



TRIANGULAR  $\mu$ OS 1.32/C128

for



User's Manual

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## Contents:

### PART A: PREPARATIONS

1. Introduction	4
2. What's new	5
3. What you need	6

### PART B: HOW TO USE TRIANGULAR $\mu$ OS

4. How to use TRIANGULAR $\mu$ OS 1.32/C128	8
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### APPENDICES

A. Troubleshooting	14
B. Support & References	15
C. Changelog	16

## PART A

# PREPARATIONS

# 1. Introduction

TRIANGULAR  $\mu$ OS is GUI (graphic user interface) operating system for 8-bit Commodore computers. This User's Manual pertains to TRIANGULAR  $\mu$ OS 1.32/C128 version for Commodore 128.

## Package contains files:

- *TRIANGULAR  $\mu$ OS 1.32-C128 for Commodore 128 Users Manual.pdf* – this manual
- *TRIANGULAR  $\mu$ OS 1.32-C128.d81* – image of TRIANGULAR  $\mu$ OS System Disk containing 3 files, which take 29.94 KB (122 disk blocs = 30.5 KB on disk)
- *TRIANGULAR  $\mu$ OS 1.32-C128 Documents.d81* – empty formatted  $\mu$ OS Documents 1581 type disk image for storing your documents
- *TRIANGULAR  $\mu$ OS 1.32-C128 Documents.zip* – archived  $\mu$ OS Documents disk

Goal of creating this system was to develop GUI for 8-bit Commodore computers with lowest amount of memory: that is Commodore PET with at least 4 KB of memory. Next it was expanded for Commodore VIC-20 with standard 5 KB of memory or later with more amount of expansion RAM was required. And in later versions of  $\mu$ OS was adapted for Commodore 64. This iteration of TRIANGULAR  $\mu$ OS (1.32/C128) is designed to run on Commodore 128.

This software was written in Commodore BASIC language (port of Microsoft BASIC) using CBM prg Studio 4.01, and is designed to run on Commodore 128 in its standard C128 40-column mode. This version of TRIANGULAR  $\mu$ OS is designed to support BASIC 7.0 and works in color text mode. Commodore BASIC (a runtime interpreted language similar in basic concept to JAVA RTM or C# CLI) is default language used in 8-bit Commodore computers and also functions as their OS and user interface. In similar fashion to early Microsoft Windows (1.0 to 3.11),  $\mu$ OS sits atop of BASIC and KERNAL (Commodore's kernel) and Commodore DOS, which is implemented in every Commodore disk drives or 3rd party solutions in order to load  $\mu$ OS modules, load/save settings and documents, perform operations on floppy disks and communicate with disk drive(s).

## 2. What's new

**What's new in TRIANGULAR  $\mu$ OS 1.32/C128 for Commodore 128:**

- WINDOW command added
- Enlarged DESKTOP area
- Change versioning scheme and version held as value in memory
- Change file system from filename>ext (extension) to filename.ext (extension) eg.: uos>cfg to uos.cfg
- BASIC 7.0 sound commands implemented
- Minor improvements and bugfixes

### 3. What you need

In order to run TRIANGULAR  $\mu$ OS 1.32/C128, you need real Commodore 128 with disk drive and joystick to operate cursor. Printer is optional and can be used as device #4 to #7, although #4 is standard practice and thus recommended.

Or you can use freeware VICE emulator, which is available here:

<https://vice-emu.sourceforge.io>

Commodore 128 emulator VICE must be configured with enabled disk drive that can read 800KB 3.5" diskette (.d81 file): recommended CBM 1581\*. Also, you should enable joystick. You can easily configure it as Numpad keys:

- Up (8), Down (2), Left (4), Right (6)
- You can move diagonally e.g., Up-Left (7)
- 0 or right Ctrl: Fire (click/select)

You can also enable printer in in VICE emulator. Do this in:

Settings -> Peripheral devices -> Printers or similar options. You can choose printer as device #4 - #7, although #4 is standard and recommended.

