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AUTO-START BASIC PROGRAMS

Introduction

Cartridge software (popularly called "firmware") has many advantages for the computer user. Most currently available firmware for the Commodore Vic-20 and C64 computers is written in machine language. This is well suited to many applications like games, etc. but very often it is desirable that auto-start (or auto-boot) cartridge software be written in BASIC.

This publication describes methods by which cartridge firmware can be made by VIC-20 and C64 users from BASIC programs. For this purpose, the PROMENADE C1® EPROM programmer is an excellent tool for transferring the necessary data to an EPROM. This EPROM can then be soldered or plugged into a PC board which then becomes the cartridge.

What Is Needed

When an EPROM cartridge is plugged into the Memory Expansion Port of a 20 or 64, the data stored on the EPROM is inserted into the computer's memory and is directly accessible by the computer's microprocessor.

How does the computer know a cartridge is present? It looks for five special characters at five specific addresses. These are:

VIC-20			C64		
ADDRESS	DATA	ASCII	ADDRESS	DATA	ASCII
40964 ($A004)	65 ($41)	A	32772 ($8004)	195 ($C3)	c
40965 ($A005)	48 ($30)	0	32773 ($8005)	194 ($C2)	b
40966 ($A006)	195 ($C3)	c	32774 ($8006)	205 ($CD)	m
40967 ($A007)	194 ($C2)	b	32775 ($8007)	56 ($38)	8
40968 ($A008)	205 ($CD)	m	32776 ($8008)	48 ($30)	0

If this data is present, then the program jumps to an address given by locations 40960,1 ($A000,1) (VIC-20) or 32768,9 ($8000,1) (C64).

The program at this point is necessarily written in machine language. It must first do the required system initialization. Pointers

are then set and control is turned over to BASIC in such a way that the BASIC program on the cartridge runs automatically.

The programs given in the next section include everything needed to accomplish this. What they do is to put 67 bytes in front of the "object" program. (The main program which is to auto-start) which will get everything going in the desired way.

The programs given here do one more necessary thing: A basic statement (statement no. 0) is tacked on to the beginning of the "object" program and will appear at the beginning of a 'LIST 'ing. This statement sets pointers and clears the screen.

How To Proceed (VIC-20)

First, type in the following BASIC program, and 'SAVE' it on cassette, disk, or EPROM.

```
1   REM VIC 20
2   REM AUTO-START BASIC
3   FORI=0T066
4   READ A
5   POKE40960+I,A
6   NEXTI
7   DATA9,160,86,255,65,48,195,194
8   DATA205,32,141,253,189,129,2,149
9   DATA8,189,41,160,157,129,2,189
10  DATA43,160,157,119,2,232,224,2
11  DATA144,234,240,243,134,198,76,50
12  DATA253,46,160,82,213,13,0,67
13  DATA160,0,0,151,52,54,44,194
14  DATA40,57,41,58,156,58,153,34
15  DATA147,34,0
```

Now when you wish to make an auto-start cartridge, this program will be used to put the auto-start routine in its proper place.

Making The Cartridge

Step 1 - Install 8k of expansion RAM in BLOCK 5. (40960-49151) or $A000-$BFFF). Install additional expansion RAM in blocks 1 and 2 if needed for your program.

Step 2 - Load the Auto-Start program above and RUN it.

Step 3 - PEEK the start of BASIC pointer and jot down the values. (Note the PEEK(43) and the PEEK(44).)

Step 4 - POKE the start of basic pointer to 41027 ($A043). To do this, execute these POKE's:

```
POKE43,67
POKE44,160
```

Step 5 - LOAD your object program (the one which is to become the cartridge). Do not run it.

Step 6 - POKE the start of basic pointer back to the original value noted in step 3.

Step 7 - Type "NEW" and a carriage return.

Step 8 - LOAD PROMOS. RUN PROMOS.

Step 9 - Use the PROMOS 'π' command to program your EPROM:

```
π40960,<MEM END>,0,<CW>,<PMW>
```

Be sure MEM END is large enough to include all of your basic program plus 67 bytes.

Step 10 - Solder your EPROM in a cartridge board, (or plug it in if you're using sockets) following the directions that come with the board. Your cartridge is now ready for use.

How To Proceed (C64)

First, type in the following BASIC program and SAVE it on cassette, disk, or EPROM.

```
1   REM C 64
2   REM AUTO-START BASIC
3   FORI=0T066
4   READ A
5   POKE32768+I,A
6   NEXTI
7   DATA9,128,188,254,195,194,205,56
8   DATA48,142,22,208,32,163,253,32
9   DATA80,253,162,0,189,44,128,157
10  DATA129,2,189,46,128,157,119,2
11  DATA232,224,2,144,239,240,243,134
12  DATA198,76,248,252,49,128,82,213
13  DATA13,0,67,128,0,0,151,52
14  DATA54,44,56,58,156,58,153,34
15  DATA147,34,0
```

Now when you wish to make an auto-start cartridge, this program will be used to put the auto-start routine in its proper place.

Making The Cartridge

Step 1 - Remove any cartridge from the memory expansion port.

Step 2 - Load the Auto-Start program above and RUN it.

Step 3 - POKE the top of memory pointer down as follows:

```
POKE55,0
POKE56,128
```

Step 4 - POKE the start of basic pointer up as follows:

```
POKE43,67
POKE44,128
```

Step 5 - LOAD your object program (the one which is to become the cartridge). Do not run it.

Step 6 - POKE the start of basic pointer back down as follows:

```
POKE43,1
POKE44,8
```

Step 7 - Type "NEW" and a carriage return.

Step 8 - LOAD PROMOS and RUN it.

Step 9 - Use the PROMOS 'π' command to program your EPROM:

```
π32768,<MEM END>,0,<CW>,<PMW>
```

Be sure MEM END is large enough to include all of your basic program plus 67 bytes.

Step 10 - Solder your EPROM into a cartridge board, (or plug it in if you're using sockets) following the directions that came with your board. Your cartridge is now ready for use.

One Final Note

The Auto-Start programs given above disable the RESTORE key and the non-maskable interrupt. This is done so the basic program can retain complete control of computer operation at all times.

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