

Using 3.5" Disk Drives with TANDOS-R

Quick Start

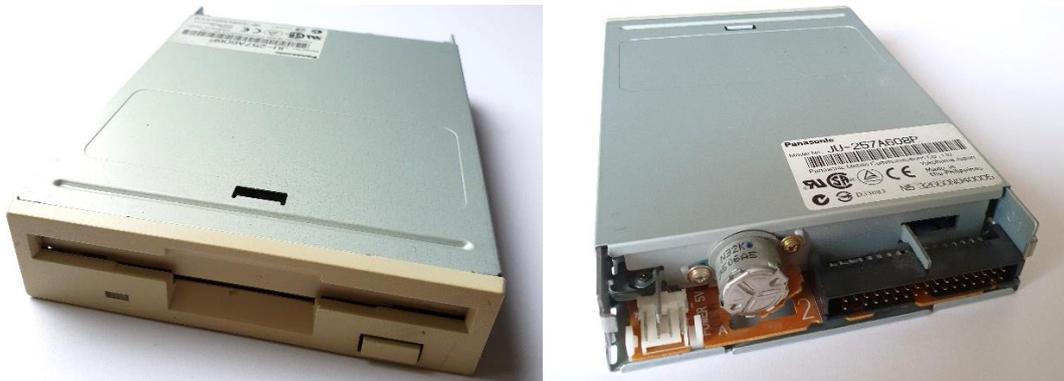
Below are the technical details of using 3.5" drives with TANDOS-R. The short answer is that a typical 3.5" drive salvaged from a standard PC using 720K disks (not the later 1.44MB HD ones) and a special ribbon cable (not a standard PC one) should work fine as 80 track double sided drives.

Drives

The 3.5" Disk drive was standardised in about 1983 and became popular in 1984 when it was adopted for the Apple Mac and Atari computers. Early drives are all 80 track but may be single or double sided and use various recording formats and densities. By far the most common drives however are the PC compatible units. There are two variations, drives that only support the 720K capacity 80 track MFM double density format and those that support both this and the later 1.44MB High Density or HD format. TANDOS-R is able to work with an 80 track drive but uses a single density FM encoding. Single Density FM encoding is electrically and magnetically very similar to double density MFM just at a lower frequency so almost all drives should support it. FM single density encoding is not compatible with drives in HD mode.

Early drives may well have a number of jumpers to configure them, typical jumpers will change the drive number, the behaviour of the "disk change" or "RDY" signal and the behaviour of the "density select" signal. Later drives have no jumpers and are hard wired to work for the PC standard as drive 1. Luckily with the correct cable, see below, these drives can be made to work with TANDOS-R as 80 track double sided drives.

Testing has been carried out with Panasonic drives model no. JU257A608P and JU257A607P. These drives and very similar ones are freely available for little cost on auction sites and should work.



A typical 1.44MB drive salvaged from an old PC. No configuration jumpers or switches.

Disks

When the 1.44MB HD standard was introduced in 1997 the disks themselves acquired an extra cutout to allow the drive to identify it as an HD disk. The cutout is on the opposite side to the write protect cutout but does not have a slider to cover it up. Some early drives apparently had a jumper to allow them to be configured to override this automatic density selection.

Even if the drive can be put into DD mode, or the cutout is covered to fool it into seeing an HD disk as DD disk writing to it in DD mode if it has ever been written to in HD mode may not work (see below). The HD disk surface has a higher coercivity than a DD disk and it seems the heads are energised differently in HD and DD modes and the heads in DD mode will not erase the old HD data. An HD disk is almost certainly written to during testing even if it is in theory new and unformatted.

For TANDOS-R use therefore DSDD disks (usually called 720K disks or MF2DD) are the ones to work with. Tests with several disks that had previously been formatted in PCs have shown them to work perfectly when formatted for TANDOS.



