

ZXOS+

Manual



ZXDOS+ and gomaDOS+ Manual

kounch

Version 1.1.9

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Introduction

ZXDOS+ and gomaDOS+ are the continuation of [ZX-Uno](#) a hardware and software project based on an FPGA board programmed to work like a ZX Spectrum computer, and created by the ZX-Uno team: Superfo, AVillena, McLeod, Quest and Hark0.

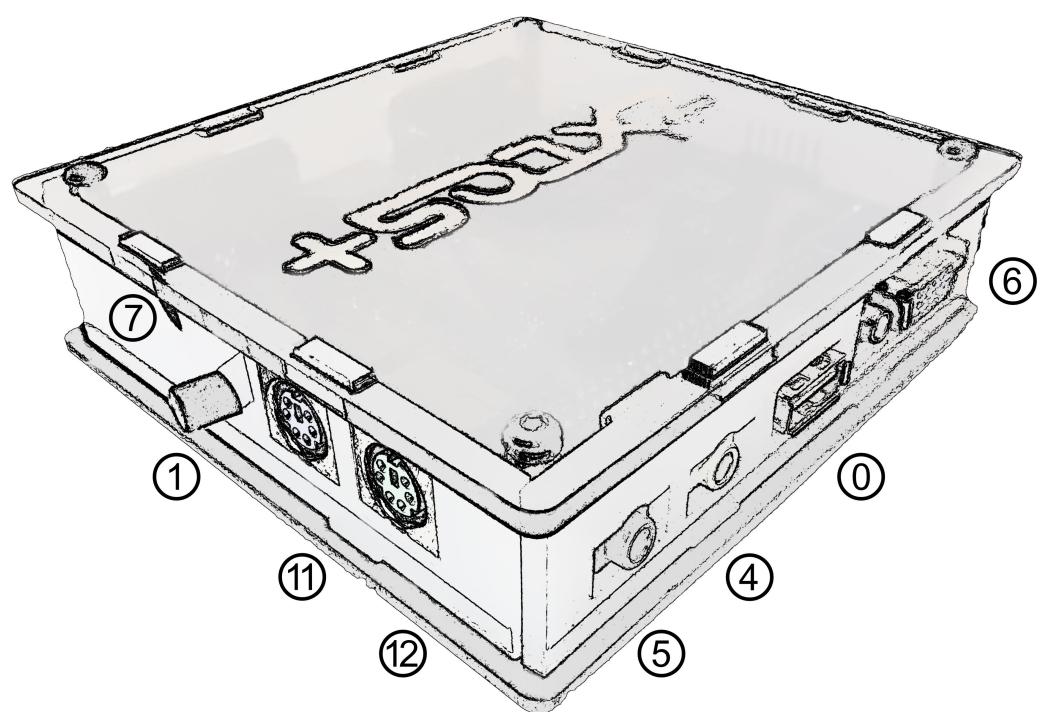
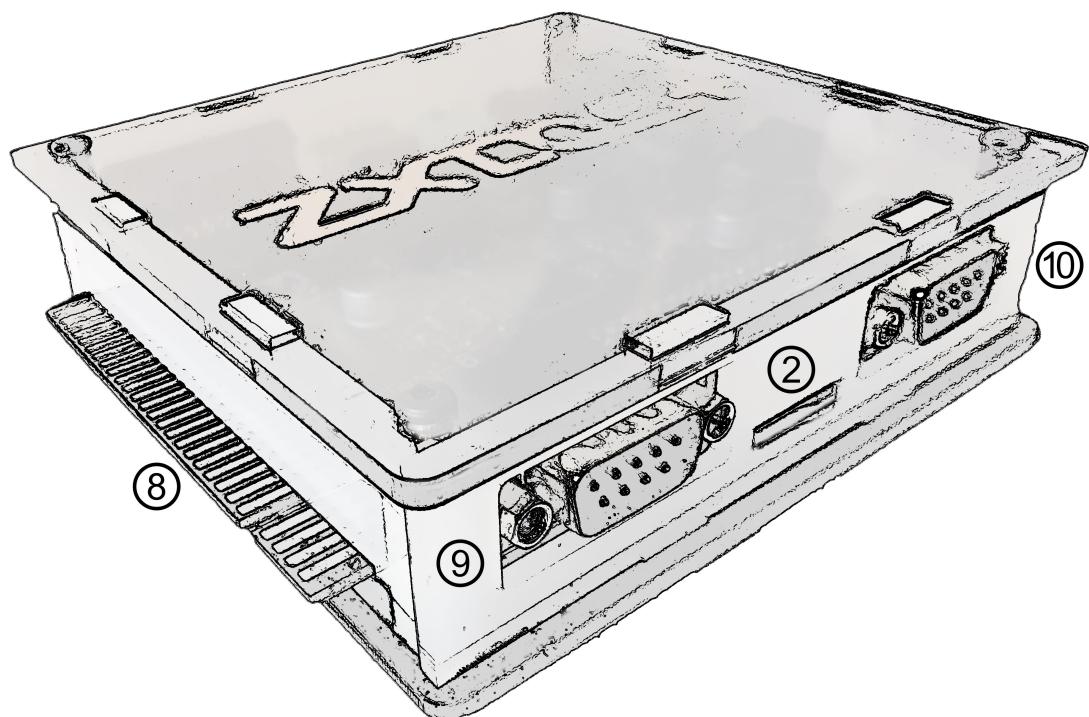
Over time, the project has been growing, and now it is possible to install different software configurations (cores) in the flash memory of the FPGA, which work like different systems than the ZX Spectrum, and you can choose to start the ZXDOS+ with the desired configuration among all those installed.

