



TRIANGULAR μ OS 1.27

for

 **Commodore**  **64**

Programmer's Reference Guide

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Contents:

A. Introduction	3
B. What you need	4
C. How to compile TRIANGULAR μ OS 1.27	5
D. Troubleshooting	6
E. BASICALLY	7
F. Support & Legal note	8
G. Changelog	9

A. Introduction

Programmer's Reference Guide for TRIANGULAR μ OS 1.27 SDK (Software Development Kit) explains programming aspects of TRIANGULAR μ OS, a GUI (graphic user interface) operating system for 8-bit Commodore computers.

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 and in later versions higher amount of RAM was required. This iteration (version 1.27) of TRIANGULAR μ OS requires Commodore 64.

This software was written in Commodore BASIC language (port of Microsoft BASIC) using CBM prg Studio 4.1.0, and is designed to run on standard Commodore 64. TRIANGULAR μ OS supports BASIC 2.0 (alternatively named BASIC V2) and works in color text mode. Commodore BASIC (a runtime interpreted language) is default language used in 8-bit Commodore computers and also functions as their OS and user interface. Similarly, to early Microsoft Windows (1.0 to 3.11), μ 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 μ OS modules, load/save settings and documents, perform operations on floppy disks and communicate with disk drive(s).

Package contains files:

- ***TRIANGULAR μ OS 1.27 for Commodore 64 Programmer's Reference Guide.pdf*** – this document
- ***Source Code*** folder with 4 files: ***UOS.bas*** (source code of UOS program), ***GUI.bas*** (source code of GUI program), ***uos.cfg.seq*** (default configuration file) and ***CHUCK.bas*** (game)
- ***TRIANGULAR μ OS 1.27 for Commodore 64 System Registry.xlsx*** – spreadsheet which details usage of variable stored in memory by TRIANGULAR μ OS 1.27
- ***TRIANGULAR μ OS 1.27 for Commodore 64 System Disk Content.xlsx*** – spreadsheet which presents file structure of System Disk of TRIANGULAR μ OS 1.27
- ***TRIANGULAR μ OS 1.27 for Commodore 64 Variables.xlsx*** – spreadsheet which details BASIC variables used by TRIANGULAR μ OS 1.27
- ***TRIANGULAR μ OS 1.27.d64*** – empty, preformatted System Disk
- ***TRIANGULAR μ OS 1.27 Documents.d64*** – empty, preformatted Documents Disk

B. What you need

In order to change and/or compile TRIANGULAR μ OS 1.27 you need to do this using external program like CBM prg Studio 4.1.0 (which was used in development and for compilation of .prg files). Using BASIC V2 on real hardware or emulator is out of question, since source code uses extensive line concatenation (up to 255 bytes long lines). Standard BASIC won't present program lines properly (especially print statements) and its screen/program editor won't be able alter those lines.

Download CBM prg Studio here: www.ajordison.co.uk

For fast creation and modification disk content I recommend DirMaster. I formatted my disk with custom PETSCII characters in Disk name and Disk ID in TRIANGULAR μ OS CMD program (N>TRIANGULAR μ OS< μ - μ symbol can be achieved by pressing C= + M and then C= + X).

Download DirMaster here: style64.org/dirmaster

For testing and debugging use real Commodore 64 or emulator (I use freeware VICE emulator).

Download VICE emulator here: vice-emu.sourceforge.io

Commodore 64 emulator VICE must be configured with enabled disk drive that can read 170KB 5.25" diskette (.d64 file): recommended CBM 1541 or 1541-II (default). 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. You can choose printer as device #4 - #7, although #4 is standard and recommended.

C. How to compile TRIANGULAR μ OS 1.27

Source code of UOS, GUI and CHUCK programs is stored in UOS.bas, GUI.bas and CHUCK.bas files. Segments of programs are commented with simple descriptive caption-like comments (!- is used to comment out line in CBM prg Studio).

