RTO FLASH CARTRIDGE USER MANUAL

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The hardware cartridge "Intellivision RTO Flash Cart" (henceforth referred to as RTO) allows Program/Game files to be loaded on the Intellivision console; these files are "Cartridge Dumps" i.e. transfers of the programs contained in the ROMs of the Intellivision cartridges.
These files must be stored on a micro SD card, which is inserted into the compartment located to the left of the RTO, and the latter will be inserted into the cartridge port of the console.

TECHNICAL FEATURES

-) Supported console : Mattel Intellivision

-) Compatible type of files : .BIN + .CFG

-) RTO reads files stored on a micro SD

-) Compatible media : micro SD Card from 1 Gb to 32 Gb - FAT and FAT32 formatting

-) Compatible Intellivision Console : PAL/NTSC or SECAM

-) Operations of searching and loading files by three Push Buttons located on the RTO cartridge

-) Titles must be placed in the Root of the micro SD card or, to sort Titles, inside folders placed in the Root of the micro SD card, for example to sort them by alphabetically, by genre etc. - Sub-folders can NOT be used.

-) It needs to be stored in the Root of the micro SD the basic configuration file "0.cfg". See Appendix

-) Folders and file names : Compatible with Long Names, max 45 Characters + extension for files

-) RTO shows the list of folders and files on the OLED display

-) Two LEDs are the indicators of RTO cartridge operation.

-) Direct power supply from the console's cartridge port

IMPORTANT

All connections and disconnections, both electrical and mechanical, must be made with the equipment off and the cables not connected to the mains electrical outlets.

Do not use liquids to clean the RTO cartridge, but only cloths made of antistatic material.The RTO cartridge is composed of electronic parts and its casing is made of PLA or ABS plastic material.

Do not press on the small window that houses the OLED Display, this is a delicate component and pressure can damage it and cause it to come out of its housing creating further damage to other electronic components that are inside the RTO cartridge.

Do not disassemble the RTO cartridge and do not make any repair attempts; these tasks should only be carried out by qualified personnel.

Be careful not to spill liquids on the RTO cartridge, in case of accidental spillage of liquids, do not insert the RTO cartridge into the console, and in case it is inserted, remove the plug from the electrical outlet immediately, and dry the RTO cartridge. Before connecting the RTO cartridge make sure it is completely clean and dry, otherwise repeat the cleaning and drying steps.

The User of the RTO Cartridge is solely responsible in case of damage to People, Animals and Property occurred with the use of the RTO Cartridge; the Hardware Designer, the Author of the Manual and the Vendors are not responsible in case of damage to People, Animals and Property occurred with the use of the RTO Cartridge.

By using the RTO Flash Cartridge for Intellivision, the User agrees to the above conditions.

INTELLIVISION CONSOLE CONNECTION

The RTO cartridge should be inserted directly into the right cartridge port of the console.
Insert the RTO cartridge into the console's cartridge port with the side where the text and LEDs are located facing up.

Tip : Place under the RTO cartridge a stand, a support base, which makes the RTO secure and rigidly stable in its position, this for when Push Buttons are pressed during operations.
This holder prevents the RTO cartridge from flexing with finger pressure on the Push Buttons, thus preventing force on the Intellivision connector contacts and the connector itself.
Bending the cartridge could create false contacts and malfunctions, and in the long run could also damage the Intellivision connector or the RTO cartridge itself, or both.
This expediency is advisable because the RTO works through buttons located on the cartridge itself, whereas standard cartridges are inserted into the port but have no buttons to operate.

INSTRUCTIONS ON THE USE OF RTO CARTRIDGE

Using a Personal Computer (the following directions consider a PC with Windows O.S.) copy the program files with the extension .BIN + .CFG to a micro SD card.
You can create folders (only on the Root) to search and sort your Files, e.g. to sort them by genre, type etc. but you CANNOT create sub-folders, the files can be stored either in the Root or in a folder on the micro SD.
The .BIN file must always be associated with a .CFG file, and they must have the same name.

