



Sparkle is a trackmo loader solution for the Commodore 64 inspired by Lft's Spindle and Krill's loader. It utilizes full on-the-fly GCR processing, fast data transfer, and blockwise data compression. Demos are built using loader scripts and demo parts are loaded sequentially. Loader calls are parameterless. Sparkle handles multi-disk trackmos as well. A Win32 tool is provided to edit script files and build demo disks. For version history please see Addendum 1.

## MAIN FEATURES

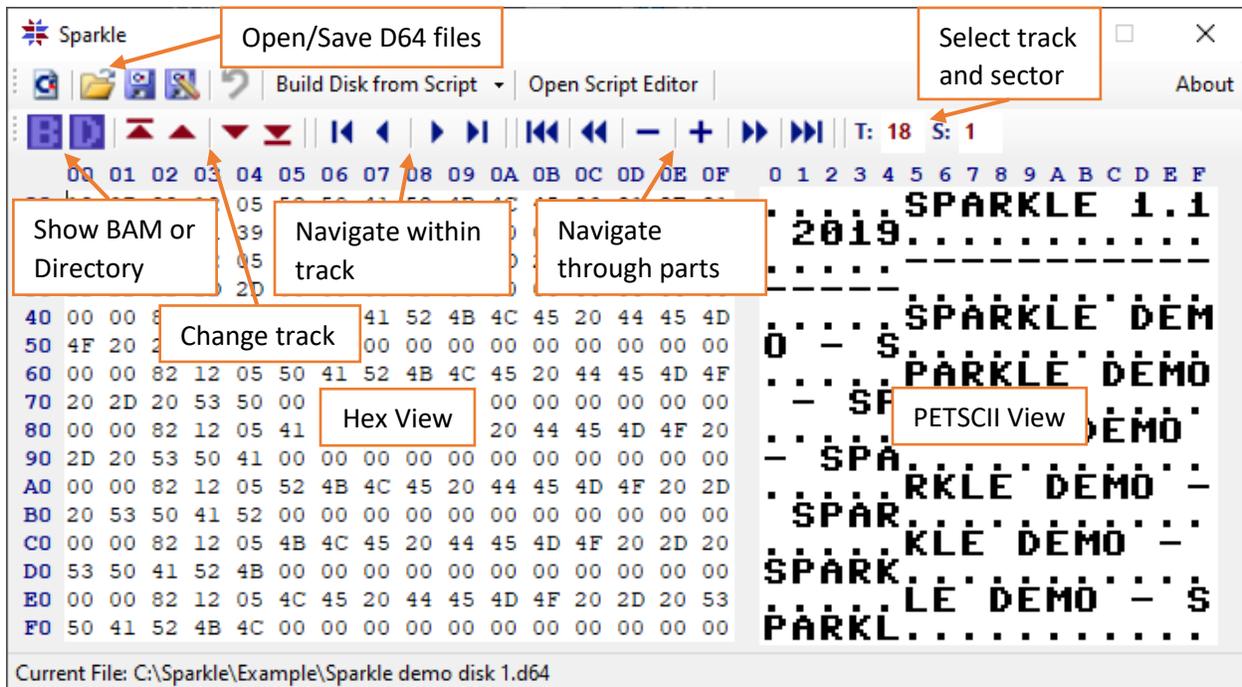
- Tested on 1541-II, 1571, and Ultimate-II+. Passed THCM's rigorous 24-hour test.
- Resident size: \$280 bytes including loader, depacker, fallback IRQ (\$0180-\$02ff), and buffer (\$0300-\$03ff). Stack is reduced to \$0100-017f. The buffer contains preloaded data between loader calls, so it needs to be left untouched.
- Only two bytes are clobbered on the zeropage which can be set from the script. Default is \$02-\$03. OK to use them between loader calls.
- 125-cycle on-the-fly GCR fetch-decode-verify loop tolerating disk rotation speeds of 289-311 rpm across all four speed zones, providing high stability.
- Very simple communication code with reset detection.
- 2Bit+ATN transfer protocol, 72 bytes/block transfer speed. Transfer is freely interruptible.
- Spartan Stepping™ for seamless data transfer across adjacent tracks with zero additional stepper delay.
- Sequential loading only. No random file access.
- Built-in blockwise packer/depacker. The packer compresses demo parts back-to-back. Thus, no partially used sectors are left on the disk.
- Combined fixed-order and out-of-order loading.
- Bus lock. The loader uses \$dd00 for communication. The user can freely abuse \$dd02 between loader calls, but \$dd00 needs to be left untouched.
- Loading under I/O is supported.

