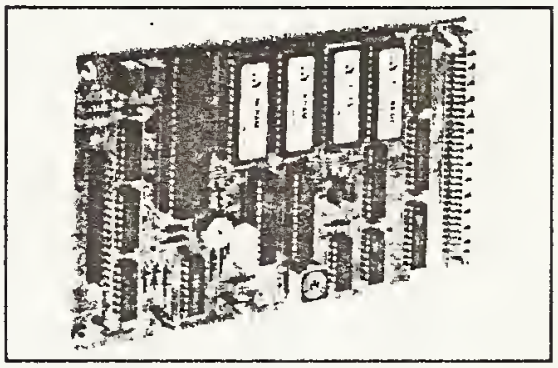
CUBE Technical Manual

CUBE Doublestore Double Density Disk Controller

Control Universal Limited

CUBE Doublestore
Double Density Floppy Disk Controller



CUBE Doublestore

CB200AA-5H-3

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CUBE Doublestore: Double Density Floppy Disk Controller

1.1 - Features

* Full operation with BBC BASIC on EuroBEEB
* Provides the disk controller for EuroBEEB
* 1 MHz or 2 MHz operations
* Single or double density
* On-board formatter
* Will support both 3 1/2" and 5 1/4" disk drives
* Full Microware DDFS software for 6502 users
* Four drive operation for 6809 FLEX users
* Versatile memory mapping including sideways facilities
* Four 28-pin paged memory sockets
* Supports BBC-compatible DFS and FLEX disk formats

1.2 - Overview

CUBE Doublestore was primarily developed to provide the disk controller for use with EuroBEEB. The design was influened by the licence agreement for the Microware . Double-density Disk Filing System (DDFS), and uses the Western Digital 2793 FDC device. With CUBE Doublestore, the complete range of Microware disk commands are available to the user.

As part of the EuroBEEB system, the disk filing system had to be in a sideways ROM. EuroBEEB does not (because of the lack of board space) support sideways ROMs, so Doublestore has been designed with four sideways ROM sockets. One is used to house BASIC, which must be transferred from its socket on the EuroBEEB, and one is used for the DDFS.

The other two sockets are spare, and can be used for either two 16kB devices, or as a pair of 8kB devices making 16kB in total.

1.3 - 1 MHz or 2 MHz Operations

CUBE Doublestore is able to run on both 1 MHz and 2 MHz CPU cards. The 2 MHz option is achieved by simply fitting the on board link LK2. Double density is only available with a 2 MHz CPU, since the data rate is too great for a 1 MHz processor.

1.4 - Double or Single Density

When the CUBE Doublestore is running with a 2 MHz CPU, both double and single densities are available. When a new disk is inserted the CUBE Doublestore attempts to access it in the same density as the last disk. If the disk does not respond, a second attempt is made in the other density. This is why disk access sometimes appears to be slow on the first attempt. During formatting the density can be selected by the user.

1.5 - 3 1/2" and 5 1/4" Disk Drives

CUBE Doublestore is able to offer true plug-in compatibility between the 3 1/2" or 5 1/4" disk drives. The user need only plug in whichever drive is required, even one of each.

1.6 - Formatting

The Format command is resident in the DDFS ROM on the 6502 systems and on the FLEX master disk for 6809 systems.

*FORMAT <drive> <density> <number of tracks> <disk name>

is the instruction for the 6502 system. This formatter generates a large data table in RAM from &6000. Therefore, to use this facility, RAM must be available from &6000 to &7FFF.

This may be achieved with the mapped RAM option on CUBE Doublestore or with a memory card such as CU-MEM.

NOTE: Any user code or data in this area will be overwritten by the data table. On a 6809 system the formatter is initiated by typing NEWDISK <drive number>. This is a menu driven system which will prompt the user to specify density, tracks etc. Again a large data table is generated but the space for it is allocated by FLEX, and provided that there is enough space no user data should be destroyed.

1.7 - The Sideways System

In order to use more complex software, such as the DDFS filing system, space must be found within the memory map to accommodate the new commands. This is done by reserving an area of the memory and switching ROMs into and out of the hole. On both the 6502 and 6809 systems, the hole is the 16kB from &8000 to &BFFF. On a 6502 system the MOSB ROM also makes use of these facilities to control the BASIC, DDFS, FORTH and other ROMs. Switching between the ROMs is automatic. As the FLEX operating system is essentially disk based, it does not need to make use of sideways area. Paging can be used effectively with both processors to keep user programs in ROM or to provide a large, fast access data storage area.

1.8 - The Concept of SIDEs

The memories which are paged in and out are usually known as 'pages'. This usage is somewhat confusing since a 'page', as far as the processor is concerned, is a 256 byte block of memory. As far as BBC BASIC is concerned PAGE is a pseudo variable which contains the start address of a user's BASIC program. To remove these ambiguities we have used the word 'SIDE' to denote a sideways memory which can be paged in or out. This usage is consistent with the command *SIDE <number> which is part of the SIDEMON sideways monitor for EuroBEEB (or EuroCUBE-65) systems.