Example : **"Burgertime.bin"** + **"Burgertime.cfg"**

NOTE : In case you transfer only the .BIN file without the .CFG configuration file, then the RTO cartridge, not finding the latter, will use, by default, the configuration file "**0.cfg**" , which must be transferred to the Root of the micro SD, and obviously it may or may not be compatible with your .BIN file.

In general, the "0.cfg" configuration file is compatible with the vast majority of Roms, but not all.

If the RTO cartridge does not find the associated configuration file neither the "0.cfg" file, then it will not be able to run the Program/Game.

The .BIN file contains the "Dump" of the Roms, i.e., all Program/Game data, while the .CFG file contains information on how the various data areas of the Roms should be allocated in the Intellivision's memory map.

Without this important file, the RTO cartridge would not know where to place the contents of the Rom and would not start the Program/Game.

Obviously the .CFG file must contain the correct data, otherwise RTO cannot run the Program/Game.

There are .CFG files that in addition to containing the parameters for Rom allocation, contain additional data, namely "Hacks".

For example, these "Hacks," may have been added to activate the Infinite Lives on a game, or increase the running time of a "Stage," to activate the character's invulnerability, to select which "Stage" to start from, and so on.

In this case the RTO cartridge recognizes the presence of the "Hacks" added in the .CFG file, and asks if you want to activate them or not.

To activate any "Hacks" you press PB 2 on the RTO, but if you want to start the standard Game without "Hacks" you press one of the other two Push Buttons, either PB 1 or PB 3; the detailed explanation of the RTO Push Buttons and their location can be found in the following paragraphs.

NOTE : The .CFG files containing the "Hacks" are created by console enthusiasts, and made generally for use on Intellivision Computer Emulators, so they may also not be fully compatible with the Intellivision console and RTO.

Tip : For transferring the Files to the micro SD, it is preferable to keep a folder with all Programs/Games on the PC and select all Titles and Folders, then right-click on the first Title or Folder in alphabetical order and select "copy," then place on the micro SD card and select "paste" to begin the transfer.

This procedure makes sure to transfer all Files and Folders by copying them in alphabetical, order so that they are found in the same order on the OLED display of the RTO cartridge.

Similarly when you want to add one or more Programs/Games, the best procedure is to copy them to the folder on the PC that contains the ones already transferred previously, then wipe, i.e., delete all the contents of the micro SD card and transfer all the contents from the folder of the PC to the micro SD card as described above.

This avoids ending up with the latest titles added at the top of the list, or in the middle of existing ones, thus maintaining the alphabetical order on the OLED display of the RTO.

It may happen that by adding Titles on the micro SD that already contains others, these added Titles will be shown first on the OLED display by the RTO.

Of course, there is nothing to prevent you from adding titles progressively and proceeding as you like.

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HOW TO NAME FILES

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The RTO cartridge handles long names, but in order to avoid non-recognition of a title, it is strongly recommended that titles be simplified as much as possible, for example by avoiding the "Space" between names, and instead use the "Minus - " sign and "Underscore _ ", these symbols are fully supported by the RTO cartridge.
Avoid to include symbols such as "Dot", "Apostrophe", "Comma", "Exclamation/Question marks", "Asterisks", etc. etc. and keep the file name as short as possible; Names up to 45 characters long are supported.

Example : a title such as "**Masters of the Universe-The Power of He-Man! (1983) (Mattel).bin**" would be best reduced to the following "**Masters_o_t_Universe-T_P_o_He-Man-(1983).bin**"; the exclamation mark was removed, then simplified and shortened, but it still remains understandable, especially for fans of the Intellivision console who are very familiar with all the titles produced.
You can still leave the original title unchanged without any simplification, as you prefer, always respecting the maximum number of 45 characters
Only in the case where, due to some unsupported character, or a bad combination of characters, the title does not appear on the OLED display of the RTO cartridge (in this case a blank space appears when scrolling forward and backward through the titles) then it can be decided to simplify the title to make it compatible.

