Disk Drive Connections

$\overline{DS0}$	Drive Select 0. Control signal supplied from the Parallel Interface via the decoder. Active state, logic low. When active, selects the disk drive configured as drive 0.
$\overline{DS1}$	Drive Select 1. Control signal supplied from the Parallel Interface via the decoder. Active state, logic low. When active, selects the disk drive configured as drive 1.
HLD	Head Load. Control signal supplied from the Parallel Interface. Active state, logic high. When active, engages the read/write head of the selected disk drive against the disk.
SSO	Side Select Output. Control signal from the FDC used to select the side 0 or side 1 of double-sided disks. Follows the state of an associated control bit within an internal register. A logic high on SSO selects side 0 and a logic low, side 1.
STEP	Step Pulse. Pulsed output generated by the FDC for positioning the disk drive read/write head. Each positive going pulse moves the head to an adjacent track location in the direction determined by the DIRC output.
DIRC	Direction Control. Control signal generated by the FDC to determine the direction of movement of the disk drive read/write head. When DIRC is set to logic high, each step pulse causes the head to step in one track (away from track 0). When DIRC is set to logic low, each step pulse causes the head to step out one track (towards track 0).

continued ....

WG	Write Gate. Control signal generated by the FDC. Active state, logic high. When active, enables current to flow into the disk drive read/write head.
WD	Write Data. Output for writing MFM encoded data to the disk drive.
RAW RD	Raw Read. Input to the FDC for MFM encoded data from the disk drive.
READY	Input to the FDC from the disk drive. When set to logic high, indicates that the selected disk is ready for data transfer operations. When set to logic low, indicates that the selected disk is not available. In this condition attempted data transfer operations between the FDC and the disk drive are inhibited, and cause an active interrupt request to be generated on INTRQ. READY also sets an associated control bit within an internal register according to the logic state on the control line.
$\overline{TR00}$	Track 00. Control input from the disk drive. When $\overline{TR00}$ is set to logic low, indicates to the FDC that the read/write head of the selected drive is positioned over track 0 of the disk.
IP	Index Pulse. Control input from the disk drive. A negative going pulse generated every revolution of the disk, which informs the FDC of the start of the first sector of each track.
$\overline{WPRT}$	Write Protect. Control input from the disk drive. When $\overline{WPRT}$ is set to logic low, any attempted write operation to the selected drive is inhibited. $\overline{WPRT}$ also sets an associated control bit within an internal register according to the logic state in the control line.

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INTRODUCTION

This chapter provides information on the standard disk drive fitted within the Apricot, the Sony OA-D31V MicroFloppy Disk Drive, which is characterised by incorporating a single read/write head and utilising 70 track single-sided MicroFloppy disks.

The disk drive is mounted on a metal chassis assembly above the System Board in the System Unit and held in position by two pairs of screws in each of the chassis side plates.

DISK DRIVE

Connections from the disk drive controller, the Floppy Disk Interface on the System Board, are linked to the drive via a 26-way ribbon cable assembly. Power supply connections to the drive also originate from the System Board and are provided by a 4-wire cable assembly.