## SPARKLE WINDOWS TOOL

The Sparkle Windows tool (written in VB.NET, target .NET Framework 4.5, should work on Windows 7+) features a simple disk monitor and a built-in script editor. D64 and script files can be opened from within the tool or drag-and-dropped to process them. Script files use the .sls (Sparkle Loader Script) extension. Run Sparkle as administrator to associate the .sls file extension with the tool. Once the necessary registry entries are installed you can also build your demo disks by double clicking script files. (This can also be achieved by selecting Sparkle from the Open with... list after double clicking a script file.) Sparkle can also be used as a command line tool (e.g. sparkle mydemo.sls). A simple demo project is provided as an example.

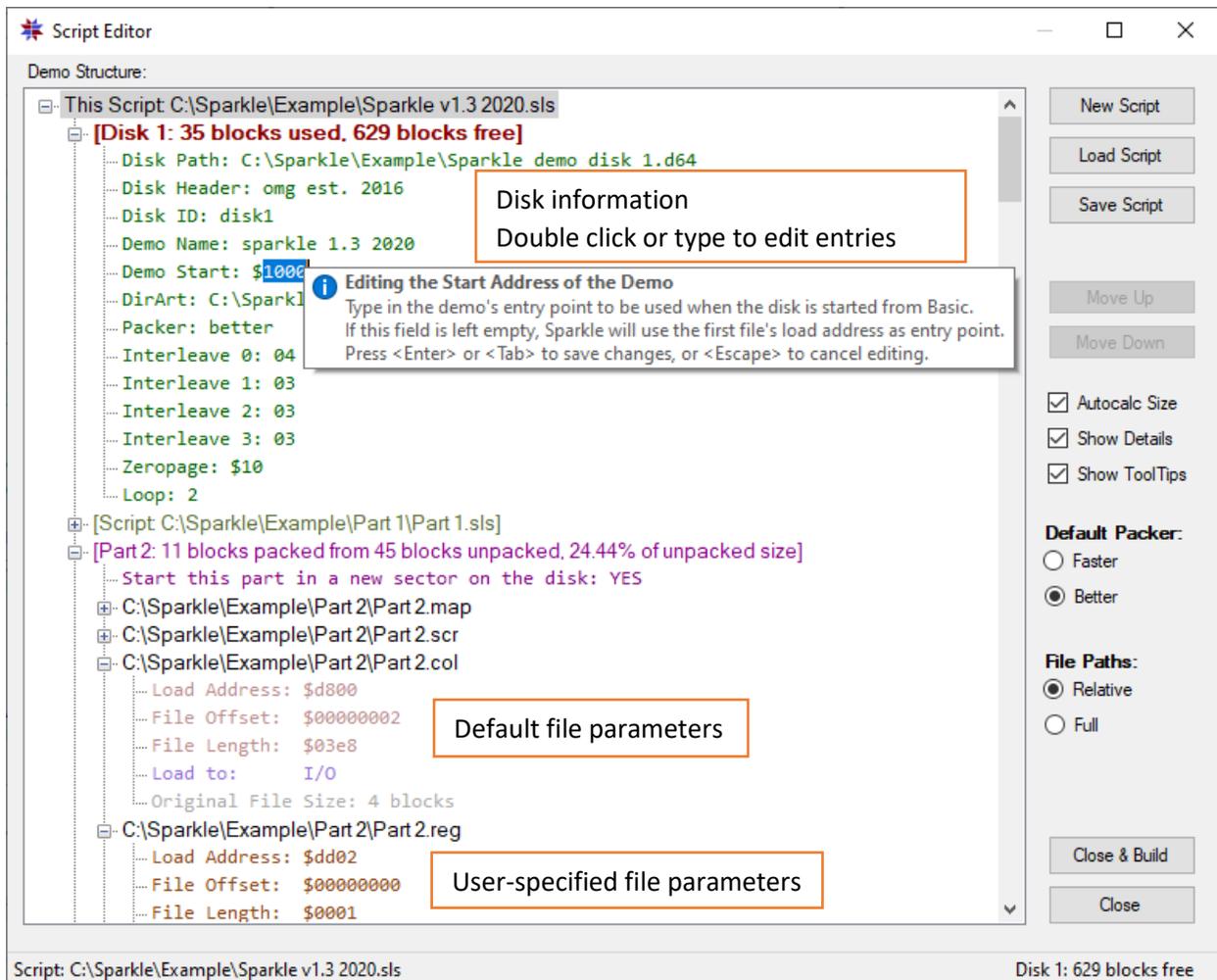
## MAIN WINDOW

Sparkle features a simple disk monitor which is the main window of the program showing the hex and PETSCII views of the selected sector and two toolbars. Here you can start a new disk , open , and save  D64 files, and build demo disks from scripts. On the second toolbar, the leftmost two buttons will show the BAM  and the first sector of the directory . The next four buttons will navigate to the first , previous , next , and last  track on the disk. The following four buttons will load the first , previous , next , or last  sector of the selected track. The next group of six buttons are used to navigate through demo parts, jumping to the first sector of the first part , the first sector of the previous part , the previous sector in the part , the next sector in the part , the first sector of the next part , and the first sector of the last part . Finally, on the right side of the toolbar you can see the current or manually select the desired track **T: 18** and sector **S: 1**. Hovering over a button will show a tooltip with the description of the button's function. In the Hex View panel, you can perform changes in the selected sector.



## SCRIPT EDITOR

Scripts can be created, loaded and saved in the script editor window where demo information is organized in a treeview structure. Opening the editor will prepopulate the treeview structure with a blank disk or with the previously opened script. Pressing the <Enter> key or double clicking on an item allows editing. Deleting a value will reset it to its default if such exists. Here you can specify where you want to save your demo disk, add a disk header