

X16 Edit user manual

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1 Introduction

Thank you for trying out X16 Edit!

X16 Edit is a simple text editor written in 65C02 assembly especially for the Commander X16 retro computer.

The look and feel of the program is inspired by GNU Nano. There are, naturally, a lot of differences, but you will feel at home if you are used to Nano.

The Commander X16 was devised by David Murray a.k.a. the 8-Bit Guy. For more information on the platform, go to www.commanderx16.com.

2 Basic usage

2.1 Getting started

The default version of X16 Edit consists of just one file, X16EDIT-x.x.x.PRG, where x.x.x is the version number.

There are several more executable files in the X16 Edit project, but you may ignore them for the time being.

The editor is loaded and run in the same way as a BASIC program.

To run the editor on hardware, just store the program file on an SD card. Insert the SD card into your X16 computer. Type `LOAD"X16EDIT-x.x.x.PRG"` to load the program. And then `RUN` to start it.

If you want to run the editor in the x16emu emulator, you first need to store the X16 Edit executable in the host computer's file system. Then type the following command in the terminal:

```
x16emu -sdcard sdcard.img -prg X16EDIT-x.x.x.PRG -run
```

An SD card image needs to be attached to the emulator with the `"-sdcard"` option for the editor to fully work. When you download the emulator you get an empty SD card image (sdcard.img) that can be used for this purpose.

A valid path to the editor executable must be specified after the `"-prg"` option. Otherwise the emulator will not know where to find the program.

The `"-run"` option automatically starts the editor after the emulator is launched. You may remove this option and start the editor manually by typing `RUN` in the emulator.

2.2 Entering text

X16 Edit is a modeless text editor. As soon as it is started, everything you type is stored in the text buffer.

The cursor is moved with keys normally used for that purpose on a modern keyboard, *i.e.* the arrow keys, Tab, Home, End, PgUp and PgDn.

The go to line feature (Ctrl+L) lets you move the cursor to a specific line number.

As you type and reach the right margin the editor does not insert a line break by default. Instead the current line is scrolled horizontally to make room for more characters. There is no limit to the length of a line other than the available memory.

2.3 Saving and loading text files

The current text buffer is saved to file on the SD card when you press Ctrl+O. Type in the file name you like to use, and press the ENTER key. You will be prompted to confirm before overwriting a file that already exists.

To load a file from the SD card, press Ctrl+R. Just type in the name of the file you want to load, and then press the ENTER key.

2.4 Keyboard shortcuts

X16 Edit is controlled by keyboard shortcuts. You find a complete list of shortcuts in Appendix A.

Shortcuts are primarily selected by pressing and holding down Ctrl at the same time as you press a key that is linked to the wanted command. Instead of the Ctrl key, you may hold down the Left Alt key.

It is also possible to press and release the ESC key. A message is displayed in the status bar indicating that the program is ready to receive a command. Just press the wanted command key without holding down any modifier key.

2.5 User interface

X16 Edit's user interface is similar to GNU Nano, and should be mostly self-explanatory. It consists of the following main parts:

- Title bar
- Editor area
- Status bar
- Shortcut list
- Cursor position display

The *title bar* is at the top row of the screen. The name of the current file is displayed at the center. If the text buffer has not been saved to file, it displays "New text buffer". At the right edge the letters "MOD" are shown if the text buffer has been changed since last saved to file.

The *editor area* is right below the title bar. It takes up most of the screen, and it is here you do all text editing.

The *status bar* is at the third row from the bottom of the screen. All messages from the program are displayed in the status bar. If the program needs to prompt you for input, the input prompt is displayed here as well.

At the input prompt you may either press ENTER to confirm your input or press ESC to abort the current operation.

The *shortcut list* takes up the last two rows of the screen. Here you find the most common keyboard shortcuts.

The *cursor position* (row:column) is always displayed at the bottom right corner of the screen.

2.6 Built-in help

A lists of available keyboard shortcuts and a short description of what each command does is displayed in the built-in help screen (Ctrl+G).

3 More on text editing

3.1 Supported character sets

The editor supports the following built-in character sets:

- PETSCII upper case/graphics. This is the default mode of both the Commander X16 and the C64.
- PETSCII upper/lower case. This is the same mode as is available on the C64.
- ISO character set. This mode is new for the X16, and there is no corresponding mode supported by Commodore 8 bit computers. Text is encoded according to ISO-8859-15, making it easier to transfer files to and from modern computers.