1.44MB HD disk

720K DD disk

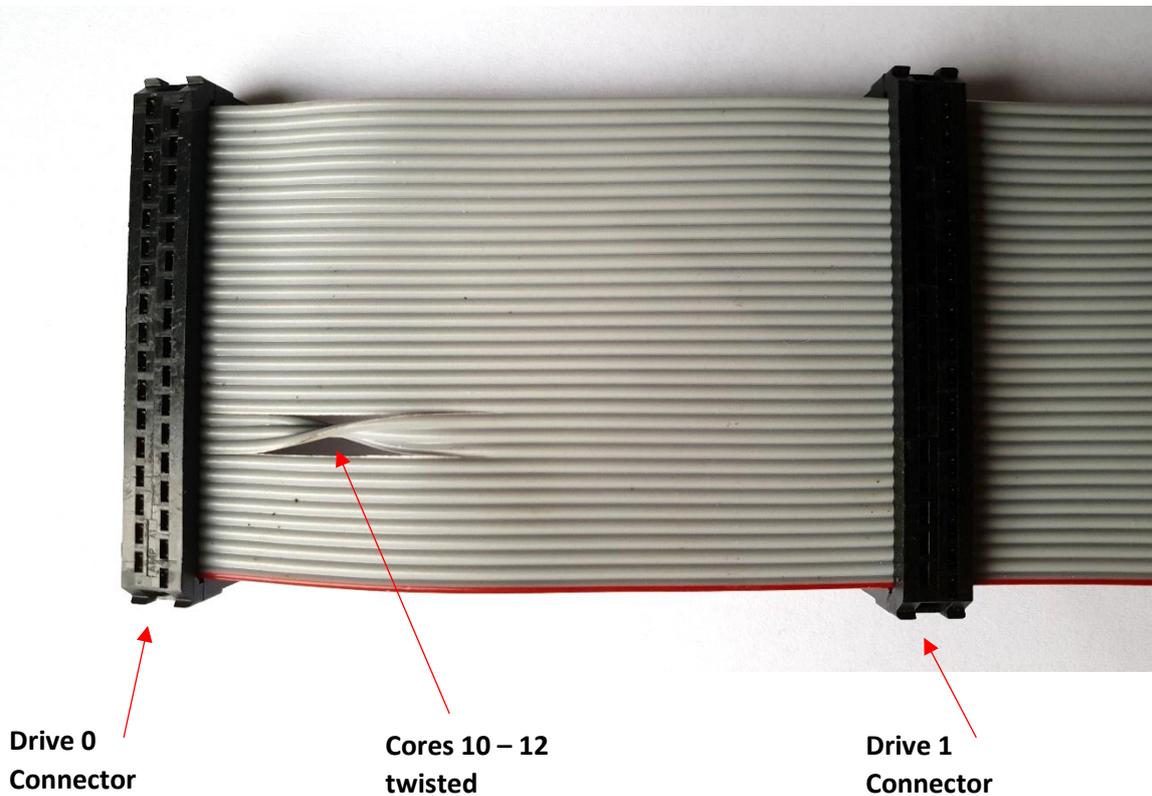
Cable

The earliest 3.5" drives may well have a pinout similar to the original Shugart standard however when IBM launched the original PC they made some small changes to this interface which are reflected on PC compatible 3.5" drives. IBM replaced the single "Motor On" signal with two and changed the position of the drive select lines. In an IBM PC all drives are configured as drive 1 (seen by the operating system as drive B), and the ribbon cable has a twist in cores 10 to 16 so that the drive after the twist is seen as Drive 0 (or drive A to the operating system). It seems that the motivation was that all spare drives were identical and needed no configuration other than plugging into the cable in the right place.

TANDOS-R complies with the original Shugart pinout so a standard PC 3.5" drive appears to be drive 1 (accessed as drives 2 and 3 in TANDOS). If the drive has jumpers to select it's drive number then changing these from the default of drive 1 to drive 0 and using a straight ribbon cable should work. As is noted above however the majority of drives have no jumpers.

No	TANDOS		DRIVE
Pin 2	NC		NC or DENSEL
Pin 4	NC		NC
Pin 6	DSEL 3		NC
Pin 8	INDEX		INDEX
Pin 10	DSEL 0		NC
Pin 12	DSEL 1		DSEL
Pin 14	DSEL 2		NC
Pin 16	MOTOR ON		MOTOR ON
Pin 18	DIR		DIR
Pin 20	STEP		STEP
Pin 22	WR DATA		WR DATA
Pin 24	WR GATE		WR GATE
Pin 26	TRACK 00		TRACK 00
Pin 28	WRITE PRT		WRITE PRT
Pin 30	RD DATA		RD DATA
Pin 32	SIDE SEL		SIDE SEL
Pin 34	DSKCHNG		DSKCHNG

A normal PC twisted cable will not work as the extra motor signals are not present. A slightly different twist is therefore needed. Looking at the pinouts in the table we see that we simply have to swap cores 10 and 12 on the ribbon to make the drive be seen as drive 0. (Note that all odd numbered cores are GND).



Placing a second connector before the twist will allow a drive 1 to be added as well. In most cases both drives' motor's will spin whichever drive is being accessed, this is unusual but not a problem. When making a twisted cable it is always worth having an extra 10mm or so sticking through to make sure the parts of the cable are properly re-aligned, then trimming it back. The connectors must be perpendicular to the cable and can be closed initially by hand to make sure they are correctly positioned, the finally closed with a vice to exert even pressure.