and ID for the directory, enter the demo's title (first prg in the directory), the start address (entry point when disk is loaded from BASIC), and you can also add DirArt (16 characters in a row separated by line breaks, saved as a .txt file). DirArt files, disks, parts, scripts, and demo files can be deleted by pressing the <Delete> key. Disks, demo parts, and scripts can also be freely rearranged. Entries can be saved with absolute file paths or relative to the script's path.



Instead of files, Sparkle works with demo parts. A demo part is the sum of arbitrary files and data segments designated to be loaded during a single loader call. (This may not literally correspond to an actual part in a demo which may require multiple loader calls.) When adding files to a demo part, you can specify what and where you want to load by editing the load address (where the data will go), offset (first byte of data in the file), and length of the desired data segment (number of bytes to be loaded) within the selected file. By default, Sparkle uses the first two bytes of the file as load address, 2 as offset, and (file length-2) as length. If you only specify the load address, then Sparkle will use 0 as offset and the file's length as length. During disk building, Sparkle will only compress the selected segment of the file.

If any part of a data segment overlaps the I/O area (\$d000-\$dfff) you can select whether it should be loaded to the I/O area (e.g. VIC registers, color RAM, etc.) or in the RAM under the I/O area. In the latter case Sparkle will mark the filename with an asterisk (\*) which indicates that the loader will need to turn I/O off during loading of the specified data segment.

Sparkle offers two packer options: a faster one and a better one. The faster option is somewhat less effective but both packing and unpacking are faster. The better option results in better compression but packing and unpacking are both slower. As a result, using the better option may save a few blocks on the

disk but load times may not be any better (and in some cases even worse) than with the faster option. The packer can be separately set for each disk side in the demo. By default, Sparkle will use the faster option. The default compression method can be changed in the script editor window.

Sparkle sorts files within a part during compression to achieve the best possible compression ratio. Therefore, file order within a part can be random.