On startup, the editor detects the current character set and continues using that.

You may change the character set by pressing Ctrl+E, which cycles through the options.

3.2 Tab stops

The default tab stop width is four spaces.

You may change the width by pressing and releasing the ESC key followed by one of the digits 1–9.

3.3 Auto-indent

The auto-indent feature is used to keep the level of indentation when line breaks are inserted manually or automatically by the word wrap feature.

Auto-indent is turned off when the editor starts. To toggle the feature on or off, press Ctrl+A.

3.4 Word wrap

The editor does not automatically insert line breaks by default. Instead the current line is scrolled horizontally when you reach the right margin.

Automatic word wrap may be toggled on or off by pressing Ctrl+Z. When turned on you are prompted for the column where to wrap.

The word wrap feature works in a very simplified way. When you reach the right margin the editor breaks the line after the previous blank space. If there is no blank space on the line, the line break is inserted at the right margin. The line break position is not recalculated if you delete characters from the line or if you insert new characters at the beginning of the line.

3.5 Text justification

The justify command (Ctrl+J) divides the text buffer into paragraphs and recalculates all line breaks according to the line width specified in the word wrap feature (default 80). The word wrap function need not be enabled to run the justify function.

When auto-indent is turned off a new paragraph is considered to begin

- if two or more consecutive line breaks are found, or
- if a line starts with one or more blank spaces.

If auto-indent is turned on, a new paragraph is considered to begin

- if two or more consecutive line breaks are found,
- if a line contains only blank space characters, or
- if the level of indent is different from the previous line.

3.6 Cut, copy and uncut

The editor supports cut, copy, and uncut (commonly called paste in other editors).

The copy (Ctrl+C) and cut (Ctrl+K) commands always copy a whole line to the clipboard. You may copy or cut multiple lines into the clipboard. The clipboard may hold a maximum of 3 kB of data.

Uncut (Ctrl+U) copies the content of clipboard into the text buffer at the cursor position. It is possible to do repeated uncuts. The clipboard is cleared upon the first cut or copy after uncutting.

3.7 Search and replace

The search command (Ctrl+W) lets you search the text buffer for a particular string. The replace function (Ctrl+S) lets you replace it with another string.

Both search and replace are case sensitive. Search starts from the character right of the cursor and is forward looking.

If the string you are searching for is found, the cursor is moved to that position.

When replacing a string, you are given the option to only replace the next occurrence or all subsequent occurrences.

4 More on file handling

4.1 Commodore DOS file paths

The editor accepts full Commodore DOS file paths when prompting you for a file name.

A Commodore DOS file path consists of a directory and a file name separated by a colon, for example:

- //MY-APP/:APPNAME.PRG
- /MY-APP/:APPNAME.PRG

The first example starting with double slashes is an absolute path from the root of the SD card. The second example starting with a single slash is a relative path starting from the current directory.

4.2 The built-in file browser

At the prompt where a file name is entered you may alternatively press Ctrl+T to show the built-in file browser. The file browser is there to make it easier to move between directories and select files.

To select an item in the file browser, first highlight it with the up or down arrow keys, and then press Enter.

If the selected item is a directory, it will be made the new current directory, and its content will be displayed in the file browser.

The file browser shows at most 50 files or directories on one page. If not all items fit on one page the listing is ended with "— MORE —". In case the items are spread over several pages, you may go to the next page with PgDn or Ctrl+V and back to a previous page with PgUp or Ctrl+Y.

If there are no more items to show the listing is ended with "— END —".

4.3 Change disk drive device number

By default the file handling functions use device #8. The device number may be changed by pressing Ctrl+D.

4.4 Disk drive commands

You may invoke disk drive commands by pressing Ctrl+I. The raw disk drive command is entered in the prompt that is displayed.

Any valid command may be invoked. Some of the most useful commands are:

- "C:dst=src", copy src file to dst file
- "R:dst=src", rename src file to dst file
- "S:filename", delete filename
- "CD:dirname", change current directory
- "MD:dirname", create directory
- "RD:dirname", remove directory

Just be careful! There is nothing stopping you from deleting files or even formatting the disk.

5 Miscellaneous functions

5.1 User-configurable keybindings

The shortcut key bindings in X16 Edit are user-configurable.