Once you have completed preparing the micro SD card you can insert it into the slot located on the left side of the RTO; the micro SD should be inserted with the label facing up, and the electrical contacts facing down.

Now you can insert the RTO into the right cartridge slot of the Intellivision console and then turn on the TV or Monitor and the console.

FUNCTIONS DESCRIPTION OF RTO PUSH BUTTONS

The RTO cartridge has three Push Buttons (PB 1 – PB2 – PB3) to operate and to perform various functions, the diagram below shows the location and the Push Buttons Position :
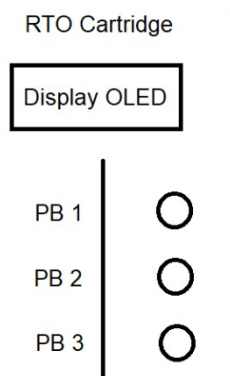
Functions of the three Push Buttons before starting a Rom on the Intellivision Console

PB 1 - Forward Scrolling Titles and Folders

PB 2 - Enter/Exit a Folder - Starts the selected file (NOTE : to exit from a Folder, use PB 1 or PB 3 to display two exit points with the following characters : **" . . Kb:0 "** then press PB 2

PB 3 - Backward Scrolling Titles and Folders

Functions of the three Push Buttons while a Program/Game is running on the Console

PB 1 - Reset Intellivision Console (NOTE : If Pushing PB 1 the screen on the TV/Monitor turns black, it means the "Capacitor" on the Reset line of your Intellivision is defective, and to restart the Program/Game that was running you have to press, in addition, the Reset Button on the Intellivision console)

PB 2 - Not Used

PB 3 - Reset Cartridge RTO

When the TV/Monitor and Intellivision console are turned on, the following condition is observed :
The TV/Monitor shows the Main Screen " **RTO - Cart Please Select a Game** ".
The OLED Display shows the following : " **Press a Button on RTO** ", use the PB 1 and PB 3 buttons to navigate back and forth through the Titles and Folders, in order to position on the desired Title.
If the Main Screen image does not appear on the TV/Monitor and you have a black screen instead, and also pressing the PB1 and PB 3 buttons they do not work, it means that your console has the "Capacitor" on the "Reset" line defective.

This is not a problem, in fact simply pushing the "Reset" button on the Intellivision, the RTO will be activated, and the Main Screen of the RTO cartridge will appear on the TV/Monitor : " **RTO - Cart Please Select a Game** ", now you can scroll through the Titles as reported above.

Pushing PB 2 starts a Program/Game or enters in a Folder.

The OLED Display shows the "filename.bin," while the "filename.cfg" is not displayed because it is only for the system and its display has no practical use.

On the OLED display of the RTO in addition to the "filename.bin" the line below shows the size of the ROM in Kb.

Pushing PB 2 will load the ROM into the console and start it.

The OLED display will show the following message : "**Emulating ROM : filename.bin**" and the Program/Game will start.

If, same as before, the TV/Monitor will remain black without displaying anything, (again due to the defective "Capacitor" mentioned above), to start the Program/Game you must push the Reset button on the Intellivision console.

At this point the control moves to the Intellivision console and you can use all the functions of the "Gamepads" as an original cartridge had been inserted.

By pressing the Reset button on the Intellivision console, the Program/Game will restart, remaining present at all times and behaving as an original cartridge had been inserted.

The same thing is done by pressing PB 1 on the RTO; this button, while the Program/Game is running, has the same function as the Reset button of the Intellivision console.

Pressing the PB 3 instead, while the Program/Game is running, will reset the RTO and remove the Program/Game from the Intellivision console, on the OLED display will appear : "**Press a button on RTO**", the TV/Monitor will turn black showing nothing more.

At this point the Program/Game is quit and you can proceed to load another one.

In case your Intellivision has the defective "Capacitor", in order to load a new Program/Game you need to do an additional step, in fact pressing any of the 3 buttons nothing happens, then you have to push the Reset button on the Intellivision console, so the Main Screen " **RTO - Cart Please Select a Game** " will appear on the TV/Monitor.