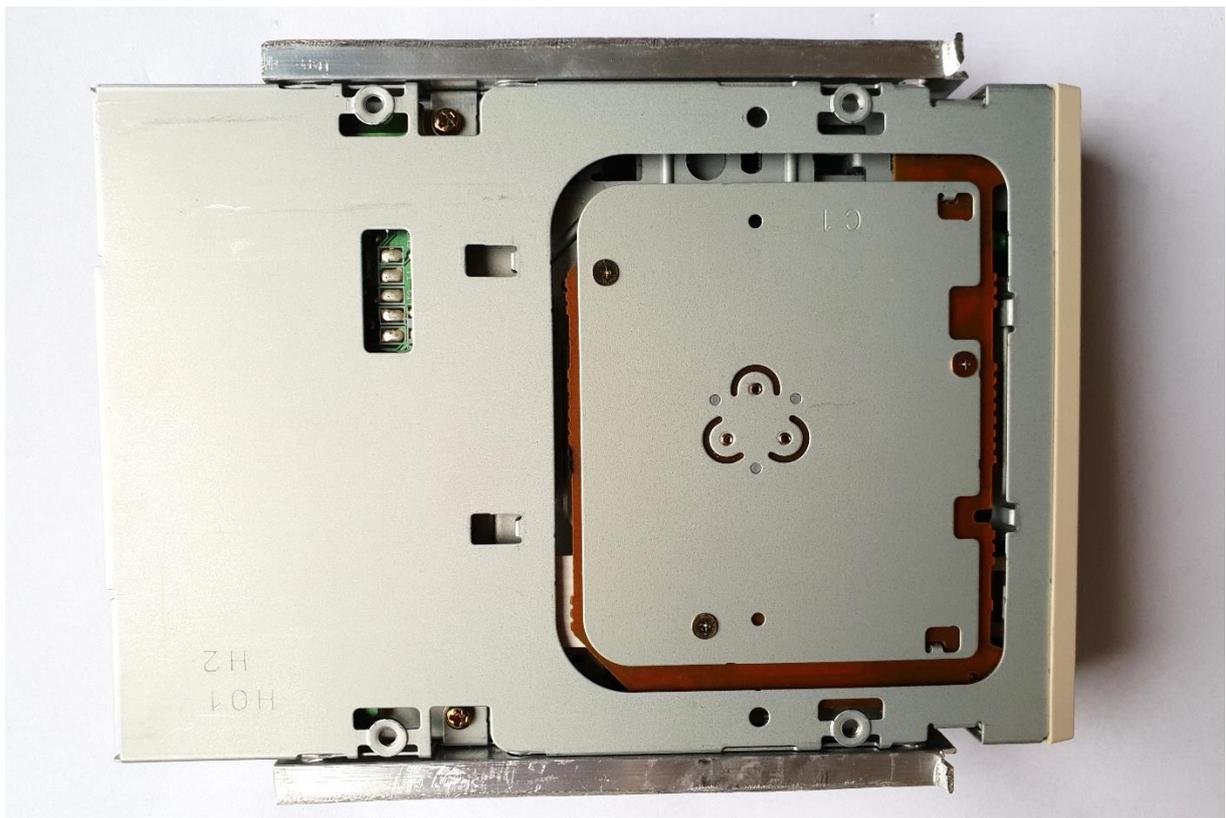
Power considerations

The power connector standard for 3.5" drives has connections for +12v and +5v and separate grounds. The majority of modern drives only use the 5v supply but +12v is still needed for the FD1793. The MB8877 only uses +5v so if this controller chip and the right drive are in use it may be possible to operate from 5v alone although this has not been tested.

Tests show that powering a drive from the connector HxC emulator power connector provided on the TANBUS-R board works fine, but it is bad practice to power a motor from a digital board and so the connection should be taken right back to the PSU.

Drive mounting

A 3.5" drive is smaller than a Microtan board and most modern drives have a height the same as the width of one card slot in the rack. It is therefore possible to mount a drive vertically in a spare slot in the rack with suitable "rails". The rails in the picture were made by cutting 11.5 x 11.5mm right angle aluminium section (available in many DIY centres) down to 7mm on one side and drilling appropriate holes in the other. The ends of the rail are bent over to control how far back in the card guides they can slide.



A note on HD disks and Drives

Testing by Alan of www.microtan.ukpc.net has revealed that 1.44MB HD drives can only be used in read mode, and that HD disks can be written to and read by 720K drives and, if written by a 720K drive can be read by an HD drive. It is well worth testing with whatever disks and drives are available to see what works.