*\* Using 5.25" disk drive: 1571 (default), alternatively 1541 type drive (1541-II) is possible, but System Disk and Documents disk images first must be converted to .d71 or .d64 file in external program (e.g DirMaster). Additionally using 1571 disk drive amounts to over twice disks drive speed reduction, while 1541 type drive bring speed to default Commodore 64 levels (~10 times slower than 1581) thus only 1581 type drive is officially supported.*

## PART B

# HOW TO USE TRIANGULAR $\mu$ OS

## 4. How to use TRIANGULAR $\mu$ OS 1.32/C128

Make sure that you are using Commodore in its standard C128 40-column mode. To start using TRIANGULAR  $\mu$ OS insert *TRIANGULAR  $\mu$ OS 1.32-C128.d81* disk into disk drive and type command: **DLOAD “\*”** or **DLOAD “UOS”** (when using disk drive #8), **LOAD “\*”,8** or **LOAD “UOS”,8** in BASIC and press Return key (or Enter on PC keyboard in case of emulators). System launcher named UOS will check your computer. If you are using your disk drive as device #8, use one of above commands. If you are using different device # then change last number (8) to it (e.g.: **DLOAD “\*”,U9** or **LOAD “\*”,9** if you want to use disk drive #9). After successfully loading startup program type RUN (and press Return/Enter) to start  $\mu$ OS.

Now system starts. BIOS is first element of this system. It checks if running machine is indeed Commodore 128 computer, check memory available and checks screen memory. In this stage, if any of above system checks weren't finished successfully,  $\mu$ OS will display error message, beep 3 times and return to default BASIC mode.

Next  $\mu$ OS BIOS proceeds to launchings screen and checks if there are any disk drives, detects their hardware IDs, and if system disk is present, automatically sets boot drive to lowest disk drive # containing matching system disk and loads configuration file. If there isn't proper TRIANGULAR  $\mu$ OS System Disk inserted in any of disk drive or disk drive has not been detected, beep sound and error message will be displayed (along with sound of 3 beeps) with possibility to retry detection procedure (F1) or exit to BASIC (F8).

If everything went OK, F1 BIOS SETUP option will appear. By pressing F1 key, you can enter BIOS SETUP menu, where system parameters and list of detected disk drives will be presented. To change Boot Drive or Work Drive hit highlighted key (F1 - F8) displayed after name of available disk drive\*. You can also change system time by using T key and entering new time in format HHMMSS left of white arrow or reset system clock by hitting R key. To continue without saving changes (besides time clock which is changed independently) and go back to launch screen press E key. To save changes and restart  $\mu$ OS use S key. By pressing B key computer shuts down  $\mu$ OS completely by going into standard BASIC mode. When F1 key is not pressed when launching screen is present, BIOS continues to launching GUI.

*\* If you have another disk drive enabled, you can insert TRIANGULAR  $\mu$ OS 1.32-C128 Documents.d81 or any other disk into second drive and in BIOS Setup menu change Work Disk to that drive number (most probably #9). By doing this you can easily load/save documents on separate disk from TRIANGULAR  $\mu$ OS System Disk (which is recommended setup). Otherwise, you will load/save documents on System Disk (unless you will change disk while working in WORDS word processor), which is default option (Work Disk is set as #8 or other device # of Boot Drive if #8 is not available).*



GUI (graphic user interface) is central element of TRIANGULAR  $\mu$ OS. GUI's is operated by arrow-like sprite mouse pointer which is joystick navigated:

- Up, Down, Right, Left [(or 2,4,6,8 on Numpad in emulator)]
- You can move diagonally (e.g., Up-Left [or 7 on Numpad in emulator])
- Fire to select/click [or 0 / right Ctrl in emulator]

On bottom of the screen there is task bar with black TRIANGULAR logo on center and digital clock on the right side with up arrow symbol to right of the clock. By clicking on this arrow, you will be able to go back directly to initial desktop screen from future windows (this is very useful when you want to skip closing previous windows).