ZXDOS+ and gomaDOS+ official web page is <http://zxdos.forofpga.es>.

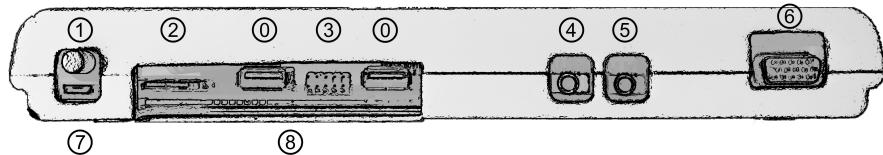
Most of the functions and features of ZXDOS+ and gomaDOS+ are the same, so this document will generally talk about ZXDOS+, indicating the differences with gomaDOS+ where necessary.

Ports and Connectors

ZXDOS+



gomaDOS+



Description

1	Power Switch
2	microSD Card Slot
3	JTAG and Joystick
4	Audio Out
5	Audio In
6	RGB/VGA Out
7	Power Socket
8	Expansion Port
9	Left Joystick Port
10	Right Joystick Port
11	PS/2 Keyboard Port
12	PS/2 Mouse Port
0	USB (PS/2) Port

Initial Setup

In order to be able to set up and use a ZX DOS+ or gomaDOS+ you need, at least, the following:

- A USB charger or a TV or other device that offers USB power
- VGA cable and monitor
- PS/2 keyboard (in the case of ZX DOS +)

In order to take advantage of its full potential, you should also have:

- A microSD card, not necessarily very large
- PC speakers to connect to the audio output, or a stereo jack cable to two red/white RCA connectors to connect to the TV (this is optional on gomaDOS+, as it has a beeper inside)
- A standard Atari joystick, such as a Megadrive DB9 gamepad (gomadOS+ needs a joystick adapter)
- A PS/2 mouse (USB to PS/2 adapter is needed when using a gomaDOS+)

microSD card formatting

In order to use a microSD card, it has to be formmatted with, at least, one FAT16 or FAT32 format (depending on the case, one or the other format is recommended for compatibility with different third-party cores). It must be the first partition if there are more than one.