1.9 - Using the Sideways Area

The SIDEs in the sideways area are switched by writing the appropriate page number to the 6-bit page control latch. This is located at &FE30 on the 6502 systems and at &EE30 on the 6809 systems. As the MOSB ROM is also using the sideways area, it is nescessary to inform the operating system when a page is changed. This is done by writing the new page number to location &F4. The selected memory device is now in the memory map between &8000 and &BFFF. When the system is RESET the Doublestore will select SIDE 0.

1.10 - Versatile Memory Maps

CUBE Doublestore has four on-board memory sockets which can be configured in a number of ways, depending upon the positions of LK3 and LK5. The four sockets can be arranged as follows:

1. Four sideways ROMs.

2. Two sideways ROMS and one 16kB sideways RAM.

3. Two sideways ROMs and 16kB of memory-mapped RAM from &4000 to &7FFF.

If one of the two RAM options is to be used, the devices must go into the sockets marked IC3 and IC4.

1.11 - Memory Device Options

The memory devices on a Doublestore will respond as follows:

Option 1 : LK3 2-3 ; LK5 2-3

IC2 is a 27128 appearing as SIDE 1
IC3 is a 27128 appearing as SIDE 2
IC4 is a 27128 appearing as SIDE 0
IC5 is a 27128 appearing as SIDE 3

Option 2 : LK3 2-3 ; LK5 1-2

IC2 is a 5565 appearing as half of SIDE 2
IC3 is a 5565 appearing as half of SIDE 2
IC4 is a 27128 appearing as SIDE 0
IC5 is a 27128 appearing as SIDE 3

Option 3 : LK3 1-2 ; LK5 2-3

IC2 is a 5565 in the memory map from &4000 to &5FFF
IC3 is a 5565 in the memory map from &6000 to &7FFF
IC4 is a 27128 appearing as SIDE 0
IC5 is a 27128 appearing as SIDE 3

NOTE: The RAM in Option 3 is NOT battery-backed.

1.12 - Relocation of Doublestore

It is possible to change the SIDE (ROM number) which the sockets represent, by changing the hex micro-dip switch SW1. This is normally set to zero, giving the ROM numbers previously stated for a given option. If SW1 = 1, then this increases the SIDE number by 4. If SW2 = 2, then the SIDE number is increased by 8.

i.e.

For Option 1

SW1	IC 2	3	4	5
0	1	2	0	3
1	5	6	4	7
2	9	10	8	11
:	:	:	:	:

The effect of SW1 on the other options is similar, except that the linear RAM is not affected by the position of SW1.

For details of using Doublestore in the same system as a CU-MEM Selecta, please consult the appropriate section in the CU-MEM Selecta manual.

1.13 - Getting Started

All disks MUST be formatted before they are used. Double density is available on 2 MHz 6502 systems and on both 1 MHz and 2 MHz 6809 systems. Up to four double-sided drives can be supported on a 6809 system, while only two drives are supported by 6502 systems. Each side of the disk is treated as a separate drive.

The TOP side of the FIRST disk is drive 0 and the BOTTOM side is drive 2. The TOP side of the SECOND disk is drive 1, and the BOTTOM side is drive 3.

Any errors which are encountered are reported at the end of a format. If the DDFS reports that all the tracks are corrupted, it is likely that there is not enough RAM for the formatter data table. The RAM can be provided by selecting memory map 3 on CUBE Doublestore.

EuroBEEB users who are adding the CUBE Doublestore to their systems, MUST REMOVE THE BASIC ROM FROM THE M1 SOCKET ON THE CPU AND REPLACE IT IN THE SOCKET MARKED IC5 ON THE CUBE DOUBLESTORE.

They must also ensure that the DDFS ROM occupies the lowest 'SIDE' (or ROM number) of any of the ROMs. The DDFS intercepts service calls to ROMs and prevents these calls from being passed on to lower SIDEs.

6809 users must deselect any RAM in the &8000 to &BFFF area. If the sideways facilities are not required on tne 6809 system, the RAM can be left in, providing that the locating switch is moved to position 1. This will force the sideways sockets to respond to ROMs 4, 5, 6 and 7. Since CUBE Doublestore powers up with ROM 0 selected, there will be no conflict.

1.14 - Real Time BASIC in Doublestore

Real Time BASIC can be used in Doublestore with the following switch settings and ROM positions.

Option 2

LK3 2-3
LK4 not connected
LK5 1-2
SW1 0 (usually)

IC2 Real Time BASIC
IC3 5565 : 8k RAM
IC4 DDFS
IC5 BASIC

1.15 - Summary of Links and Switches on Doublestore

LK1 Not used
LK2 2 MHz operation (if fitted)
LK3 Determines memory map with LK5
LK4 Not used
LK5 Determines memory map with LK3
SW1 Relocates the ROM positions (SIDEs) in the sideways memory map

1.16 - Controlling the Paging in 6502 MOSB Systems

The user can change SIDEs by writing to the SIDE control latches. In the 6502 system the user must also inform the operating system of the change of SIDE. If this is not done, the old SIDE will be switched back after an interrupt.