By clicking on TRIANGULAR logo, you will open start menu where you can select:

- SETTINGS – opens SETTINGS window
- RESTART – restarts TRIANGULAR  $\mu$ OS
- SHUT DOWN – exits to standard BASIC mode

On main screen desktop there are 4 icons:

- THIS C128 – open window similar to My Computer or This PC in Windows
- APPS – opens folder with selection of apps
- GAMES – opens folder with games
- SETTINGS – opens SETTINGS window

SETTINGS window is divided on two tabs: SYSTEM and GRAPHIC. SYSTEM tab allows you to change system time (by clicking on + and – signs to change hours, minutes, seconds). Click on RESET CLOCK button to reset system clock. Below label WORD DISK there are buttons with device # (8> to 11>) on them. Red color of those buttons indicate that device is unavailable. Cyan color marks available drive and green show current selected work drive. Clicking on cyan button will change Work Drive to it. Below of PRINTER label there are buttons to select printer device # (NO, #4 - #7). If NO button is selected (default) no port is assigned and printing functions are not available in TRIANGULAR  $\mu$ OS apps (e.g., WORDS). Most popular setup is to use printer as device #4. APPLY button saves selection into config file. As in most GUIs clicking on X button closes the window. By doing so without saving, any changes (besides time) are canceled.

GRAPHICS tab enables color options. By clicking on one of 16 tiles on right of BACKGR PATTERN label you can change desktop wallpaper pattern. COLOR offers selection of colors for background wallpaper. REVERSED will turn reverse of wallpaper patten off/on (enabled with first pattern will change it to solid color). TITLE BAR will change color of title bar of windows. DEAFULT button will reverse colors to default color theme. Don't forget to click on APPLY button to save color changes or exit this window without saving them to discard changes.

THIS VIC window contains 2 icons:

- DISK – open program which shows content of disk and starts programs stored on it
- CMD – starts a command prompt program

DISK is a program for viewing disk content. Right of status info with number of files on disk and current page there are buttons with device # (8> to 11>) on them. Red disk button indicate that device is unavailable. Cyan color marks available drive and green show current selected drive. Clicking on cyan/green button will start displaying disk content (on start program will display content of disk inserted in Work Drive). Further below is displayed disk name and disk ID. When there no disk in disk drive or disk is empty (not formatted) program will display message: NO DISK! While program retrieves disk content directory from disk drive CHECKING DISK... F8 ABORT label is displayed and pressing F8 key aborts disk checking procedure. Further down there is field for disk content listing, which will display 10 items per page. In both bottom corners of window there are 2 arrows: > (on right) and < arrow (on left) will change page if additional program pages are available. Clicking on program from that list will start it.

CMD is a DOS-like command prompt program that allows you to manage disk content. It accepts one of following commands (disk and file names cannot be longer than 16 characters):

- HELP – shows help
- CLR – clears screen
- EXIT – go back to desktop
- RESTART – restarts TRIANGULAR  $\mu$ OS
- BASIC – restarts computer to BASIC
- & – displays basic system info
- ! – displays current device info
- #[*device number*] – changes disk drive: #1 for Datasette, disk drives 8-11 e.g.: #1, #8, #11
- \$ – show directory (content) of disk
- ↑[*filename*] – load program e.g.: ↑SIMCITY
- ↑ – load first encountered program (similar to LOAD “\*”,8 in BASIC)
- S>[*filename*] – deletes file e.g.: S>SIMCITY
- R>[*old name*]=[*new name*] – renames file e.g.: R>OLD NAME=NEW NAME
- C>[*original file*]=[*new file*] – copies file e.g.: C>ORIGINAL FILE=NEW FILE
- N>[*disk name*<*id*] – formats disk (ID must be 2 characters long) e.g.: N>DISKNAME<ID
- I> – initialize disk
- V> – validates disk

If any of above command will be entered erroneously or with improper parameter(s) error message INVALID COMMAND! or BAD PARAMETER! will be displayed alongside with beep sound. After any operation user will be informed of its success (message: OK ✓) or descriptive error message will be displayed.