FAT16 partitions have a maximum size of 4GB

Windows

For simple configurations, and cards of the correct size (less than 2GB for FAT16 or less than 32GB for FAT32), you can use [the official formatting tool of the SD Association](#).

For other, more complex, configurations, and depending on operating system version, you may use the command line tool [diskpart](#) or Windows Disk Managemente GUI.

MacOS

For simple configurations, and cards of the correct size (less than 2GB for FAT16 or less than 32GB for FAT32), you can use [the official formatting tool of the SD Association](#) or Disk Utility, which is included with the operating system.

In other case, you should use the command line.

For example, to format a card, shown as [disk6](#), with only one FAT16 partition (if the card size is less than 2GB):

```
diskutil unmountDisk /dev/disk6
diskutil partitionDisk /dev/disk6 MBR "MS-DOS FAT16" ZX DOSPLUS R
```

To split it into two FAT16 partitions of the same size (if the card size is 4GB or less):

```
diskutil unmountDisk /dev/disk6
diskutil partitionDisk /dev/disk6 MBR "MS-DOS FAT16" ZXDOSPLUS 50% "MS-DOS FAT16"
EXTRA 50%
```

To create two FAT 16 partitions (e.g. to use MSX core) and have the rest of space as another FAT32 partition (for cards more than 8GB in size):

```
diskutil unmountDisk /dev/disk6
diskutil partitionDisk /dev/disk6 MBR %DOS_FAT_16% ZXDOSPLUS 4G %DOS_FAT_16% EXTRA 4G
"MS-DOS FAT32" DATA R
sudo newfs_msdos -F 16 -v ZXDOSPLUS -b 4096 -c 128 /dev/rdisk6s1
sudo newfs_msdos -F 16 -v EXTRA -b 4096 -c 128 /dev/rdisk6s2
```



diskutil cannot create FAT16 partitions which are bigger than 2G and also format them. That's why, in this example, after only creating the partitions, we have to format them.

To create one FAT32 4GB partition (e.g. to use with Amstrad CPC core), and then have the rest of space available as a second FAT32 partition (for cards of more than 4GB):

```
diskutil unmountDisk /dev/disk6
diskutil partitionDisk /dev/disk6 MBR "MS-DOS FAT32" ZXDOSPLUS 4G "MS-DOS FAT32" EXTRA
R
```

Linux

There are a lot of tools for Linux that can format and/or partition an SD card ([fdisk](#), [parted](#), [cfdisk](#), [sfdisk](#) or [GParted](#) to name a few). It should only be taken into account that the partition scheme must always be MBR, and the first partition (the one that will be used for esxdos) must be primary partition.

esxdos

[esxdos](#) is a firmware for the DivIDE/DivMMC hardware interfaces (which ZXDOS+ implements). This allows access to storage devices such as a microSD card. It includes commands similar to those of UNIX, although to use them you must precede them with a period, for example `.ls`, `.cd`, `.mv`, etc.

For it to work, it is necessary to include the corresponding files in the first partition of the microSD card.

At the time of writing this document, the version included with ZXDOS+ is 0.8.6, and it can be downloaded from the official website [at this link](#).

Once downloaded and extracted, you have to copy the directories `BIN`, `SYS` and `TMP`, and all of their content, to the root of first partition of the microSD card.

If everything has been done correctly, when you turn on the ZXDOS+ Spectrum core, you will see how esxdos detects the card and loads the necessary components to work.



It is also recommended to add the specific esxdos commands for ZX DOS+. These can be obtained from the project source page ([here](#) and [here](#)), and are as follows:

```
back16m  
back32m  
corebios  
dmaplayw  
esprst  
iwconfig  
joyconf  
keymap  
loadpxz  
playmid  
playrmov  
romsback  
romsupgr  
upgr16m  
upgr32m  
zxuc  
zxunocfg
```

<<#_zxdos+_commands, It is explained later> what each of them does.

