers? The PC does not normally use dual speed operation - only 360 rpm for the 5-1/4" drives and only 300 for the 3-1/2" drives.

But let's discuss what some of the other jumper positions are supposedly for:

- S1 - 3.5" drive Normal Density output signal to pin 4 of 34-pin cable, "Open/In Use" (not used in Z-100 or PC). This is S12 on FD505-309.
- S2 - "In Use" signal from 5.25" drive, via pin 4 of 34-pin cable.
  - On - signal provided
  - Off - signal disabled
 This is S6 on FD505-309.
- S3 - "In Use" signal from 3.5" drive, via pin 4 of 34-pin cable. This is S13 on FD505-309.

All three of these are not jumpered (not used).

The FD505-309 also had several jumpers not shown on the attached drawing:

- S1 - Labeled "PY-" on the drawing, it shorts pin 24 of U1 to ground. Open by default.
- S2 - Shorts pin 2 of the 34-pin cable and pin 23 of U1 to ground. Open by default.
- S3 - Labeled "US" on the drawing, it shorts pin 1 of U1 to ground. Shorted by default.
- S7 - Connects pin 19 of U1, labeled "IU" to pin 10 of the 34-pin connector "Drive Select 0". Open by default.
- S14 - Connects pin 6 of 34-pin cable "Open/Drive Select 3" to pin 13 of 3.5" drive cable "Open/In Use". Open by default.
- S15 - Connects pin 11 of 3.5" cable "Open" to pin 13 of 3.5" cable "Open/In Use". Open by default.
- S16 - Shorts pin 13 of 3.5" cable "Open/In Use" to ground. Open by default.
- S17 - Shorts pin 2 of U1 to ground. Shorted by default.

There are several other labels defined by Mike Zinkow for the FD505-100 that I cannot locate on the drawings:

- FG - Frame ground, connects electrical ground to chassis.
- HL - Activate head loading with Head Load signal. (Not normally used.)
- HS - Activate Head Loading.
  - Off - Motor On signal
  - On - Motor On \* Drive Select
- LG - Select Density mode determined by the signal level of the 34-pin connector terminal #2 Density Select signal from the modified Z-207 controller (See the "Z-207 Floppy Controller Mods" article in this issue).
  - Pin #2 High (5v) (LG - On) = High Density (1.2 Mb)
  - Pin #2 Low (0v) (LG - Off) = Low Density (720 Kb)
- ML - Activate Motor On.
  - Off - On with Motor On signal.
  - On - Motor On + LED On. (See LED table below)
- IU, U0, U1 - Activate LED On as depicted in the LED Table

LED Table:

#:	IU:	U0:	U1:	LED On Condition:
1	Off	Off	Off	Drive Select
2	On	Off	On	Drive Select + In Use
3	On	On	Off	In Use
4	Off	On	On	Drive Select * Ready
5	On	On	On	In Use + Drive Select * Ready

Mike reported that there was no definition of IU, U0, and U1 that he could find. He assumes they mean "In Use", "Unit 0", and "Unit 1", respectively. Nor is there a definition or reference to E2, US, or PY.

I hope you find this information useful. If you have any questions or comments, please email me at:

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