APPS folder contains 4 programs: WORDS, MATH, MONITOR and SYNTH.

WORDS is a word processor. Use Cursor Up or Cursor Down/Return to scroll page. Shift + Return to discard changes in current line and advance to next line. All operation evoked by function keys beside F5 (F1-F4 and F8) will pop up confirmation Yes/No prompt. Press F1 to start new file. F2 prints document on printer (you must have printer assigned to any port [#4 - #7] in SYSTEM tab of SETTINGS, before printing otherwise F2 key won't enable printing function). Use F3 key to load document and F4 to save current document to file. F5 inserts tabulation of 10 spaces. F6 key will copy line to clipboard, while F7 will paste copied line or number copied to clipboard in MATH calculator to current line. Pressing Home key will get you to beginning of document and Shift + Home will delete clear current line. Exit by pressing F8.

MATH – scientific calculator. To add 2 numbers, enter 1st number (by keyboard or by cursor by clicking on numbers in purple/blue field). Entered number will appear on right from B label. Use left arrow button or DEL key to delete 1 digit. Reset B register by clicking on C button or pressing C key. Click on = or + button or press = or Return key to store number from B register in A register. Next similarly add 2nd number and then click on any desired operation button or press +, -, \*, /, % keys. Result will be showed in A register (above B register). Other mathematical functions operate similarly: enter 1 or 2 numbers and then press button with given function. Pi button (with  $\pi$  symbol on it) stores  $\pi$  value in register B. Click ON or press O key to reset calculator state. Clicking on A $\leftrightarrow$ B button will swap numbers in registers A and B. A>M will store value of A register in clipboard. M>A button will store number saved to clipboard either in MATH or WORDS program. MC will erase clipboard.

MONITOR is a program that shows and edits computer memory. Memory cells values are displayed in hexadecimal number system (0-F). Possible commands:

- HELP – shows help
- CLR – clears screen
- EXIT – goes back to APPS folder
- E>[address] – change memory from given memory address, one byte after one byte (in prompt type X to cancel, you can type R to repeat previous byte value)
- M>[address] – shows memory block of 256 bytes containing given memory address
- F>[1st address]-[2nd address]=[byte] – fills specified memory region with given byte value
- T>[1st address]-[2nd address]=[destination address] – copies specified memory region to another
- S>[1st address]-[2nd address]=[start address of other region] – swaps specified memory region with another
- G>[address] – executes machine language program starting at address

SYNTH is sound synthesizer program. F1 and F2 keys will lower/rise volume (which is represented by green volumeter). Use keys showed on keyboard scheme to play sound in normal octave. Pressing those keys while holding Shift will play them in higher octave, while holding C= key will play them in lower octave. Use Spacebar to stop playing sound. Pressing function keys F3 - F7 will change voice characteristic. Use F8 key to exit.

GAMES folder offers only one game:

- SIMCITY – create and develop your city. Move cursor by joystick and press R, C or I key to place Residential, Commercial or Industrial zones. Use Space to build a road. Roads are essential since only land plots with road adjacent to them can further develop into occupied one and bring revenue to the city