GomaDOS+ keyboard modes

gomaDOS+ keyboard, being similar to the original ZX Spectrum keyboard, lacks some of the existing keys on a modern PC keyboard. The keyboard membrane is connected to an Arduino board, which manages the transformation key presses to PS/2 keyboard protocol. The board is programmed so it can behave in different modes according to your needs.

The default is ZX Spectrum mode. To change to a different mode, you must press **Caps Shift+Symbol Shift+U** and then the key for the desired mode. After doing that, some text is automatically typed, to show the selected mode (for example **.zx** if you press **Caps Shift+Symbol Shift+U** and then **0**).

This table shows the available modes and activation keys:

Mode	Key
ZX Spectrum	0
Amstrad CPC	1
MSX	2
Commodore 64	3
Atari 800XL	4
BBC Micro	5
Acorn Electron	6
Apple (I and II)	7
Commodore VIC 20	8
PC XT	9
Oric Atmos	A
SAM Coupé	B
Jupiter ACE	C

ZX Spectrum mode key assignment, with the corresponding keypress when used simultaneously with **Caps Shift+Symbol Shift**:

1	2	3	4	5	6	7	8	9	0
F1	F2	F3	F4	F5	F6	F7	F8	F9	F1
Q	W	E	R	T	Y	U	I	O	P
F11	F12					Mode			
A	S	D	F	G	H	J	K	L	Enter
				ScrLk					
CShift	Z	X	C	V	B	N	M	SShift	Space
		Save		Vers	hRes	sRes			

Where:

- **ScrLk:** **Scroll Lock** changes between composite and VGA video mode (on Next Core, you must use **Caps Shift+Symbol Shift+2** or `F2` instead)
- **Save:** Sets the current mode as the default one
- **Vers:** Shows (types) current firmware version
- **hRes:** Hard Reset
- **sRes:** Soft Reset

The full list of key combinations (and compatible modes) is as follows:

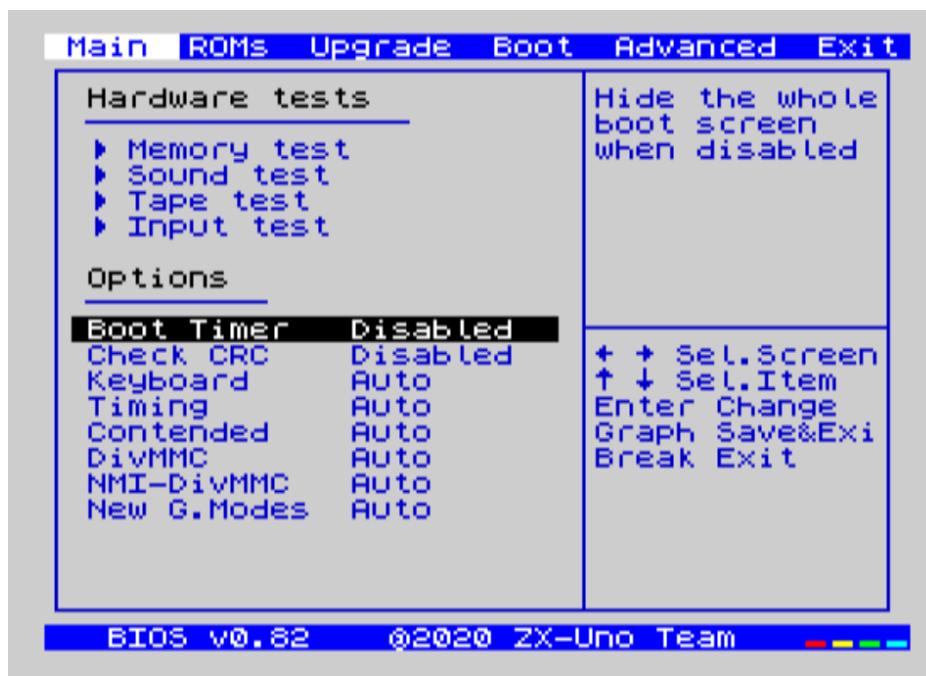
Caps S.+Symbol S.	Mode	Action
1	All	F1
2	All	F2
3	All	F3
4	All	F4
5	All	F5
6	All	F6
7	All	F7
8	All	F8
9	All	F9
0	All	F10
Q	All	F11
W	All	F12
S	C64	Ctrl+F12
E	Acorn/CPC	PgUp
R	Acorn	PgDown
U	All	Mode
G	ZX/MSX/C64	ScrLk
X	All	Save
C	PC	OPQA
V	All	Version
B	ZX	Ctrl+Alt+Bcksp
N	ZX	Ctrl+Alt+Supr