You can then repeat the above mentioned operations to load a new Program/Game.

INTELLIVISION FILE FORMATS

There are a few formats of the files extracted from Intellivision cartridges, following the three most important ones.
All the Cartridges Dumps at least they are available on one of these three formats :

"filename.BIN"   "filename.INT"   "filename.ROM"

1. "filename.BIN" is the classic binary file extracted from the roms contained in Intellivision cartridges, this type of file needs the configuration file "filename.CFG" as described above.

2. "filename.INT" also this is a binary file exactly the same as the previous one, only the extension changes, this type of file needs the configuration file "filename.CFG" as described above. This type of extension was adopted on the Intellivision Emulators, which, probably having to run also on PCs, with Windows O.S., it does not like extension conflicts, in fact the extension .BIN, was already in use on these O.S., and using it could have created association problems with other programs.

3. filename.ROM is the binary file with configuration data included, that is the contents of the "filename.CFG" file, so this type of file does not need the configuration file having it already internally.

As described in the technical features of the RTO cartridge, the only format supported is .BIN, in fact if we transferred files with the extensions .INT and .ROM to the micro SD they would not be showed on the OLED display, and in any case would not be handled.
Let's see how we can handle these two formats and make them compatible with the RTO cartridge.

filename.INT

For this format the procedure is very simple, just rename the extension from .INT to .BIN
Example : "**burgertime.int**" renaming the extension will become "**burgertime.bin**", having done this simple step we treat it exactly like a .BIN file.

filename.ROM

As described before this is an "Embedded" file that it includes the two files "filename.BIN" and "filename.CFG" in the .ROM file.
In order to use it on the RTO cartridge, it is necessary to extract the two files and save them separately.
To do this we use a program that runs on the Windows O.S. called
"rom2bin.exe"
The program can be downloaded from the following link : **http://spatula-city.org/~im14u2c/intv/** where you can find the SDK (Software Development Kit) of the Intellivision emulator "jzintv".
The program, (once unpacked the downloaded file, currently named "jzintv-20200712-win32-sdl2.zip"), it's inside the folder "bin/" .
This program is a converter, which converts a .ROM file into two separate .BIN and .CFG files
Its use is very simple: copy into a folder the program "rom2bin.exe" and the files you want to convert, then drag and drop the file "namefile.rom" on the program file "rom2bin.exe", and you will get two separate files "namefile.bin" and "namefile.cfg".
These two files are now compatible with the RTO cartridge.

IF A PROGRAM/GAME FILE DOES NOT RUN ON RTO

We can face the condition of having transferred to the micro SD card a Program/Game that does not start, some reasons may cause the issues , below we try to find the solution.

1. The names of the files are not the same and as a result the RTO cannot find the configuration file.
   Solution : rename the .CFG file exactly like the .BIN file.
2. The two .bin and .cfg files are located in a subfolder.
   Solution : move the two files to the root of the micro SD card or into a root folder and delete the sub folder that contained them, it has no use.
3. The .ROM file was converted incorrectly and the two .BIN and .CFG files are damaged.
   Solution : repeat the file conversion.
4. Even if the file has the extension .BIN it is not a binary .BIN or even it's not an Intellivision Rom.
   Solution : the file is not usable
5. The .BIN file or the .CFG file is corrupt.
   Solution : the file is not usable
6. The .CFG file is incorrect or it's only compatible with the PC Emulators and not with the RTO cartridge.
   Solution : correct and edit the .CFG file.