## MANUAL SCRIPT EDITING

Use the following template to manually prepare or edit your scripts:

```
[Sparkle Loader Script]
```

```
Path:      your path\your d64 file
Header:    max. 16 characters as in the directory header
ID:        max. 5 characters as in the directory ID
Name:      max. 16 characters
Start:     xxxx (program entry when disk started from Basic)
DirArt:    your path\your dirart.txt file
Packer:    faster vs better (can be changed for subsequent disks)
IL0:       n (sector interleave of n>0 for speed zone 0)
ZP:        xx (set once in first disk info section)
Loop:      0 for no looping or disk number 1-255 (set once)
```

```
File:      your path\your file*  dxxx  yyyyyyyy  zzzz
File:      your path\your file   xxxx  yyyyyyyy  zzzz
```

Align

```
Script:    your path\your script file to be inserted here
```

The script must start with the file type identifier in brackets and must contain at least one file entry. Everything else is optional and can be omitted. If `Start` is omitted Sparkle will use the load address of the first file entry as start address. Entry types (`Path`, `Header`, `ID`, `Name`, `Start`, `DirArt`, `Packer`, `IL0-IL3`, `ZP`, `Loop`, `File`, `Script`) and their values are separated by tabs. The loader's zeropage usage (hex byte format, default is 02) and the `Loop` entry type can only be set once, in the first disk's setup (see Addendum 2 for a workaround for `ZP` usage). Demo parts are separated by blank lines. Files in a single demo part are in consecutive lines. File paths can be absolute or relative to the script's folder. After at least one file or script entry is added to the script, you can start a new disk simply by adding new disk info entry types (`Path`, `Header`, etc.) followed by the next disk's files. See example demo project's script for details.

You can specify three parameters for each file entry, separated by tabs. The first one is the load address of the file segment, the second one is an offset within the original file that marks the first byte to be loaded, and the last one is the length of the file segment. Parameters are hex numbers in word format (max. 4 digits) for the file address and file length, and dword format (max. 8 digits) in the case of the file offset, prefix is not needed. Parameters can be omitted but each one depends on the one on its left. I.e. you cannot enter the offset without first specifying the load address. Sparkle can handle `SID` and `PRG` files so parameters are not needed for these file types unless you want to change them. If all three

parameters are omitted then Sparkle will load the file as a PRG file: it will use the file's first 2 bytes to calculate the load address, offset will be 2, and length will be (file length - 2). The only exception is files shorter than 3 bytes for which at least the load address is mandatory. If only the load address is entered then Sparkle will use 0 for the offset and the file's length as length. Sparkle will calculate the length as (original file's length - offset), but max. ( $\$ffff - \text{load address}$ ) bytes if the load address and the offset are given but the length is not.

By default, Sparkle writes  $\#\$35$  to  $\$01$  and turns the BASIC and KERNAL ROMs off during loading but leaves I/O on. If any part of a file is to be loaded in the RAM under the I/O area ( $\$d000-\$dfff$ ), an asterisk (\*) must be added to the end of the file name (see template above). This will instruct Sparkle to turn off the I/O area while unpacking the file. If the \* is omitted the file will be loaded to the I/O area (VIC, SID, and CIA registers, etc.). A demo part may contain two file segments sharing the same load address if one is destined under I/O and the other one is to be loaded to the I/O area.

Sparkle will ignore any unrecognized entries. Resaving a script from the editor will result in losing these entries.

## RUNTIME CONSIDERATIONS

The installer, C64 resident code, and drive code take 8 blocks on track 18. Thus, you have the entire 664 blocks for your demo and the remaining 10 blocks of track 18 for DirArt. Loading and running any entry from the disk's directory will start the installer which will install the C64 resident code and the drive code, perform an `sei` instruction, set  $\$01$  to  $\#\$35$ , reduce the stack to the lower  $\$80$  bytes and set the NMI vector to an `rti` instruction. Then the installer will automatically load the first demo part. During loading, the value of  $\$01$  can be either  $\#\$34$  or  $\#\$35$  depending on the destination of the part. Once the first part is loaded, the loader will restore  $\$01$  to  $\#\$35$  and it will jump to the start address as specified in the script (or to the first byte of the first file in the script if a start address was not specified) without changing the I flag (IRQs remain disabled). The installer and the loader do not alter any other vectors or VIC registers.