After compiling source code files add UOS.prg, GUI.prg and CHUCK.prg program files to System Disk. File names on disk should always be UOS and GUI (in upper case/graphic mode) or uos and gui (in lower case mode). Remember to put UOS file first (to properly load system with LOAD “*”,8 command).

Add uos.cfg.seq file and change its name to UOS.CFG (it should have SEQ property) and place it in the middle of UOS and GUI, while CHUCK program as last (that’s my convention).

You can use empty, preformatted System Disk file to speed up process (TRIANGULAR uOS 1.27.d64 file).

D. Troubleshooting

Loading of next module of TRIANGULAR μ OS can “freeze” in process of inter-loading next μ OS module or disk program (very rare occurrence). This happens when loading screen not proceeds to next module for over 2 minutes for μ OS (smaller program will take less time to do so). When loading screen is not responsive for longer time, it means 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. 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).

E. BASICALLY

Below are listed functions of nascent BASICALLY API of TRANGULAR μ OS 1.27.

1. Window generator: draws empty window based on data in variable arguments. Before evoking this function assign desired values to those variables:
 - w1 - window top-left vertical position
 - w2 - window top-left horizontal position
 - w3 - window bottom-right vertical position
 - w4 - window bottom-right horizontal position
 - wn\$ - window name which will be displayed on title bar and on task bar

Next evoke this function with gosub51 command.

This function also generates w1\$ string variable (vertical start of window) and w2\$ (horizontal start of window) that can be used in further alignment of windows elements

Caution: j variable is used in for-to:next loops.

2. left\$(s\$,x) – will display x number of spaces (max x = 39)
3. left\$(v\$,x) – will display x number of cursor down {down} (max x = 23)
4. left\$(h\$,x) – will display x number of cursor right {right} (max x = 39)

F. Support & Legal note

More information about TRIANGULAR μ OS for Commodore 64 or other computers system is available on TRIANGULAR μ OS website, where you can download SDK, report bug or get help:
triangular-uos.blogspot.com

LEGAL NOTE:

TRIANGULAR μ OS is free and open software which you can freely copy, share and edit but give credit to creators of μ OS (especially 3rd party games creators).

G. Changelog

TRIANGULAR μ OS 1.27 for Commodore 64 [29-09-2023]:

- Filenames convention changed from filename>ext[ension] to standard filename.ext[ension]
e.g. uos>cfg to uos.cfg
- Added SYSTEM DISK folder for use with SD2IEC
- GUI: Menu Start button in the center of taskbar now made from purple TRIANGULAR logo
- WORDS: file extension changed to .txt
- MONITOR simplified running Machine Language program function
- STAR WARS X-Wing vs TIE Fighter (based on PET version) in place of CHUCK CHALLENGE
- CHUCK CHALLENGE added as extra on System Disk
- Various other bugfixes and improvements

TRIANGULAR μ OS 1.25/C64 for Commodore 64 [20-10-2022]:

- Code of TRIANGULAR μ OS is reviewed, improved, cleaned and bug fixed
- System Registry is rearranged to make space for 2 sprites
- Slightly updated loader module screen (LOADING/RESTARTING/SHUT DOWN)
- Multi-characters handled by special function amounting 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 μ OS API named BASICALLY 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 function 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

TRIANGULAR μ OS 1.20/C64 for Commodore 64 [31-08-2022]:

- Supports Commodore 64 with its 40 column VIC-II text mode and SID chip
- 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 is reworked with simplified keyboard and limited to 1 voice channel which now can play sounds in normal, lower and higher octave ranges
- Only 1 game: SIMCITY is carried over from TRIANGULAR μ OS for Commodore VIC-20
- 3 new games from Roman Werner are added in place of old games:
TAXI TAXI, CHUCK'S CHALLENGE and LIFE RAFT RESCUE
- All games merged into GUI program file
- Bugfixes and improvements