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Subject: Cortland Banks \$E0/\$E1 Memory Map

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### Revision History

- 00:00 Initial release.
- 00:10 Exact locations of memory used defined.  
Mousekit/Double Hi-Res graphics routines/Multiple slot use.  
firmware RAM deleted from requirements.  
Various allocations increased and decreased in size.
- 00:20 Exact locations of memory used redefined.  
Size available to firmware routines reduced.  
Dedicated RAM for non-interrupt/interrupt/general buffer eliminated.  
Dedicated RAM for DeskAccessory manager eliminated.  
Dedicated RAM for general super hi-res usage eliminated.  
Dedicated RAM for sound toolkit eliminated.  
RAM for new entry points and for memory manager allocated.  
Capability module manager renamed Tool Locator.  
Language card in bank E1 is tentatively reserved for AppleTalk or  
Finder.
- 00:30 SANE reserved bytes removed.  
Clock buffer increased by 3 bytes.  
Memory manager buffer decreased by 3 bytes.  
User access vectors/new entry points/monitor increased by 8 bytes.
- 00:40 Disk transfer buffer increased to 4 pages.  
Disk buffer2 removed.  
Desk Accessory Manager buffer increased by 2K to 4.5K bytes.  
Keyboard input buffer for buffering mode added.  
Clock buffer increased by 3 bytes.  
Serial input buffer moved.  
16K AppleTalk buffer defined for higher level protocols.  
Future system expansion RAM dropped from 4K to 2.25K.  
All addresses in bank E1 changed.  
Super hires graphics vector RAM removed.
- 00:50 FDB interrupt queue moved.  
Serial port variables moved and doubled in size.  
Memory manager lost 16 bytes.
- 00:60 Keyboard interrupt input buffer removed.  
Reserved space for future expansion grew by 256 bytes.  
Environment save area for disk routines, firmware zero page save  
area for disk routines, system zero page save area for disk  
routines, and scratch RAM for disk routines has been consolidated  
into one buffer called Disk ports' usage only.
- 00:70 Sound variable storage area added.

Serial port buffers area increased.  
Reserved area decreased.  
Disk transfer buffer decreased.  
Additional FDB variable storage area added.  
Memory Manager permanent storage area decreased.  
00:80 Miscellaneous Tool buffer added.  
QuickDraw // vector buffer added.  
Disk transfer buffer reduced in size by 6 bytes.  
Reserved for future system expansion space reduced by 512 (\$200)  
bytes.  
Bank E0 language card area is now occupied by the Prodos System  
Loader and AppleTalk buffers.  
Bank E1 language card area is now occupied by AppleTalk and AppleTalk  
buffers.  
00:90 Memory manager buffer reduced in size.  
Text Tools buffer assigned.  
Front desk bus storage area reduced.  
Serial ports given more buffer area.  
Extra buffer given to desk accessory manager.  
Reserved space reduced by 1 page.  
01:00 Memory manager buffer reduced.  
Serial ports buffer space increased.  
Miscellaneous tools buffer space increased.

'1' indicates change in text.

This document identifies the firmware RAM in Cortland. All memory references in this document refer to RAM locations designated in the diagram call "Memory Map of Banks E0 and E1" contained in this document. On the graph, pages and pgs refers to hex pages (\$100) and K refers to 1024 byte decimal blocks.

Firmware RAM should be and must be divided into the following categories.

1. RAM for firmware permanent storage
2. RAM for desk accessories data area usage
3. RAM for operating system expansion usage
4. RAM for memory manager usage
5. RAM reserved for future usage
6. RAM for Tool Locator usage
7. RAM for front desk bus (FDB) manager
8. RAM for AppleTalk higher level routines
9. RAM for Quickdraw // vectors

Each category above will be referred to as option #x where x is 1-7 in the rest of this document.

#### Option #1

<u>Use</u>	<u>Memory Required in Bytes</u>
1. AppleTalk (Buffer only)	1250 = \$04E2
2. Disk I/O (Disk ][ and dumb Sony)	1080 = \$0438
3. Mouse	8 = \$0008
4. Serial ports	40 = \$0028
5. Monitor / User access vectors	696 = \$02B8
6. Battery backed up RAM (BATTERYRAM)	256 = \$0100
7. Clock routines	32 = \$0020
8. Serial input buffer	556 = \$022C
9. Sound	32 = \$0020
	(3950) = (\$0F6E)

#### Option #2

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Desk accessory application buffer storage	4864 = \$1300

#### Option #3

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Prodos System Loader/AppleTalk buffers	16384 = \$4000

Option #4

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Memory manager	0954 = \$038A

Option #5

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Reserved for future system expansion	1837 = \$072D

Option #6

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Tool Locator	16 = \$0010

Option #7

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Front desk bus address/attribute list	64 = \$0040
2. Front desk bus interrupt queue	16 = \$0010
3. Front desk bus variables	38 = \$0026

Option #8

<u>Use</u>	<u>Memory Required in Bytes</u>
1. AppleTalk higher level protocols	16,384 = \$4000

Option #9

<u>Use</u>	<u>Memory Required in Bytes</u>
1. QuickDraw //	512 = \$0200

Option #10

<u>Use</u>	<u>Memory Required in Bytes</u>
1. Miscellaneous Tools Locator Usage	37 = \$0025

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SUBTOTAL ----- 45,056 = \$8000