From your demo, the following functions are available:

- Loader call:

```
jsr $0180 //Parameterless
```

This parameterless subroutine call will load the next part as specified in the script. The loader writes  $\#\$35$  to  $\$01$  at the beginning of every loader call and will return with this value in  $\$01$ . Loader calls do not clobber the I flag. When the loader is called, it first depacks the first partial block (if such exists) of the next part from the buffer before receiving the next block. During depacking I/O may be turned on or off depending on where the data are designated. Once the last part on a disk is loaded the loader moves the read/write head to track 18 and checks the last three bytes of the BAM to determine whether there is a next disk side to be loaded. In case of a multi-disk demo, the next (standard) loader call will instruct the loader to wait for disk flip before the next part is loaded. The loader will reset the drive if there are no more disks.

- Fallback IRQ Installer:

```
jsr $01e0 //X/A = IRQ subroutine vector Lo/Hi
```

Use it to install a simple fallback IRQ with a music player call or any other function. The IRQ routine is located at \$02dd and the subroutine call initially points at an `rts` instruction. The low and high bytes of the subroutine address need to be in the X and A registers, respectively before the IRQ installer is called. Use `jsr $01e6` if you do not want to change the subroutine vector. The I flag is set during the initialization of the loader and remains set after loading the first part is completed. Calling the IRQ installer does not change the I flag allowing the user to set or clear it at the desired moment.

## CAVEATS

VIC bank selection must be done by writing #`$3c`-#`$3f` to `$dd02`. Do not change `$dd00`.

Loading to pages 1-3 is not recommended as it would overwrite the loader or preloaded data in the buffer. While Sparkle can load files compressed by another packer such as Exomizer, make sure to restore the stack pointer and any other registers and zeropage values as required by the packer before you start your program. Restoring the stack pointer will result in overwriting Sparkle's resident code on the stack, so further loader calls will not be possible.

Start the Win32 tool from a local or removable drive as it does not seem to work properly from network drives.

## DISCLAIMER

Sparkle is a free software and is provided "as is". It is a hobby project, I am not a professional coder so use it at your own risk and expect bugs. I do not accept responsibility for any omissions, data loss or other damages. Please credit me in your production should you decide to use Sparkle. Feel free to contact me with any questions via PM on CSDB or by emailing to [spartaofomg@gmail.com](mailto:spartaofomg@gmail.com).

Please find the most up-to-date version of Sparkle on GitHub: <https://github.com/spartaomg/Sparkle>

