THE HELIX APPLE BUBBLE MEMORY WITH PRODOS
EPROM VERSION 3.40

OVERVIEW

Besides supporting APPLE DOS3.3, PASCAL 1.1, and SOFTCARD CPM 2.23 as
previous versions did, the EPROM version 3.40 contains additional code
that enables the Helix Apple Bubble Memory (ABM) board to operate as a
disk device under the PRODOS operating system. Because PRODOS was
designed to support the installation of third party device drivers, no
patching of the operating system is required. Under PRODOS, the ABM board
is recognized as a storage device with 256 blocks and is able to cold
boot the system when loaded with the necessary files.

INSTALLATION

1) With the power to the computer OFF, place the ABM board in any slot
   below the slot containing the disk controller card. With the PRODOS
   system disk in the disk drive, turn on the computer and boot the
   operating system.

2) Choose "S" from the menu to "DISPLAY SLOT ASSIGNMENTS." The word
   "PROFILE" should appear in the slot assigned to the ABM. Return to the
   menu.

3) Choose "F" from the menu for "PRODOS FILER (UTILITIES)" and then
   choose "V" for "VOLUME COMMANDS."

4) Choose "F" from the menu to "FORMAT A VOLUME" and provide the slot
   number and desired volume name for the ABM board. Ignore the notice
   warning that "YOU ARE ABOUT TO FORMAT A LARGE DISK" and answer the
   "destroy" question with "Y". The formatting of the ABM will take just
   a few seconds. Use the <ESC> key to return to the menu.

5) The ABM is now ready to use as a PRODOS disk. While still in the
   "VOLUME COMMAND" menu one can choose "B" to see the "BLOCK
   ALLOCATION." After providing the slot number for the bubble board, the
   screen should indicate 7 blocks used, 249 blocks free, and 256 blocks
   total.

BOOTING FROM THE ABM

The ABM board can be used to boot the PRODOS operating system if it
contains the files required for this operation. These files are normally
PRODOS, BASIC.SYSTEM, STARTUP, FILER, and CONVERT. Using the PRODOS
FILER's "FILE COMMAND" menu, these files can be conveniently copied one
at a time from a PRODOS system disk to the ABM using the "COPY FILES"
command and the wild card "?" to selectively copy the desired files. With
this done, the ABM will boot the PRODOS operating system from initial
power on if it is in a slot higher than any other disk controller card.
Of course, the usual Applesoft command PR#N or a jmp to $CN00, where N is
the slot number of the ABM, will also cause it to boot PRODOS.

MISCELLANEOUS

The checksum for version 3.40 EPROM is $03BC2A and can be determined
using the DIAGNOSTICS program on the DOS 3.3 disk.

The "COPY A VOLUME" command from the "VOLUME COMMANDS" menu will not
allow a floppy disk to ABM or vice versa transfer since their block sizes

are different. The "COPY FILES" command from the "FILE COMMANDS" menu
using the "=" wildcard is the simplest way to copy all files from a
floppy disk to ABM or vice versa.

ASSEMBLY LANGUAGE INTERFACE VIA PRODOS PROTOCOL

The bubble driver for PRODOS follows the proscribed device driver
protocol as defined by Apple Computer. Specifically the following
parameters are expected:

LOCATION	DESCRIPTION	OPTIONS
$42	Command Code	$00 = STATUS $01 = READ $02 = WRITE $03 = FORMAT (this is a NOP)
$43	Unit Number	0SSS0000 SSS = Slot number (1 to 7)
$44-45	I/O Buffer	Can be $0000 to $FFFF
$46-47	Block Number	Must be $00 to $FF
	Return Code	The processor CARRY flag is set upon return from the device driver if an error occurred. The Accumulator contains the return code. $00 = No errors $27 = I/O error $2B = Write protect error
$3A-3F	Temp Storage	Used for temporary storage by bubble driver routine. Previous values not restored when routine exited.
$FB59	Prev Unit	0SSS0000 Normally expect to find previous unit number here so can check if disk drive motor is off.

The STATUS command returns the number of 512-byte blocks available in the
X-reg (low byte) and Y-reg (high byte). The READ (WRITE) commands will
read (write) the indicated block to (from) the 512-byte I/O buffer. The
FORMAT command is really a NOP since the bubble is already formatted.
When the above addresses are loaded, the desired operation is performed
by a JSR to $Csxx where s is the slot number of the ABM and xx is the LSB
of the driver entry found at $CsFF which is $2A for EPROM version 3.40.
Normally, the ram bank is enabled and the Prev Unit number is stored at
$FB59 by the disk driver. This byte is used by the bubble driver to check
for disk motor off and is updated. However, ram bank selection is
unnecessary for bubble driver operation, and the motor checking
subroutine is a NOP if the low nibble of the Prev Unit byte is non-zero
as it is at the rom bank address. A complete description of PRODOS and
custom device driver parameters can be found in "BENEATH APPLE PRODOS" by
Worth and Lechner published by Quality Software.