131,072 total bytes available in banks E0 and E1

77,824 bytes total non-video memory available

32,768 non-video memory not assigned

45,056 non-video memory assigned

53,247 bytes video memory assigned

Memory Map of Banks E0 and E1

Bank E0		Bank E1
E0 Main Language Card 20 pages (8k reserved)	<---- \$FFFF ---->	E1 Aux Language Card 20 pages (8k reserved)
Bank 0   Bank 1 10 pgs (4k   10 pgs (4k reserved)   reserved)	<---- \$E000 ---->	Bank 0   Bank 1 10 pgs (4k   10 pgs (4k reserved)   reserved)
I/O always active	<---- \$D000 ---->	I/O always active
	<---- \$C000 ---->	20 pages (8k free space)
60 pages (24k free space)	<---- \$A000 ---->	
	<---- \$8000 ---->	Super Hi-Res (\$2000-\$9FFF)
	<---- \$7000 ---->	
	<---- \$6000 ---->	
Double Hi-Res Page 2 (\$4000-\$5FFF)	<---- \$5000 ---->	Double Hi-Res Page 2 (\$4000-\$5FFF)
	<---- \$4000 ---->	
Double Hi-Res Page 1 (\$2000-\$3FFF)	<---- \$3000 ---->	Double Hi-Res Page 1 (\$2000-\$3FFF)
14 pages (5k reserved)	<---- \$2000 ---->	14 pages (5k reserved)
Text Page 2	<---- \$0C00 ---->	Text Page 2
Text Page 1	<---- \$0800 ---->	Text Page 1
4 pages (1k reserved)	<---- \$0400 ---->	4 pages (1k reserved)
	<---- \$0000 ---->	

### Application Notes for Bank E0/E1 Usage

1. Language card area is switched by the same soft switches used to switch Apple // simulation language cards in banks 00 and 01.
2. Before switching language card banks or ROM for RAM or RAM for ROM current configuration must be saved. It must be restored after the subroutine is finished accessing the switched in area. This is facilitated by use of the memory status softswitch.
3. User applications may freely use any of the video buffers not needed for its own screen display. Text oriented applications can recover huge graphics buffers for its own use. 32K of data in E1 and another 16K in E0 can be used by a text application.
4. Firmware may NOT use any of the video buffers for anything except video displays since it has no way of determining which video modes a user's application will need.
5. Applications and possible firmware may make use of the shadowing ability in Columbia to display overlay data to the screen. For instance in simulation mode the user's application writes into banks 00 and 01 which is shadowed into E0 and E1 where the Mega// reads and displays the data from. An overlay would write directly to banks E0 and E1 to show things to the user. When the overlay is no longer needed the application/firmware need only load and store (use the MWN or MVP for speed) the data overlaid in banks 00 and 01 and allow the hardware to shadow the data into banks E0 and E1. This method means the application doing the overlay does not have to save the part of the screen it overlays.
6. I/O space from \$C000 to \$CFFF are always mapped in and can never be mapped out regardless of soft switches accessed.

Byte by Byte Usage of Banks E0 and E1

Bank E0

<u>Address Range</u>	<u>Usage</u>
\$E000-\$FFFF	Prodos System Loader/AppleTalk buffers or ROM
\$D000-\$DFFF bank 0	Prodos System Loader/AppleTalk buffers or ROM
\$D000-\$DFFF bank 1	Prodos System Loader/AppleTalk buffers or ROM
\$C000-\$CFFF	I/O always mapped in
\$6000-\$BFFF	Memory managed by memory manager
\$4000-\$5FFF	Double and Regular Hi-Res screen page 2
\$2000-\$3FFF	Double and Regular Hi-Res screen page 1
\$1E00-\$1FFF	QuickDraw // vectors
\$0C00-\$1DFF	Desk accessory buffer
\$0800-\$0BFF	Text Page 2
\$0400-\$07FF	Text Page 1
\$0300-\$03FF	Storage area for desk accessory buffer
\$0000-\$02FF	768 (\$0300) bytes reserved for expansion



## Bank E1

<u>Address Range</u>	<u>Usage</u>
\$E000-\$FFFF	AppleTalk code/buffers or ROM
\$D000-\$DFFF bank 0	AppleTalk code/buffers or ROM
\$D000-\$DFFF bank 1	AppleTalk code/buffers or ROM
\$C000-\$CFFF	I/O always mapped in
\$A000-\$BFFF	Memory managed by memory manager
\$2000-\$9FFF	Super Hi-Res screen
\$4000-\$5FFF	Double Hi-Res screen page 2
\$2000-\$3FFF	Double Hi-Res screen page 1
\$1DD8-\$1FFF	Serial input buffer
!\$1DD0-\$1DD7	Miscellaneous tool variables
!\$1DB0-\$1DCF	Sound variables buffer
!\$19B8-\$1DAF	1016 (\$03F8) bytes reserved for expansion
!\$15FE-\$19B7	Memory manager buffer
!\$15C9-\$15FD	Reserved
!\$15C1-\$15C8	Serial port variables
!\$15AA-\$15C0	Text Tools storage area
\$158A-\$15A9	Serial port variables
\$154A-\$1589	FDB address/attribute list
\$14E2-\$1549	Disk ports' usage only
\$1000-\$14E1	AppleTalk (Page aligned)
\$0FFC-\$0FFF	Serial port storage area
\$0FD6-\$0FFB	Front Desk Bus storage area
\$0FD0-\$0FD5	Miscellaneous Tool usage
\$0C00-\$0FCF	Disk transfer buffer (Page aligned)

\$0800-\$0BFF	Text Page 2
\$0400-\$07FF	Text Page 1
\$03E0-\$03FF	Clock buffer
\$03D0-\$03DF	FDB interrupt queue
\$03C0-\$03CF	Tool Locator variables
\$02C0-\$03BF	BatteryRAM buffer
\$02B8-\$02BF	Mouse clamps
\$0000-\$02B7	User access vectors/new entry points/monitor