# APPENDICES

## A. Troubleshooting

Loading of module of TRIANGULAR  $\mu$ OS can “freeze” in process of inter-loading next  $\mu$ OS module or disk program (a very rare occurrence). This happens when loading screen do not proceed to next module for over 1 minute for  $\mu$ OS. When loading screen is not responsive for longer time, it can mean error in inter-loading procedure, most probably keyboard buffer was not filled with key properly. To see what really happened change color of cursor to blue (press Control + 7) and enter command POKE 53281,1 and hit Return key. This should change background color to white which will show underlying black text of loading sequence message. If computer doesn't change cursor or background color try again. If still there is no effect it might be real freeze. If color change procedure succeeds, try using RUN command to see if program will start or go to top of screen (Home key) and press Return in order try to reload program. If it will loads successfully enter RUN command. If that not work check if load command is correct. It should have format: LOAD “[filename]”, [device # (1 or 8 - 11)] like in e.g.: LOAD “GUI”, 8. If none of it works then start system anew. To prevent this kind of freeze, try not to use keyboard when inter-loading procedure is performed (it can slip improper key into keyboard buffer, which most often leads to this error).

## B. Support & References

For more information, to report bug or to get help go to links listed below.

TRIANGULAR  $\mu$ OS for Commodore 128 on Commodore 128 forum:

<https://c-128.freeforums.net/thread/1102/triangular-c128-commodore-128-basic>

TRIANGULAR YouTube channel:

<https://www.youtube.com/channel/UCdnynTqbM8S6mc0EUXY58Gg/>

Contact info:

Michael Goral

@-mail: [michaelgoral@gmail.com](mailto:michaelgoral@gmail.com)

SDK pack is available for TRIANGULAR  $\mu$ OS, which contains additional references and source code in .bas files format. To download SDK, click in link below:

[https://www.mediafire.com/file/2lxav7bsxj68qgs/TRIANGULAR uOS 1.32-C128 SDK.zip/file](https://www.mediafire.com/file/2lxav7bsxj68qgs/TRIANGULAR_uOS_1.32-C128_SDK.zip/file)

## C. Changelog

### **Changelog for TRIANGULAR µOS 1.32/C128 for Commodore 128 [11-02-2023]:**

- WINDOW command added
- Enlarged DESKTOP area
- Change versioning scheme and version held as value in memory
- Change file system from filename>ext (extension) to filename.ext (extension) eg.: uos>cfg to uos.cfg
- BASIC 7.0 sound commands implemented
- Minor improvements and bugfixes

### **Changelog for TRIANGULAR µOS 1.31/C128 for Commodore 128 [15-01-2023]:**

- Mouse pointer routines redesigned which resulted in twice faster movements
- Some additional graphic operations converted to BASIC 7.0 syntax
- Minor improvements and bugfixes

### **Changelog for TRIANGULAR µOS 1.30/C128 for Commodore 128 [12-01-2023]:**

- Commodore 128 in its standard 40 column VIC-II C128 mode is supported
- Only 3.5" 1581 type disk drive is supported
- Loading and saving is up to 10x faster due to faster C128 1581 disk drive handling
- Color theme changed from C64 blue to more resembling C128
- BASIC 7.0 handles sprites and few needed instructions added
- GAMES folder contains only SIMCITY, other 3 games removed
- Minor improvements and bugfixes
- Changelog is revised and integrated back into User's Manual



