

Saving Integer BASIC programs.

Apple 1 BASIC does not have a built in save/load command. On the original Apple 1 people used the ACI card (Apple cassette interface) to save/load the area(s) of memory used by BASIC. We can do the same but capture the text output to a file via our terminal emulator. All you need are the correct address's !

Just a note, the BASIC programs are stored from the highest available memory address (HIMEM) down to the lowest (LOMEM). Backwards to what you may think!

The following commands are only valid if BASIC has run at least once in order to initialize the page 0 memory locations.

The key memory locations are:

004A.004B    2 byte pointer to LOMEM, not actually needed but nice to know.  
004C.004D    2 byte point to HIMEM, this normally starts at 4k but can change depending on what was compiled in as the HIMEM address 32k,16k,4k etc. Can also be set manually.  
00CA.00CB    2 byte pointer to the end of the last BASIC line/statement.

From WOZMON you can see all the values with a single line command:

004A.004B 004C.004D 00CA.00CB

This gives:

004A: 00 08  
004C: 00 10  
00CA: 00 10

LOMEM = 0800h HIMEM=1000h PROGRAM\_END=1000h

The values are little endian, so LSB,MSB the values show HIMEM and PROGRAM\_END both 1000h no program in memory.

After typing in the following program:

```
10 PRINT "HELLO WORLD"  
20 END
```

The values now read:

004A.004B 004C.004D 00CA.00CB

004A: 00 08  
004C: 00 10  
00CA: E9 0F

Note the PROGRAM\_END has gone down to 0FE9h

### **Saving a program.**

We now have enough information to dump the memory to a file, like this:

004A.00FF 0FE9.1000

Before you press ENTER, capture the terminal output to a file (The exact method depends on the terminal software you use, see it's documentation)

The two areas of memory being saved are 004A.00FF this is ALL the page 0 variables used by BASIC. And the program itself 0FE9.1000

The actual output would be:

```
004A: 00 08 00 10 00 00
0050: 00 00 00 FB 00 F7 00 00
0058: 00 00 00 FF 00 FF 00 00
0060: 00 00 00 FF 00 FF 00 00
0068: 00 00 00 FF 08 FF 01 ED
0070: 00 00 00 ED EC ED ED ED
0078: 00 00 00 FF 00 FF 00 40
0080: 00 00 00 F7 00 5B 00 00
0088: 00 00 00 EF 00 FF 00 00
0090: 00 00 00 FF 00 FF 0C 0F
0098: 00 00 00 7D 68 80 EE FF
00A0: 00 00 00 EF 00 FB 00 02
00A8: 00 00 00 FF 00 FF 00 00
00B0: 00 00 00 FF 80 BF 00 00
00B8: 00 00 00 FF 00 FD 00 00
00C0: 00 00 00 FF FF 03 03 FF
00C8: 04 B2 E9 0F 00 08 17 E8
00D0: 00 00 00 ED 00 00 01 00
00D8: 20 00 ED 0F FB 0F 00 00
00E0: 06 02 00 10 A0 0F 00 10
00E8: 00 00 00 FF 04 04 05 05
00F0: 04 06 00 00 00 FF 00 00
00F8: 00 B0 00 00 00 20 00 ED
0FE9: 12 0A 00 61 28 C8 C5
0FF0: CC CC CF A0 D7 CF D2 CC
0FF8: C4 29 01 05 14 00 51 01
1000: 00
```

### **Loading a program.**

To reverse the process is far simpler, all you need to do is paste the text from the file above back into WOZMON.

But the last issue after pasting the text back in is launching BASIC without clearing the the memory you just pasted back in!

The answer is simple, instead of running basic with E000R, known as a cold start. You use E2B3R this entry point skips BASIC's init code, it's called a warm start.

You can even add the warm start to the end of the saved file, like this:

```
004A: 00 08 00 10 00 00
0050: 00 00 00 FB 00 F7 00 00
0058: 00 00 00 FF 00 FF 00 00
0060: 00 00 00 FF 00 FF 00 00
0068: 00 00 00 FF 08 FF 01 ED
0070: 00 00 00 ED EC ED ED ED
0078: 00 00 00 FF 00 FF 00 40
```

```
0080: 00 00 00 F7 00 5B 00 00
0088: 00 00 00 EF 00 FF 00 00
0090: 00 00 00 FF 00 FF 0C 0F
0098: 00 00 00 7D 68 80 EE FF
00A0: 00 00 00 EF 00 FB 00 02
00A8: 00 00 00 FF 00 FF 00 00
00B0: 00 00 00 FF 80 BF 00 00
00B8: 00 00 00 FF 00 FD 00 00
00C0: 00 00 00 FF FF 03 03 FF
00C8: 04 B2 E9 0F 00 08 17 E8
00D0: 00 00 00 ED 00 00 01 00
00D8: 20 00 ED 0F FB 0F 00 00
00E0: 06 02 00 10 A0 0F 00 10
00E8: 00 00 00 FF 04 04 05 05
00F0: 04 06 00 00 00 FF 00 00
00F8: 00 B0 00 00 00 20 00 ED
0FE9: 12 0A 00 61 28 C8 C5
0FF0: CC CC CF A0 D7 CF D2 CC
0FF8: C4 29 01 05 14 00 51 01
1000: 00
```

E2B3R

Many people also add a RUN command, so when the file is pasted in it will auto-run.

Have fun

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