

Final Expansion 3 User Guide

Version 1.0

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Version Information

Version	Date	Changes
1.0	2017-02-08	Initial draft

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Contents

Copyright Information.....	2
Version Information.....	2
Authors.....	2
Introduction.....	5
Where to Get Help.....	5
Cartridge Overview.....	6
Quick Start.....	8
Setup.....	8
Common Problems.....	9
Start Up Menus.....	10
Main Menu.....	10
RAM Manager.....	11
Disk Loader.....	13
Cartridge Loader.....	14
Secure Digital Drive.....	15
DOS Commands.....	15
SCRATCH.....	15
RENAME.....	15
COPY.....	15
Disk Images.....	16
Subdirectories.....	16
Partitions.....	16
Real Time Clock.....	16
Other Commands.....	16
Wedge Commands.....	17
Storage Device Commands.....	17
Directory Listing.....	17
Disk Commands.....	18
Load BASIC Program.....	18
Load Machine Code Program.....	19
Save BASIC or Machine Code Program.....	19
Verify BASIC Program.....	20

Final Expansion 3 User Guide

Show & Change Drive.....	20
Memory Block Commands.....	20
Block Disable.....	20
Block Protect.....	21
I/O Register Disable.....	21
Miscellaneous Commands.....	21
System Reset.....	21
Wedge Disable.....	21
Program Recovery.....	22
Number Format.....	22
Loader Files.....	23
Examples.....	23
Appendix A – Updating Firmware.....	24
Appendix B – Programmers Reference.....	25
Memory Map.....	25
Register Descriptions.....	25

Introduction

This guide describes the features of the Final Expansion 3 cartridge for the VIC-20 and how to use them. It also includes reference material for programmers to write software that uses the advanced capabilities of the cartridge.

The information given in this guide is believed to be accurate, however because there are many hardware and software variations the authors cannot guarantee that a specific system will function exactly as described.

The authors would be grateful to hear from you if you find a mistake or omission in this guide.

Where to Get Help

As there are several versions of the cartridge produced by different manufacturers the best source of information specific to yours is wherever you purchased it from.

The on-line forum Denial, <http://sleepingelephant.com/denial/>, is a community of VIC-20 users. They may be able to provide information and suggestions but cannot be expected to resolve your specific problems.

Cartridge Overview

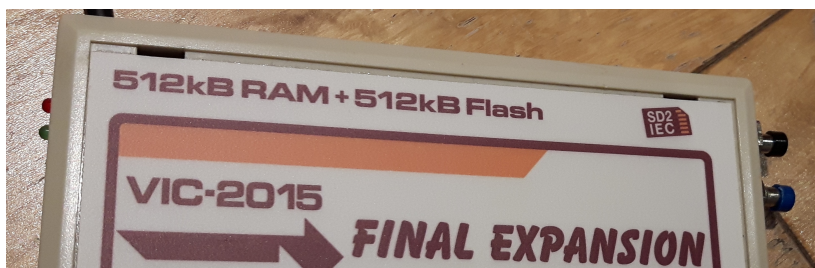
The Final Expansion 3 (FE3) cartridge expands the VIC-20 with:

- 512KB of Random Access Memory (RAM)
- 512KB of Electrically Erasable Read Only Memory (EEPROM)
- storage to Secure Digital cards emulating a serial bus disk drive (SD2IEC)

The memory expansion is highly configurable, both from interactive menus and by commands contained in user-created files. Virtually any type of memory map can be set up to allow all manner of programs to be run.

Additional commands are available to make disk devices easier to use, these are provided using a software wedge (which can be disabled) similar to those that work with physical disk drives such as the 1541.

Loading and saving to serial bus devices is accelerated if they contain support for JiffyDOS, this includes the integrated SD2IEC device.