### **Changelog for TRIANGULAR $\mu$ OS 1.25/C64 for Commodore 64 [20-10-2022]:**

- Code of TRIANGULAR  $\mu$ OS is reviewed, improved, cleaned and bug fixed
- Slightly updated loader module screen (LOADING/RESTARTING/SHUT DOWN)
- Multi-characters handled by special function amounted for saving 1 KB of code
- BIOS: Some minor visual changes (mostly colors)
- BIOS: Detection of C64 or C128 in C64 mode
- GUI: Mouse pointer uses sprite instead of PETSCII character
- GUI: Time separator : (in right bottom corner) is blinking as seconds progress
- GUI: Windows repositioned and stretched with minor visual changes
- GUI: Windows can activate elements outside their loops in more advanced manner
- GUI: First element of  $\mu$ OS API named BASICCALLY added: Window creator that draws window based on given arguments
- GUI: Windows refreshes faster and without blinking
- SETTINGS: System settings and color settings merged into one SETTINGS window, divided by 2 tabs into SYSTEM and GRAPHICS (color options)
- SETTINGS: GRAPHICS tab now supports 16 colors and 2x more background patterns
- DISK: Program window slightly enlarged and improved few minor mechanisms
- CMD: Small visual changes and improved few minor mechanisms
- WORDS: Commands panel slightly redesigned with new options added
- WORDS: Repositioned and expanded text area
- WORDS: > symbol (indicating line to write) is removed and text area is 1 character wider
- WORDS: Faster typing-in mechanism
- WORDS: Clear Screen [Shift + Home] erases currently written line
- WORDS: F6 Copy line and F7 Paste line added
- WORDS: Clipboard shared with MATH calculator (F7 will retrieve memorized number in MATH)
- MATH: Window repositioned and minimal color theme update
- MATH: Clipboard shared with WORDS word processor (memory contains number copied inside WORDS)
- MONITOR: Show memory area is reworked and enlarged
- SYNTH: Piano keyboard expanded and new voices added
- SIMCITY: Mechanism that selects land plot to activate is more random and equally covers available zoning area
- GAMES: CHUCK'S CHALLENGE & LIFE RAFT RESCUE - issues with sprites are corrected
- Changelog added as separate document

#### **Changelog for TRIANGULAR $\mu$ OS 1.20/C64 for Commodore 64 [31-08-2022]:**

- Support for Commodore 64 with its 40 column VIC-II text mode and SID chip is added
- BIOS added indicator reminding to type time (<- TYPE NEW TIME) after pressing T
- WORDS – by pressing Home key you can reach first line of document
- SYNTH – reworked with simplified keyboard and limited to 1 voice channel which now can play sounds in normal, lower and higher octave ranges
- Only SIMCITY is carried over from TRIANGULAR  $\mu$ OS 1.15/VIC for Commodore VIC-20
- In place of old games 3 new games from Roman Werner added (TAXI TAXI, CHUCK'S CHALLENGE and LIFE RAFT RESCUE)
- All games merged into GUI program file
- Bugfixes and improvements

#### **Changelog for TRIANGULAR $\mu$ OS 1.15/VIC for Commodore VIC-20 [19-08-2022]:**

- TRIANGULAR  $\mu$ OS 1.15/VIC won't start on VIC-20 with less than 29 KB of RAM (24 KB RAM Expansion is needed or higher)
- GUI merged with MONITOR, WORDS and SYNTH
- MONITOR and WORDS errors messages accompanied by beep sound
- Besides LOADING screen there is added RESTARTING (with yellow TRIANGULAR logo) and SHUT DOWN (with red logo)
- Bugfixes and improvements

#### **Changelog for TRIANGULAR $\mu$ OS 1.14/VIC for Commodore VIC-20 [14-08-2022]:**

- TRIANGULAR  $\mu$ OS won't start on VIC-20 with less than 21 KB of RAM (16 KB RAM Expansion is needed or higher)
- GUI merged with MATH and CMD
- MATH keys assigned for basic functions (+, -, \*, /, %) and ON
- CMD beep sound added while displaying error messages

#### **Changelog for TRIANGULAR $\mu$ OS 1.13/VIC for Commodore VIC-20 [12-08-2022]:**

- TRIANGULAR  $\mu$ OS won't start on VIC-20 with less than 13 KB of RAM (8 KB RAM Expansion is needed or higher)
- GUI merged with COLORS & DISK
- GUI streamlined
- DISK received minor improvement of disk content handling mechanism

#### **Changelog for TRIANGULAR $\mu$ OS 1.12/VIC for Commodore VIC-20 [09-08-2022]:**

- GUI merged with APPS, GAMES and SETTINGS
- COLORS retrieve default settings with DEAULT button
- DISK & CMD directory of disk content is retrieving by once
- CMD other updates, D> (duplicate) command added and other command syntax changes
- MATH improved, various functions added and few additional keys mapped
- MONITOR command syntax overhauled into 1-line commands
- Bugfixes and other minor improvements