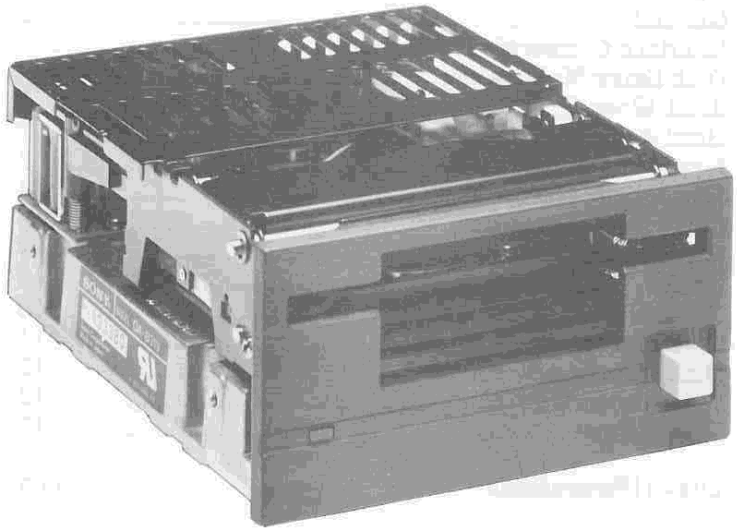


Figure 1. MicroFloppy Disk Drive

DESCRIPTION

General

The disk drive contains all the necessary electronics and mechanics for transferring MFM encoded serial data between the MicroFloppy disks and the System Board.

The electronics consist of:

(a) The interface to the disk controller (housed on a single printed circuit control board located at the base of the drive).
(b) A series of sensors for detecting various conditions within the drive (e.g. When the head is positioned over Track 0 of the disk, when a disk is in the drive, etc.).

(c) The read/write head tranducer circuitry for reading and writing data from/to the disk.

The mechanics consist of the disk drive mechanism, the disk loading/eject mechanism, and the mechanisms for positioning and engaging the read/write head.

Interface Connections

Connections between the disk drive and the System Board consist of four types; MFM encoded data signals, control input signals, status output signals and power supply lines. The latter is supplied via the four wire cable assembly; the remaining three types via the 26-way ribbon cable. All signals supplied via the 26-way ribbon cable are at TTL logic levels, apart from the Index Pulse, which is driven by an open collector.

The function of each connection is detailed in tabular format following the interface connection block diagram below.

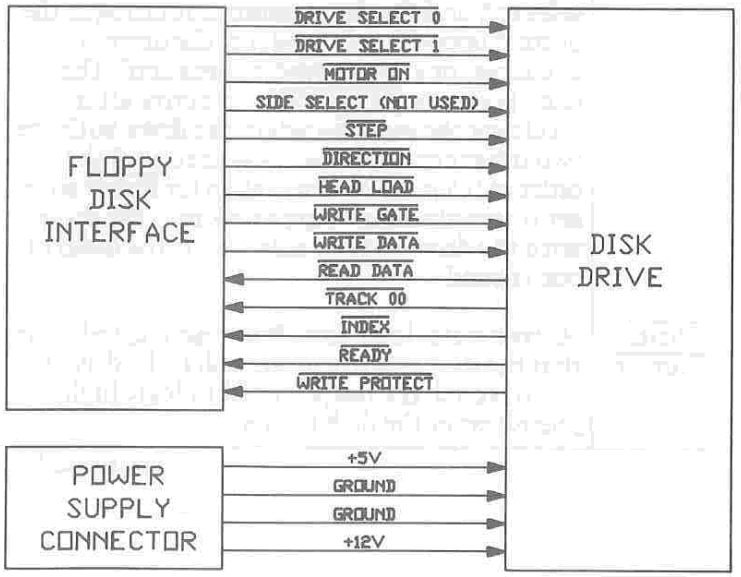


Figure 2. Interface block diagram

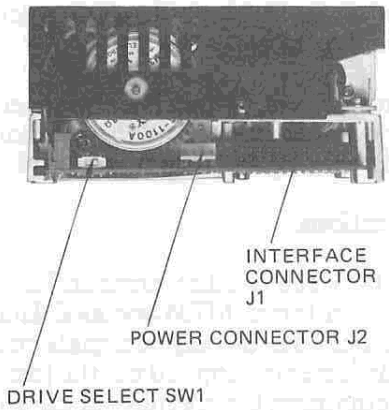


Figure 3. Connector Location

Interface Connections (Outputs)

$\overline{\text{Ready}}$	Active state, logic low. When active, indicates that a disk is within the drive, the drive is selected, and the drive motor is rotating at the normal operational speed (i.e. the drive is available for a data transfer operation). The time taken for $\overline{\text{Ready}}$ to be set active after receiving the input to select the drive with the two other conditions already met, is of the order of 0.5 μs. The time taken for $\overline{\text{Ready}}$ to be set active after inserting a disk into the drive with the drive already selected, is the order of one second.
$\overline{\text{Write Protect}}$	Active state, logic low. When active, indicates that the disk is write protected. If the drive is not selected, the output is set to logic high, regardless of the disk status.

continued ....