On startup the editor reads custom key bindings from the file X16EDITRC in the root directory of the SD card. If that file is not found, the default key bindings are used.

X16EDITRC is simply a stream of bytes representing the custom shortcuts without any metadata. Each key is represented by the value returned from the Kernal function GETIN.

The extra keys supported by the editor are represented by the following values:

- \$15 = Delete
- \$16 = End
- \$17 = PgUp
- \$18 = PgDn
- \$1a = Insert

The values in X16EDITRC are bound to shortcuts in a fixed order, the same order as the shortcuts appear in Appendix A.

If X16EDITRC holds fewer values than there are shortcuts, the editor will use default bindings for the remaining ones. If there are more values in the file than there are shortcuts, the excess is ignored.

To make it a bit easier to setup X16EDITRC, you may use the provided tool (X16EDIT-KEYBINDINGS.PRG).

5.2 Line break encoding

X16 Edit internally uses LF (ASCII \$0A) as a line break marker.

When reading a file, X16 Edit interprets every occurrence of LF (ASCII \$0A) and CR (ASCII \$0C) as a line break. If a text file was created on Windows with CRLF style line breaks, each line break will in X16 Edit be interpreted as two line breaks.

The selected character set determines how line breaks are encoded when saving the text buffer to file. If in one of the PETSCII modes, line breaks are encoded with CR. If in ISO mode, line breaks are encoded with LF.

5.3 Color settings

Both the background and the text color may be changed while using the editor. The program runs in 16 color text mode, so there are 16 background and 16 text colors to choose from.

Ctrl+T cycles through text color options. And Ctrl+B cycles through background colors.

5.4 Text buffer size

The text buffer is stored in banked RAM, which is 512 kB expandable to 2 MB.

The text buffer may not exceed the available banked RAM.

Press Ctrl+M to you get information on the remaining memory reserved for the text buffer. It will be reported as blocks free. A block may at most hold 251 characters.

6 Advanced topics

6.1 Building X16 Edit from source

If you like to build X16 Edit yourself you may download the source code from www.github.com/stefan-b-jakobsson/x16-edit.

You will need the cc65 development tools to build the project.

In the project's build folder, there are three build scripts:

- build-ram.sh, builds the RAM version
- build-hiram.sh, builds the high RAM version
- build-rom.sh, builds the ROM version

6.2 X16 Edit HI version

The high RAM version is loaded into RAM at address \$6000. The purpose is to free up the start of BASIC RAM for other programs that can be loaded there at the same time.

If present on an SD card, you may load the program with the command `LOAD"X16EDIT-HI-x.x.x.PRG",8,1`, and then start it with `SYS$6000`.

To run it in the emulator you may type the following command in the terminal:

```
x16emu -sdcard sdcard.img -prg X16EDIT-HI-x.x.x.PRG,6000
```

In the emulator, type `"SYS$6000"` to start the editor.

6.3 X16 Edit ROM version

The ROM version of the editor consists of one 16 kB ROM bank.

To use the ROM version you first need to prepare a custom ROM image. When you download the emulator you get the standard rom.bin image. Append X16 Edit to the end of it with the following command (Linux and MacOS):

```
cat rom.bin x16edit-rom-x.x.x.bin > customrom.bin
```

You then need to write the custom ROM image to the actual ROM circuit to use it on real hardware.

A custom ROM image can easily be attached to the emulator with the "-rom" option, for example as follows:

```
x16emu -sdcard sdcard.img -rom customrom.bin
```

The Kernal is in development, and the ROM bank layout may change over time. A user may also store other utilities in ROM. In order to programatically find in which ROM bank X16 Edit is stored, there is an application signature at \$FFF0. The signature consists of the text "X16EDIT" followed by three bytes representing the program version (major, minor, patch).

If the editor is placed in ROM bank 10, it can be started from BASIC like this:

```
BANK 10  
SYS $C000
```

If you like to use one of the other entry points that are described in Appendix B, you need to write a startup program stored in RAM. Code samples doing this are also found in Appendix B.

6.4 The X16 Edit API

The X16 Edit API consists of the following three entry points:

- Default entry point, starts the editor with default options and an empty new text buffer
- Load file entry point, starts the editor with default options and then loads the specified text file
- Load file with options, start the editor with custom options and then loads the specified text file

Information on how to call the different entry points and code samples are available in Appendix B.