#### **Changelog for TRIANGULAR $\mu$ OS 1.11/VIC for Commodore VIC-20 [31-07-2022]:**

- TRIANGULAR  $\mu$ OS won't start on unexpanded VIC-20 5KB. VIC-20 with 8KB of RAM (3KB RAM Expansion) is needed (or higher)
- UOS and BIOS merged into single UOS program and improved error messages system
- CMD merged with its help file CMD>HLP and further improved
- CMD syntax of R> and C> operations changed to more intuitive [original file]=[new file]
- STAR WARS merged with its game engine file STAR WARS>ENG

#### **Changelog for TRIANGULAR $\mu$ OS 1.10/VIC for Commodore VIC-20 [28-07-2022]:**

- Support for Commodore VIC-20 with at least 5KB and it's 22 columns, 8 color text mode added
- New colorful loader for inter-loading operations
- BIOS Setup menu offers option to enable/disable Datasette
- BIOS Setup supports separate Work disk drive for storing system apps documents
- BIOS improvements and bugfixes
- GUI cursor is joystick operated and can move diagonally
- GUI windowed environment uses custom color background and title bar
- Up arrow button added to task bar (placed right of clock) to go back to main desktop screen
- SETTINGS is split into two apps: SETTINGS which can change time, work disk and printer options and COLORS which can change colors of GUI elements.
- DISK is now windows & cursor operated. Changed disk content display mechanism.
- CMD introduced improved mechanism for displaying success or error of performed operation. Minor review of command syntax (I> and V> instead of I and V). Bugfixes.
- APPS folder instead of OFFICE, contains WORDS, MATH, MONITOR, SYNTH
- MATH calculator revamped, simplified, windowed and cursor operated
- MONITOR have blue background. Command SHOW displays 2 hex digits instead of 4. HELP is consolidated. Minor bugfixes.
- 4 new games: SIMCITY, STAR WARS X-Wing vs TIE-Fighter (new version), BREAKOUT (new version), NEED4VIC
- Various other bugfixes and improvements
- Empty and formatted disk image called TRIANGULAR  $\mu$ OS 1.10-VIC Documents in .d64 and archived .zip file formats added for use as Work disk

#### **Changelog for TRIANGULAR $\mu$ OS 1.05/PET for Commodore PET [29-06-2022]:**

- Config file contains system key
- UOS/BIOS error messages system improved
- DISK text program is placed in THIS PC and it shows disk content and run programs
- SETTINGS can properly cancel changes and other bugfixes
- Improvements, bugfixes and cleaned code from redundant parts of all programs produced very stable version

#### **Changelog for TRIANGULAR $\mu$ OS 1.04/PET for Commodore PET [21-06-2022]:**

- OS name changed to TRIANGULAR  $\mu$ OS
- Launching program and config file names changed
- 8 KB version removed (since it is actually slower than 4 KB version)
- GUI: windows have black close buttons
- Taskbar window name moved to left side of TRIANGULAR logo orb
- Click/select key changed to 0 (zero)
- DESKTOP renamed to GUI
- THIS PC window renamed to THIS PET and contains DISK which loads program from disk
- SETTINGS now have SAVE button for saving settings
- Some icons updated
- CMD is greatly overhauled with commands syntax similar to DOS Wedge/JiffyDOS and added listing directory of disk content function
- MONITOR improved
- WORDS instead of WORD – this is completely new word processor
- SIMCITY game added in place of LUNAR LAND
- Other games have slightly different menu keys
- Games from 8 KB version removed
- Improvements and bugfixes

#### **Changelog for TRIANGULAR OS 1.03 for Commodore PET [27-02-2022]:**

- System now have 4KB and 8KB modes – launcher will choose which one to boot into
- 8KB mode has consolidated code of GUI, STAR WARS into 1 program, as well as BIOS and TRIANGULAR OS launcher, CMD and its HELP, Monitor and its HELP
- Fixed bug in disk detection system
- Few minor bugfixes
- 2 new games (RATRUN & MAD BOMBER) only in 8KB mode (instead of SNAKES and LUNAR LAND)