The two indicators which are located on the left of the cartridge relate to the SD2IEC device

- error (top, red) – flashes when an error message is present on the command channel

Final Expansion 3 User Guide

- activity (bottom, green) – lit when a file is open on the device

The two push buttons on the right of the cartridge provide different forms of system reset

- VIC-20 system reset (top) – system resets but memory configurations etc. are retained
- VIC-20 and Final Expansion 3 reset (bottom) – system resets with defaults identical to those at power on.

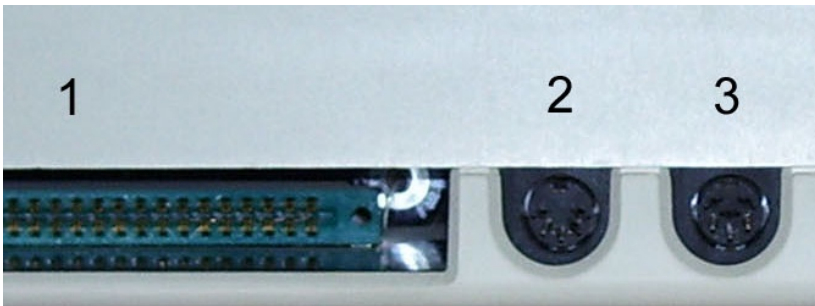
Quick Start

This section aims to help the first time user up and running as quickly as possible. It also covers likely issues that the user may run into.

Setup

The cartridge should be connected to the VIC-20 with the power switched off. It may either be inserted directly into the cartridge port or into a slot of a cartridge expander.

The SD2IEC should then be connected to the serial port of the VIC-20. The serial port is the rightmost round socket (3) when viewing the rear of the VIC-20



Some FE3 cartridges have an integral lead with a plug, others have two sockets. Either

- Connect the plug to the serial port
- Connect one plug of a serial cable into the serial port and one into either socket on the FE3

An SD card should be prepared on a modern PC by formatting it. Only SD

Final Expansion 3 User Guide

cards that are FAT formatted can be used with the SD2IEC device.

Insert the SD card, face down, into the slot on the top of the FE3, it should click into place. The card may be removed by gently pressing the top of the card. MicroSD cards may be inserted if an adapter is used.

After checking the cartridge is fully inserted and the serial cable is attached the VIC-20 can now be powered on.

Common Problems

*** text here ***

Start Up Menus

Main Menu

When the VIC-20 is powered on a menu with the following options is presented

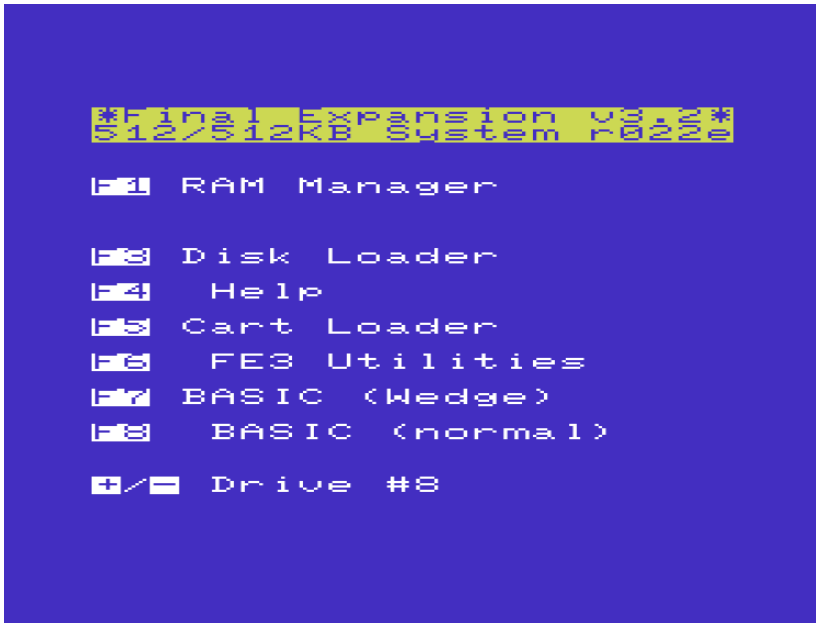
- Select common memory configurations
- Load programs from SD2IEC
- Load programs from flash
- Store programs to flash
- Change the SD2IEC device number

Options are selected by pressing the function keys (along with the Shift key if necessary).