CORRECTING AND EDITING .CFG FILES

The .CFG files originated primarily for use with Intellivision Emulators on Computers, they are needed to provide information on how to allocate and define the memory for ROMs and RAMs.
As Emulators evolved, the configuration files also began to change by adding information that was useful to a specific Emulator.
Today there are different types of .CFG files for the same Program/Game, but with different contents and parameters (Obviously except memory allocation parameters that must be maintained).
Let's look at a practical example of a standard .CFG file and the same one with a simple difference :

"filename.cfg"   Version 1   "filename.cfg"   Version 2

[mapping]   [mapping]
$0000 - $1FFF = $5000   ECS
                                                          $0000 - $1FFF = $5000

Both files are correct and they work, but the Version 1 is compatible with all emulators and will certainly not give any problems even with RTO, but in the Version 2 we can see the addition of a line with "ECS" , which informs that the Program/Game needs additional peripherals to be used.
Probably this second configuration file was created for an Emulator that has the feature to use this additional line, and it is possible that on other Emulators it could create compatibility problems.
The RTO cartridge recognizes Version 1 memory mapping, so with the configuration file containing the "ECS" information it will not start the Program/Game, so we have to change it to the Version 1 by deleting the line containing "ECS"

To better understand how a configuration file is composed we use the following example :

"Burgertime.cfg"

[mapping]
$0000 - $1FFF = $5000 ; 8K to $5000 - $6FFF
$2000 - $2FFF = $D000 ; 4K to $D000 - $DFFF
$3000 - $3FFF = $F000 ; 4K to $F000 - $FFFF

"Burgertime_(Hack).cfg"

[mapping]
$0000 - $1FFF = $5000
[memattr]
$D000 - $DFFF = ROM 16
$F000 - $FFFF = ROM 16
[macro]
p 633a 34 ; Infinite peppers (both players)
p 51f9 34 ; Infinite lives (both players)
and so on with more lines ……………………………..

These are two configuration files of the same game "Burgertime", the first file is standard and gives the memory mapping
information, the second one in addition to the mapping includes the "Hacks", they are placed after the line "[macro]".
Both files are compatible with the RTO, in fact, as described above the RTO can activate the "Hacks".
It is mandatory that before the line with "[mapping]", must not be present any lines of text or parameters, if they were
present, the Program/Game would not be executed, if you encounter this situation delete all lines placed before "[mapping]".

In the following example you can see a rather complex "Burgertime" configuration file, which contains a lot of information
and "Hacks," this file would not work on the RTO cartridge.
This file is compatible with Computer Emulators, which can handle multiple configuration and information parameters.
To make it compatible with the RTO cartridge, it is necessary to delete all lines shown in "*Underlined*" and then start the file
with the text highlighted in bold **[mapping].**

;;;BurgerTime! (Trainer) (1982) (Mattel) [h].cfg   **DELETE FROM HERE**
;;;20210616gernotschrader
[vars]
kc_compat = 0
name = "BurgerTime!, Trainer (128 Cooks)"
short_name = "BurgerTime!, Trn."
author = "Data East / Ray Kaestner"
publisher = "Mattel Electronics"
release_date = 1982
;   **TO HERE**

[mapping]   **KEEP FROM HERE**
$0000 - $1FFF = $5000
;
[memattr]
$9000 - $91FF = ROM 16
;
[macro]
p 500a 0 ; date / title $9000 ($5040)
p 500b 90 ; "
p 5013 4 ; border color
;
p 51ce 7f ; reserve Peter & Pepper (4)   **TO HERE**

To correct or edit a file "filename.cfg" use a Computer (the following consider a PC with Windows O.S.) with a "Text Editor," "Notepad" will do just fine.
Temporarily add .TXT extension to the .CFG file, then the file "filename.cfg" will become "filename.cfg.txt", the PC will open a window and warn that by changing the extension the file may become unusable, press "OK" to accept the extension change.
Load the file with the "Text Editor" and proceed to edit the configuration file, then save, close the "Text Editor" and finally delete the .TXT extension that was added, your configuration file is ready to be tested.

APPENDIX

Basic Configuration file "0.cfg" :

You can find the "0.cfg" on the web or you can write it by yourself with a "Text Editor";
following the lines to type on the Editor :

[mapping]
$0000 - $1FFF = $5000 ; 8K to $5000 - $6FFF
$2000 - $2FFF = $D000 ; 4K to $D000 - $DFFF
$3000 - $3FFF = $F000 ; 4K to $F000 - $FFFF

When done, save the file as : 0.cfg