### **Changelog for TRIANGULAR OS 1.02 for Commodore PET [6-02-2022]:**

- Minor visual changes across the board (mostly highlighted key letters)
- Launch program renamed to TRIANGULAR OS
- TRIANGULARS OS/BIOS – has improved disk drive detection system. Drive database expanded (include SD2PET (experimental)). Loads OS>CFG file with wallpaper settings.
- BIOS Setup Menu – option is added to exit to BASIC
- GUI OS – SETTINGS saves wallpaper settings in file OS>CFG
- CMD – fixed drive # change mechanism. Minor bugfixes.
- OFFICE apps visual revision and many bugfixes
- GAMES minor visual changes and bugfixes

### **Changelog for TRIANGULAR OS 1.01 for Commodore PET [16-01-2022]:**

- First version to have manual
- Various minor improvements done in launching TRIANGULAR program
- BIOS – fixed launching logo position
- GUI – memorize cursor position in-between loading modules plus minor bugfixes
- CMD – many bugfixes
- MONITOR – fixed serious bug preventing user from running machine language programs
- OFFICE – apps can now properly load and save data on disk
- STAR WARS – added music in intro and outro. Game engine now don't reset system clock
- SNAKES – AI opponent fixed and minor esthetic changes
- LUNAR LAND – received minor esthetic changes

### **Changelog for TRIANGULAR OS 1.00 for Commodore PET [24-12-2021]:**

- Starting procedure changed: TRIANGULAR disk detecting program -> BIOS (Launching screen combined with Setup Menu) -> DESKTOP (GUI)
- BIOS detects if there are disk drives #8 - #11, detecting mechanism is improved and functioning drive type detection added
- BIOS Setup Menu displays drives and can change BOOT drive and restart system
- DESKTOP is streamlined and icons redesigned
- START Menu is placed on center of task bar and is displayed just as TRIANGULAR logo and have SETTINGS, RESTART and SHUT DOWN options
- SETTINGS (renamed CONTROL PANEL) can change desktop wallpaper from 5 patterns
- MY COMPUTER is renamed THIS PC and disk icon now open CMD program
- CMD (renamed DOS) can change operating disk (#8 - #11) plus some improvements
- OFFICE – apps have minor improvements
- MONITOR – heavily reworked and improved, operates on HEX values.
- GAMES icon in place of STAR WARS icon opens folder with 4 games: STAR WARS, SNAKES, LUNAR LAND and BREAKOUT

### **Changelog for TRIANGULAR OS 1.00 BETA for Commodore PET [2016 to 24-10-2021]:**

- System supports 1 cassette recorder as device #1 and only 1 disk drive as device #8
- BIOS have implemented simple PET type detection and it detects if there is disk drive #8
- BIOS Setup Menu is accessed with DEL key where you can change or reset system time
- Starting procedure: BIOS -> TRIANGULAR DOS -> Launch screen -> DESKTOP (GUI)
- DESKTOP (GUI) contains wallpaper, task bar on which is clock (right bottom), START Menu with TRIANGULAR logo (left bottom) and 4 icons: MY COMPUTER, OFFICE, STAR WARS and MONITOR
- START Menu has CONTROL PANEL, RESTART, EXIT TO DOS and QUIT TO BASIC options
- CONTROL PANEL can change and reset system clock
- MY COMPUTER contains cassette and disk icon which can load first encountered program (LOAD for cassette icon and LOAD “\*”,8 for disk icon)
- OFFICE contains 4 office suite programs: WORD a word processor, CALC spreadsheet, CONTACTS contact manager and MATH calculator
- STAR WARS brings fabulous STAR WARS X-Wing vs TIE-Fighter game
- MONITOR a very simple memory monitor program, operates on decimal numbers