$\overline{\text{Index}}$	Index pulse which acts as the reference for the start of a track. Short duration negative going pulse (150 to 350 μs), generated once per revolution of the disk (i.e. every 100 ms at normal operational speed). If the drive is not selected, the output is held at logic high.
$\overline{\text{Track 00}}$	Active state, logic low. When active, indicates that the head is positioned over Track 0. If the drive is not selected, the output is set to logic high regardless of the position of the head.
$\overline{\text{Read Data}}$	MFM encoded serial data stream from the disk. If the drive is not selected, the output is forced to logic high.

Interface Connections (Inputs)

$\overline{\text{Drive Select 0}}$	Active state, logic low. When active, selects the drive for operation, if the drive is configured as drive 0 by a switch at the rear of the unit.
$\overline{\text{Drive Select 1}}$	Active state, logic low. When active, selects the drive for operation, if the drive is configured as drive 1 by a switch at the rear of the unit.
$\overline{\text{Motor On}}$	Active state, logic low. Hardwired to 0V on the System Board. The drive is configured by a switch on the underside of the unit so that the drive motor is switched on only when a disk is within the drive.
$\overline{\text{Step}}$	A negative going pulse generated by the disk drive controller which moves the read/write head, if the drive is selected. Each pulse causes the head to be moved to an adjacent track location, in the direction specified by the direction input.

continued ....

Direction	For each valid step pulse, the head moves in one track location towards track 69, if the direction control line is at logic low; and one track location towards track 0, if at logic high. If the head is already at either track 0 or track 69 and a step pulse is issued with the direction input set to move the head outside the normal track range, the head is held stationary.
Head Load	Active state, logic low. When active, causes the disk to make contact with the drive head, if the drive is selected. An indication that the head is loaded is provided by the activity indicator on the front panel. If the drive is deselected, whilst the head load signal is still active, the head remains loaded.
Write Gate	Active state, logic low. When active; enables the drive write control circuits to receive the write data from the disk controller; switches current through to the read/write head; and also enables the tunnel erase head. Set to the inactive high state during disk read and all head positioning operations.
Write Data	MFM encoded serial data. Changes the polarity of the current flowing through the read/write head on each negative-going transition, providing the following conditions are met: 1. The drive is selected. 2. The Write Gate input is active. 3. A write unprotected disk is inserted. 4. The drive motor is rotating at operational speed. 5. The head has been loaded and is stationary.

Disk Drive Mechanism

The disk drive mechanism is a brushless direct drive motor, which employs a velocity servo control circuit to ensure that the disk rotates at a constant speed of 600 rpm. The drive is configured so that the motor rotates only when a disk is within the unit. Removal of the disk from the drive causes the motor to stop. The time taken for the motor to reach the normal operating speed, following the insertion of a disk, is the order of one second.

The servo control circuit also generates the index pulse once per revolution of the disk.

Read/Write Head

The head consists of a read/write element and a pair of tunnel erase heads which provide guard bands for adjacent tracks. Current is supplied to the read/write element on receipt of an active Write Gate signal from the disk controller, which also activates the tunnel erase section.

Head Positioning Mechanism

The head positioning mechanism uses a stepping motor and a guide arm controlled by a needle screw to precisely position the read/write head over the tracks on the disk. Control of the movement of the head is supplied by the Step and Direction inputs from the disk controller. On application of the power supplies, the drive automatically generates control signals to position the head over Track 0.