Pressing the **F8** key returns from any submenu.

Bypassing the start up menus can be achieved by holding down one of the following keys during power on:

- **SHIFT** – wedge enabled, no additional memory
- **C=** – wedge disabled, no additional memory



The common configuration of all memory blocks being filled is available by pressing **F7** (with the command wedge) or **F8** (without the command wedge).

The device number used by the SD2IEC device can be changed by pressing the **+** and **-** keys. Values between 8 and 15 are supported.

Pressing the **F4** key displays a brief description of the commands the wedge provides. See “Wedge Commands” on page 17 for more details.

Pressing the **C** key displays a list of credits.

RAM Manager

This submenu allows different memory configurations to be set up. After selection the system will enter BASIC as normal.

Final Expansion 3 User Guide



The configurations available are summarized in the following table:

Key	Memory	Blocks	Wedge?
F1	3K	RAM1,2,3	Yes
F2	8K	BLK1	Yes
F3	16K	BLK1,2	Yes
F4	24K	BLK1,2,3	Yes
F5	3K + 24K	RAM1,2,3 & BLK1,2,3	Yes
F6	-	-	No
F7	3K + 24K+8K	RAM1,2,3 & BLK1,2,3,5	Yes

At the bottom of the menu two checkboxes are shown:

- I/O registers (R) - Allow software access to the registers which

control the memory configuration of the cartridge

- Command wedge (**W**) – Enable commands listed on page 17

Pressing the given key toggles each checkbox.

Disk Loader

This submenu allows memory configurations to be set up and program files to be loaded by selecting an entry from a list. The selections are defined in loader files, see “Loader Files” on page 23 for details of how to create them.

The menu is navigated by using either the cursor keys or the joystick, an entry is selected by pressing **RETURN** or the fire button. When there are more than one page of entries the **F1** and **F3** keys can be used to move between pages. The **F5** and **F7** keys can be used to move to the start and end of a page respectively.



Cartridge Loader

*** text here ***

Secure Digital Drive

The SD2IEC drive allows Secure Digital (SD) cards to store files which can then be accessed by the VIC-20 in the same way as would if they were on a floppy disk.

As with other devices attached to the serial bus the SD2IEC responds to commands sent to it on the command channel. This can be done using the @ wedge command or the **OPEN** and **PRINT#** BASIC commands. The following sections describe the various commands that are implemented.

DOS Commands

The following commands perform operations in the same manner as physical disk devices. Only the first character of a command needs to be given, a : (colon) must be present between the command and any parameters.

SCRATCH

Deletes one or more files given as parameters. Multiple file names must be separated by commas, wildcard patterns containing * and ? may also be used.

RENAME

Changes the name of a file, the existing and replacement file names are specified as **NEWNAME=OLDNAME**.

COPY

*** text here ***

Disk Images

*** text here ***

Subdirectories

*** text here ***

Partitions

*** text here ***

Real Time Clock

*** text here ***

Other Commands

*** text here ***

Wedge Commands

The following commands are available in immediate mode, they cannot be included in BASIC programs. They may also be used in loader programs see “Loader Files” on page 23.

The wedge interpreter usually resides in BLK5, if the “All RAM” option was selected in the “RAM Manager” menu then it will reside in the 3K region within BLK0.

Storage Device Commands

The following commands access files stored on the SD card inserted into the SD2IEC device.

File names may be given in quotes or follow the command immediately (unless otherwise stated).

Directory Listing

The **\$** command can be used to display the contents of an SD card (or disk image or subdirectory) without overwriting any program in memory



For long directory listings pressing the **CTRL** key slows down the rate at which the screen scrolls.