Sparta/OMG, 2019-2020

## ADDENDUM 1

### VERSION HISTORY

#### V1.3

- New feature: script embedding. If your script is very long, you can save part of it in a separate file and then add this to your script using the "Script:" entry type followed by <TAB> and the script file's path. When Sparkle reaches a script entry during disk building, it will first process its content before continuing with the next entry. You can even add whole disks to your script this way. Scripts cannot be inserted in an existing demo part. I.e. files in the embedded script will always start a new demo part, and won't be added to the current part. If relative paths are used, Sparkle will use the path of the embedded script to calculate the path of the files in it.
- New feature: demo looping. Use the "Loop:" entry type followed by <TAB> and a decimal value between 0-255 in the *first* disk's info section to determine your demo's behavior once it reaches its end. The default value is 0 which will terminate the demo. A value between 1-255 will be interpreted as a disk number where 1 represents the first demo disk. Once the last part on the last disk is loaded Sparkle will wait for this disk to be inserted to continue. If you use the last disk's number then Sparkle will reload the last disk in an endless loop. This entry type can only be used once in a script. If not specified then the default value of 0 will be used.
- New feature: aligning a demo part with a new sector on the disk. By default, Sparkle compresses demo parts back-to-back, not leaving any unused space on the disk. If the length of a part changes during demo development, it will affect the compression and distribution of every subsequent part on the disk. This may adversely influence the timing of the demo. From the editor, double click the "Start this part in a new sector on the disk" line under the part node to change its value to YES from NO where this type of timing is crucial to force Sparkle to always start the part in a new sector on the disk. If you prefer to manually edit your script, use the "Align" entry type in a new line preceding a demo part to achieve the same result.
- New feature: custom sector interleave. Sparkle now allows the user to specify the interleave for each speed zone on the disk. The default is 4 for speed zone 0 (tracks 1-18), and 3 for speed zones 1-3 (tracks 19-35). Use `ILn:<TAB>N` in the disk info section in your script where `n=0-3` specifies the speed zone and `N>0` is a decimal value for the desired interleave to be used during disk building.
- New feature: Sparkle now generates an exit code when running from command line. The exit code is non-0 if there is an error during disk building.
- Improved and updated editor to accommodate the new features. The editor now accepts alphanumeric (a-z, 0-9) characters in addition to <Enter> to start editing an entry. Just press the first character of the new value to overwrite the previous one, or <Enter> if the first character is not alphanumeric. Once you are done editing, press <Enter> or <Down> to step to the next entry, or <Up> to step back to the previous one.
- Updated, more flexible script handling:
  - Sparkle now recognizes both LF and CRLF line endings.

- The script entry "New Disk" is no longer needed to start a new disk during manual script editing. Just add the next disk's info after the last file or script entry. Make sure there is at least one file entry after every disk info section. Otherwise, the next disk info section will overwrite the previous one.

- Sparkle will skip any unrecognized lines in the script. This can be used to manually comment your script. Manual comments will be ignored in the editor window and will be lost when the script is resaved from the editor.

- File offset values can be as large as \$ffffffff. The maximum value of file address and length remains \$ffff.

- Bug fixes. Thanks to Raistlin/G\*P and Visage/Lethargy for testing and feature requests.

#### V1.2

- Optional better packer. Sparkle now offers two versions of its packer. The original, faster one, and a new, better one. The new packer results in better compression at the expense of slower packing and unpacking compared to the original faster but less effective option.

- Minor improvements in the C64 code saving about 10000 cycles on the unpacking of a disk side.

- GUI update.

- Bug fixes.

#### V1.1

- Option to select ZP usage in the script.

- Improved default file parameter handling.

- Minor changes in the editor.

- Bug fixes related to loading under I/O.

#### V1.0

- Initial release.

## ADDENDUM 2

### SCRIPT HACK

The following \$46-byte script hack will change the loader's zeropage usage at any time during loading:

1. For the example's sake let's say you want to change zeropage usage from the default \$02/\$03 to \$fe/\$ff. Prepare a 4-byte long file, e.g. NewZP.bin with the following content:

```
$fe, $ff, $2d, $02
```

2. Add the following lines to any loader part in your script where the ZP change is needed:

```
File: Your Path\NewZP.bin    00fe 0002
File: Your Path\NewZP.bin    02a4 0000 0001
File: Your Path\NewZP.bin    022d 0000 0001
File: Your Path\NewZP.bin    023c 0001 0001
File: Your Path\NewZP.bin    0290 0000 0001
File: Your Path\NewZP.bin    0296 0001 0001
File: Your Path\NewZP.bin    0292 0000 0001
File: Your Path\NewZP.bin    024b 0000 0001
File: Your Path\NewZP.bin    0263 0000 0001
File: Your Path\NewZP.bin    0265 0000 0001
File: Your Path\NewZP.bin    026d 0001 0001
File: Your Path\NewZP.bin    02b5 0000 0001
File: Your Path\NewZP.bin    02b7 0000 0001
File: Your Path\NewZP.bin    02bb 0001 0001
File: Your Path\NewZP.bin    02c3 0000 0001
File: Your Path\NewZP.bin    02c8 0001 0001
File: Your Path\NewZP.bin    02d3 0000 0001
```

Don't forget to replace the bold text with your ZP address and Your Path with your file's path. 😊

Note: this hack is intended to be used with the current (V1.3) release. It may not work with previous and future Sparkle versions.