Head Load Mechanism

Head loading is controlled by the Head Load signal from the System Board. When the signal is active, a plunger causes a pressure pad to press the disk against the head. The activity indicator on the front panel of the unit remains illuminated, as long as the head remains loaded.

Sensors and Detectors

A series of photo-sensors and associated detector circuits are fitted in the drive. These generate status output signals to the disk controller, on detecting the conditions detailed below.

(a) A disk is within the drive (Ready).
(b) The disk is write protected (Write Protect).
(c) The head is positioned over Track 0 (Track 00).
(d) The start of each track (Index Pulse).

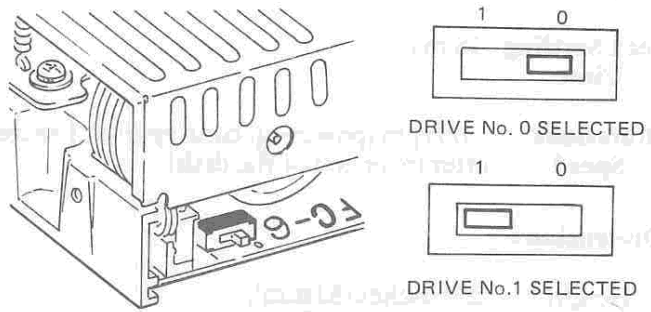
Drive Switch Settings

Two switches are located on the drive, which are set according to the application of the drive within the system. One switch (SW1) determines which of the two drive select input signals switch the drive to an operational condition. The second switch (SW2) determines the method of switching on the disk drive motor.

The drive select switch is located at the rear of the unit (see Figure 4). In single disk drive systems, the switch is set to drive position 0. In dual drive systems, the left hand drive (as viewed from the front of the System Unit) is configured as Drive 0, and the right hand drive is configured as Drive 1.

The motor control switch is located on the circuit board in the base of the unit, just behind the front panel (see Figure 4). The switch must be set to position B, so the disk motor rotates only when a disk is within the drive. Setting the switch to position A, will cause the disk motor to rotate, regardless of whether a disk is within the unit or not.

Drive Select Control



Drive Motor Control

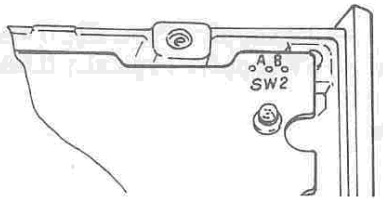


Figure 4. Disk Drive Switch Settings

Drive Specification

Media	3.5 inch 70 track single-sided MicroFloppy Disks. Soft-sectored with 9 sectors per track, 512 bytes per sector, producing a total formatted data capacity of 315 Kbytes per disk. Encoded with double density MFM data.
Data Transfer Rate	500 kbits/s.
Media Life	More than 10^6passes/track.
Track density	135 tracks per inch.
Track-to-track access time	15 ms.

DISK DRIVE

Head Load Time	60 ms.
Head Settling Time	15 ms.
Rotational Speed	600 rpm (power-up time approx. 1 second after insertion of the disk).

Dimensions

Height	2.0 inches (51mm).
Width	4.0 inches (102mm).
Depth	5.1 inches (130mm).
Weight	1.5 lbs. (700g).

Current Consumption	+12V supply: Typically 0.4A (max. 1.5A) +5V supply: Typically 0.6A (max. 0.8A)

Environmental Conditions

1. Operating

Temperature	40F to 115F (5C to 45C).
Humidity	20% to 80% relative humidity, with a wet bulb temperature of 85F (29C) and no condensation.

2. Storage

Temperature	–40F to 140F (–40C to 60C)
Humidity	5% to 95% relative humidity,(no condensation).

DISKS

General

Note: To ensure complete compatibility with the Apricot, only ACT approved MicroFloppy disks should be used with the disk drive. Using non-ACT disks, not manufactured to the same high standard, may result in intermittent read and write errors, rendering information stored on the disk totally unintelligible.