A new SIDE number is written into location &F4 as well as &FE30. When user access has been completed, the SIDEs must be switched back. Please note that SIDE control cannot be directly achieved from a language, since the language will be switched out. For the same reason, a file cannot be loaded directly into the side area from disk. A number of operating system functions can be used to access the paged memory. These are OSRDRM and OSWORDs 5 and 6

NOTE: OSWORDs are a set of operating system routines, located at &FFF1, which perform various machine functions. The required routine is specified by the accumulator, and the X and Y registers point to some parameters for the routine.

X = Low byte of the address of the first parameter.
Y = High byte of the address of the first parameter.

1.17 - OSRDRM read a byte from paged memory

This subroutine, located at &FFB9, is a fast read byte from paged memory.

On entry:

The Y register contains the SIDE number.

Locations &F6 and &F7 contain the address of the byte to be read (low byte first).

On exit:

The accumulator contains the byte read.

NOTE: The Y register is destroyed by this call, locations $F6 and $F7 are used by other routines in sideways ROMs and may be changed by them.

1.18 - OSWORDs 5 & 6

These two OSWORDs can now be used to read or write a byte in the sideways area. The OSWORDs work exactly as normal except for a fifth parameter which specifies which paged ROM is switched in. These OSWORDs will automatically switch back the original page when the call is completed.

1.19 - OSWORD 5 : Read a byte from paged memory

On entry:

Accumulator = 5
X and Y point to the parameter block (low byte, high byte)

Parameter block base address

+0	=	Low byte of address to be read
+1	=	High byte of address to be read
+2	=	0
+3	=	0
+4	=	Doesn't matter
+5	=	The SIDE number (page number)

On exit:

The byte that was read is in location parameter +4.

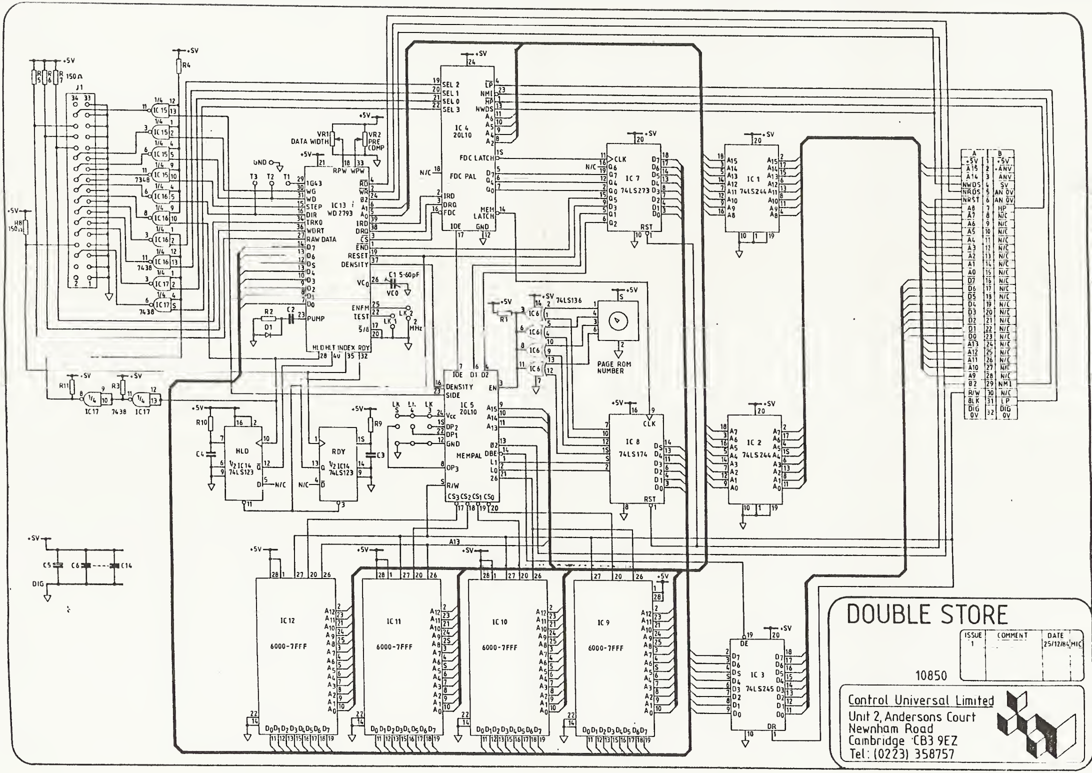
1.20 - OSWORD 6 : Write to paged memory

On entry:

Accumulator = 6
X and Y point to the parameter block (low byte, high byte)

Parameter block base address

+0 = Low byte of address of byte to be written
+1 = High byte of address of byte to be written
+2 = 0
+3 = 0
+4 = The byte to be written
+5 = The SIDE number (page number)



DOUBLE STORE

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Control Universal Limited
Unit 2, Andersons Court
Newnham Road
Cambridge CB3 9EZ
Tel: (0223) 358757