The list of files displayed can be reduced to those that only match a wildcard pattern. The character **?** matches any character in any position in the name

44-
NNC
4
Z
0000A
TZ0m
OD
OX
ATZ
00
XU
E
G

The character `*` matches any number of characters at the end of the name

[illegible]

The list can also be reduced to specific file types

[illegible]

Disk Commands

The @ command can be used to send any of the commands mentioned in “Secure Digital Drive” on page 15 to the SD2IEC

```
@R : BOMB=BOMBER
```

The status of the SD2IEC can be read by using the @ command alone

[illegible]

Load BASIC Program

The `/` command can be used to load a program from the current device

[illegible]

The start and end addresses are displayed in hex.

Load Machine Code Program

The **%** command can be used to load a machine code program into the correct location in memory

```
%HEMSOAK  
FROM $0400 TO $0A0B  
SYS1024
```

The start and end addresses are displayed in hex, the start address is often used to execute the program.

To load a program at a specific address the file name must be given in quotes followed by the address

```
%"SCREEN", $1000
```

Save BASIC or Machine Code Program

The ← command can be used to save the program in memory to the current device

```
←HELLO  
FROM $1201 TO $1234
```

The start and end addresses are displayed in hex.

To save a machine code program the file name must be given in quotes followed by the start and end addresses

```
←"GRAPHICS", $2000, $3000  
FROM $2000 TO $3000
```

If the file already exists on the device the following prompt is displayed

```
63, FILE EXISTS, 00, 00  
ABORT REPLACE UPDATE
```

Pressing **R** deletes the existing file and saves the current program with the file name given

```
DELETING FILE ...
```

Pressing **U** renames the existing file with a ` (single quote) character at the beginning then saves the current program with the file name given

```
DELETING OLD FILE ...  
RENAMING FILE ...
```

Pressing **A** cancels the operation.

Verify BASIC Program

The **>** command can be used to verify that the program in memory matches the copy saved to the current device

```
>CATACOMBS  
FROM $B4B1 TO $12E4  
OK
```

Show & Change Drive

The **#** command can be used to display the current serial device number

```
#  
DEVICE#8
```

To change to another device a number between 8 and 15 may be appended

```
#9  
DEVICE#9
```

Memory Block Commands

The following commands control the availability of and access to specific memory blocks.

Block Disable

The **BLKD** command causes one or more memory blocks to be disabled. The blocks affected are appended to the command, multiple blocks are separated by commas

```
BLKD1,2,3
```

Block Protect

The **BLKP** command causes one or more memory blocks to become read-

only. This can be useful if a program has copy protection to prevent it being run from RAM. The blocks affected are appended to the command, multiple blocks are separated by commas

```
BLKP1,2,3
```

I/O Register Disable

The **NOIO** command disables the I/O registers used to communicate with the FE3. This can be useful if another cartridge is present that also uses the I/O region used by the FE3.

```
NOIO
```

Miscellaneous Commands

System Reset

The **RESET** command can be used to restart the VIC-20. If an autostart signature is found at the beginning of BLK5 (\$A000) then the cold start routine is called. Otherwise the system enters BASIC.

Wedge Disable

The **OFF** (or **KILL**) command can be used to remove the wedge from memory. Only the standard BASIC commands will be available after running this command

```
OFF  
FE3 WEDGE (OFF)
```

Program Recovery

The **OLD** (or **UNNEW**) command can be used to restore a BASIC program that was in memory before the **NEW** command was run or the system was reset.

Number Format

The `,` command can be used to convert numbers between different number bases

[illegible]

The , may be followed by a decimal, hexadecimal (prefixed with ‘\$’) or a binary number (prefixed with ‘%’). An integer or floating point variable may also be given.

Loader Files

*** text here ***

Examples

*** text here ***

Appendix A – Updating Firmware

*** text here **

Appendix B – Programmers Reference

*** text here ***

Memory Map

*** text here ***

Register Descriptions

*** text here ***