The Sony OA-D31V disk drive uses 3.5 inch 70 track single-sided MicroFloppy disks. The disks are encased in a rigid plastic shell and feature an automatic shutter and a metal centering hub.

Two versions of MicroFloppy disks exist, which are directly compatible and interchangeable, the only differences being in minor mechanical details. The auto shutter of the earlier versions of the disks can be latched open, exposing a portion of the disk surface. The latch is released by squeezing the corner of the disk, marked by the arrow labelled "PINCH". On later versions of the disk, the shutter cannot be latched open.

The shutter protects the disk media from contamination by dust, dirt or fingerprints, allowing the disk to be easily handled without affecting the integrity of stored data. When inserted into the drive, the shutter automatically slides open, allowing the read/write head of the drive access to the recording media. Removal from the drive automatically closes the shutter.

The metal centering hub ensures that the disk is accurately positioned on the disk drive motor spindle.

Disk Precautions

The same precautions apply to the MicroFloppy disks as any other magnetic recording media. **Do not:**

(a) Touch the disk surface.
(b) Allow the disk to be placed in the proximity of other magnetic materials or other sources of magnetic fields.
(c) Expose the disks to heat or direct sunlight.
(d) Attempt to clean the disk surface.

Disk Insertion/Removal

Insert the disk into the drive shutter side first, with the metal centering hub facing downwards. The disk should slide into the drive with the minimum degree of force. Immediately the disk is inserted, the head is momentarily loaded to seat the disk properly onto the drive spindle. This causes the front panel activity indicator to be briefly illuminated. Improper insertion results in the disk not being accepted by the drive.

Remove the disk by pressing the front panel disk eject button. The disk eject button should not be pressed, whilst the activity indicator is illuminated.

Write Protecting

The method of write protecting the disk is different on the two versions of disk. The earlier versions feature a Write Protect tab, located on the rear of the disk in the lower right corner. Breaking off the tab prevents any further data being written onto the disk. The tab then should be inserted into the bottom of the recess at right angles to its original orientation (i.e. as close as possible to the lower edge of the disk). Write protected disks can be rewritten on, by moving the tab to the top of the recess.

On the later versions of the disk, write protecting the disk is achieved by sliding the tab to the lower position, creating a window in the lower left corner of the disk. To allow the disk to be rewritten onto, slide the tab back over the window.

Disk Format

Each of the 70 tracks on the disk is divided into sectors under software control (i.e. soft sectored), with the beginning of each track indicated by the index pulse generated by the drive motor assembly. The software format chosen for the disks is a derivation of the IBM system 34 format for 8 inch disks. This uses double density MFM encoded data, with 9 sectors per track and 512 bytes per sector. The total storage capacity of the 70 track disk is thus 315 Kbytes of formatted data (9x70x512 bytes).

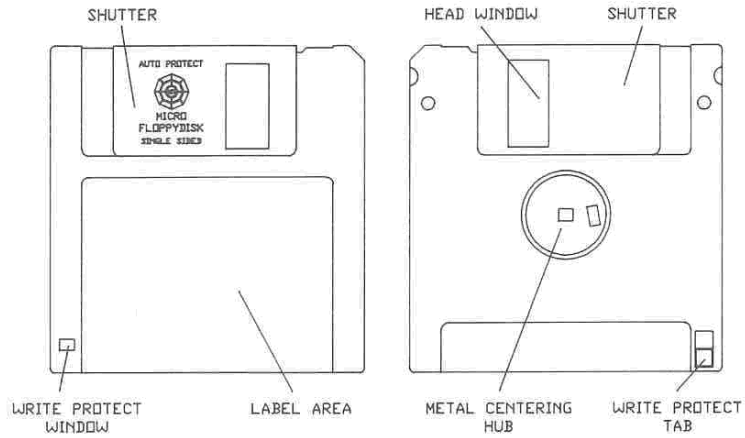


Figure 5. Microfloppy Disks