A List of keyboard shortcuts

This is a complete list of keyboard shortcuts supported by X16 Edit. You may select commands in any of the following ways:

- Ctrl+key
- Left Alt+key
- Press and release ESC+key
- A function key from the F-key column

Key	F-key	Description
G	F1	Display built-in help screen
X	F2	Exit from the program
O	F3	Write text buffer to file
R	F5	Open and read a file into the buffer
N	—	Create new text buffer
J	F4	Justify text buffer
Y	F7	Page up
V	F8	Page down
K	—	Cut current line and save it to clipboard
C	—	Copy current line to clipboard
U	—	Paste (uncut) all content from clipboard
DEL	—	Deletes current line, no copy to clipboard
W	F6	Search and find string in buffer (case sensitive)
S	—	Replace string (case sensitive)
L	—	Goto line number
A	—	Toggle auto indent on/off
Z	—	Toggle word wrap on/off
E	—	Change charset
I	—	Invoke DOS command
D	—	Set file storage device number, default is 8
T	—	Cycle through text colors
B	—	Cycle through background colors
M	—	Show memory usage (1 block=251 bytes)
space	—	Insert non-breaking space

B X16 Edit API

B.1 Default entry point

Purpose: Start the editor with default options and an empty new text buffer

Call address: \$080D (RAM version), \$6000 (HI version), \$C000 (ROM version)

Parameters: None

B.2 Load file entry point

Purpose: Start the editor and load a specified text file

Call address: \$0810 (RAM version), \$6003 (HI version), \$C003 (ROM version)

Parameters:

Register	Address	Description
X		First RAM bank used by the program
Y		Last RAM bank used by the program
r0	\$02-03	Pointer to file name
r1L	\$04	File name length, or 0=no file

If the specified file does not exist, the editor will display an error message. If the file name length is 0, the program will not try to load any text file on startup.

The first and last RAM bank settings control what parts of banked RAM is used by the program. This option may be used to reserve parts of banked RAM for other purposes.

B.3 Load file with options entry point

Purpose: Start editor with custom options and then load the specified text file

Call address: \$0813 (RAM version), \$6006 (HI version), \$C006 (ROM version)

Parameters:

Register	Address	Bits	Description
X			First RAM bank used by the program
Y			Last RAM bank used by the program
r0	\$02-03		Pointer to file name
r1L	\$04		File name length, or 0=no file
r1H	\$05	0	Auto indent on/off
r1H	\$05	1	Word wrap on/off

r1H	\$05	2-7	Unused
r2L	\$06		Tab width (1..9)
r2H	\$07		Word wrap position (10..250)
r3L	\$08		Current device number (8..30)
r3H	\$09	0-3	Text color
r3H	\$09	4-7	Background color
r4L	\$0A	0-3	Header text color
r4L	\$0A	4-7	Header background color
r4H	\$0B	0-3	Status bar text color
r4H	\$0B	4-7	Status bar background color

Parameters out of range are silently ignored, and default values are used instead.

Color settings are ignored if both the text and background color is 0.

If the specified file doesn't exist, the editor will display an error message. If the file name length is 0, the program will not try to load a text file.

The first and last RAM bank settings control what parts of banked RAM is used by the program. This option may be used to reserve parts of banked RAM for other purposes.

B.4 Code samples for the RAM version

Default entry point

```
jsr $080d ; No parameters, just call the entry point
rts
```

Load file entry point

```
ldx #$01          ; First RAM bank used by the editor
ldy #$ff          ; And last RAM bank
lda #<fname        ; Pointer to file name (LSB)
sta $02           ; Store in r0L
lda #>fname        ; Pointer to file name (MSB)
sta $03           ; Store in r0H
lda #fname_end-fname ; File name length
sta $04           ; Store in r1L
jsr $0810          ; Call entry point
rts

fname:
    .byt "mytextfile.txt"
fname_end:
```

Load file with options entry point

```

ldx #$01          ; First RAM bank used by the editor
ldy #$ff          ; And last RAM bank
lda #<fname        ; Pointer to file name (LSB)
sta $02           ; Store in r0L
lda #>fname        ; Pointer to file name (MSB)
sta $03           ; Store in r0H
lda #fname_end-fname ; File name length
sta $04           ; Store in r1L
lda #$01          ; Auto-indent on, word wrap off
sta $05           ; Store in r1H
lda #$04          ; Tab width
sta $06           ; Store in r2L
lda #$28          ; Word wrap position
sta $07           ; Store in r2H
lda #$08          ; Disk drive device number
sta $08           ; Store in r3L
lda #$b1          ; Text white, background light green
sta $09           ; Store in r3H (screen color)
lda #$07          ; Text yellow, background black
sta $0a           ; Store in r4L (header color)
lda #$00          ; Use default color
sta $0b           ; Store in r4H (status bar color)
jsr $0813         ; Call entry point
rts

fname:
    .byt "mytextfile.txt"
fname_end:

```

B.5 Code samples for the ROM version

Search ROM banks for X16 Edit

The X16 Edit ROM bank may be identified by the application signature ("X16EDIT") stored at \$FFF0. This code sample searches all ROM banks for the signature. If found, the ROM bank is returned in A with carry clear; otherwise carry is set on return.

```

find_me:
    lda $01          ; Store current ROM bank on stack
    pha
    stz $01          ; Prepare searching from ROM bank 0
    ldy #$00

scan:

```

```

    lda $fff0,y          ; Signature starts at $fff0
    cmp signature,y
    bne next             ; Signature didn't match, check next ROM bank
    iny                  ; Increase char pointer
    cpy #$07             ; Have we got 7 matching chars? If not, keep looking
    bne scan
    clc                  ; Set C = 0 as indicator X16 Edit was found
    lda $01              ; Load ROM bank into A
    bra exit

next:
    ldy #$00             ; Reset char pointer
    inc $01              ; Select next ROM bank
    lda $01
    cmp #$20             ; Have we checked all ROM banks?
    bne scan
    sec                  ; Set C = 1 as indicator X16 Edit was not found

exit:
    plx                  ; Restore original ROM bank
    stx $01
    rts

signature: .byt $58,$31,$36,$45,$44,$49,$54      ; = "X16EDIT"

```

Default entry point

```

    lda $01              ; Store current ROM bank on stack
    pha
    jsr find_me          ; Search ROM banks
    bcs done             ; Exit if X16 Edit wasn't found
    sta $01              ; Set ROM bank
    jsr $c003            ; Call entry point

done:
    pla                  ; Restore original ROM bank
    sta $01

```

Load file entry point

```

    lda $01              ; Store current ROM bank on stack
    pha
    jsr find_me          ; Search ROM banks
    bcs done             ; Exit if X16 Edit wasn't found
    sta $01              ; Set ROM bank
    ldx #$01             ; First RAM bank used by the editor
    ldy #$ff             ; And last RAM bank

```



```

    lda #<fname          ; Pointer to file name (LSB)
    sta $02              ; Store in r0L
    lda #>fname          ; Pointer to file name (MSB)
    sta $03              ; Store in r0H
    lda #fname_end-fname ; File name length
    sta $04              ; Store in r1L
    jsr $c003            ; Call entry point

done:
    pla                  ; Restore original ROM bank
    sta $01
    rts

```

```

fname:
    .byt "mytextfile.txt"
fname_end:

```

Load file with options entry point

```

    lda $01              ; Store current ROM bank on stack
    pha
    jsr find_me          ; Search ROM banks
    bcs done             ; Exit if X16 Edit wasn't found
    sta $01              ; Set ROM bank

    ldx #$01             ; First RAM bank used by the editor
    ldy #$ff             ; And last RAM bank
    lda #<fname          ; Pointer to file name (LSB)
    sta $02              ; Store in r0L
    lda #>fname          ; Pointer to file name (MSB)
    sta $03              ; Store in r0H
    lda #fname_end-fname ; File name length
    sta $04              ; Store in r1L
    lda #$01             ; Auto-indent on, word wrap off
    sta $05              ; Store in r1H
    lda #$04             ; Tab width
    sta $06              ; Store in r2L
    lda #$28             ; Word wrap position
    sta $07              ; Store in r2H
    lda #$08             ; Disk drive device number
    sta $08              ; Store in r3L
    lda #$b1             ; Text white, background light green
    sta $09              ; Store in r3H (screen color)
    lda #$07             ; Text yellow, background black
    sta $0a              ; Store in r4L (header color)
    lda #$00             ; Use default color
    sta $0b              ; Store in r4H (status bar color)

```

```

        jsr $c006                ; Call entry point
done:
        pla                    ; Restore original ROM bank
        sta $01
        rts

fname:
        .byt "mytextfile.txt"
fname_end:

```

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