BIOS

Pressing the **F2** key (**Caps Shift+1** on gomaDOS+) during boot will access the BIOS setup. The BIOS firmware is the first program that runs when the ZXDOS+ is turned on. The main purpose of BIOS is to start and test the hardware and load one of the installed cores.

Using left and right cursor keys (**Caps Shift+5** and **Caps Shift+8** on gomaDOS+), you can navigate through the BIOS setup screens. With up and down keys (**Caps Shift+7** and **Caps Shift+6** on gomaDOS+) you can choose the different elements of each screen and, with the **Enter** key, it is possible to activate and choose the options for each of these. **Esc** key (**Caps Shift+Espacio** on gomaDOS+) is used to close open option windows without applying any action.

Main

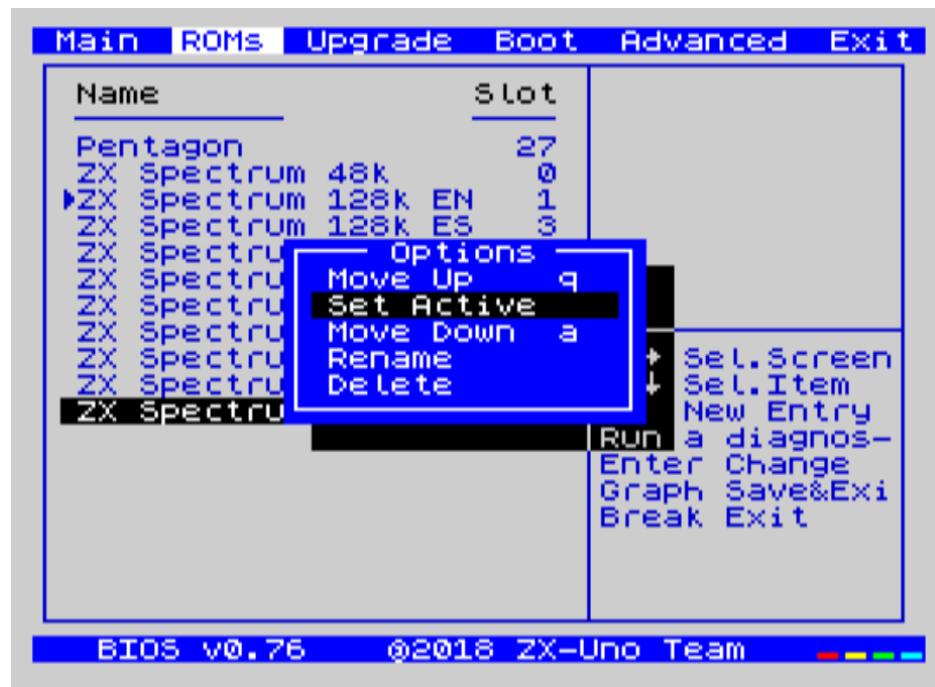


In the first configuration screen, in addition to being able to run several tests, you can define the default behavior for the following:

- Boot Timer: Sets how long the boot screen is available (or hiding it completely)
- Check CRC: Check ROM integrity when loading (more secure) or bypassing it (faster)
- Keyboard
- Timing: ULA Behaviour (48K, 128K, Pentagon Modes)
- Contended
- DivMMC
- DivMMC NMI Support
- New Graphic Modes Support (ULAPLus, Timex, Radastan)

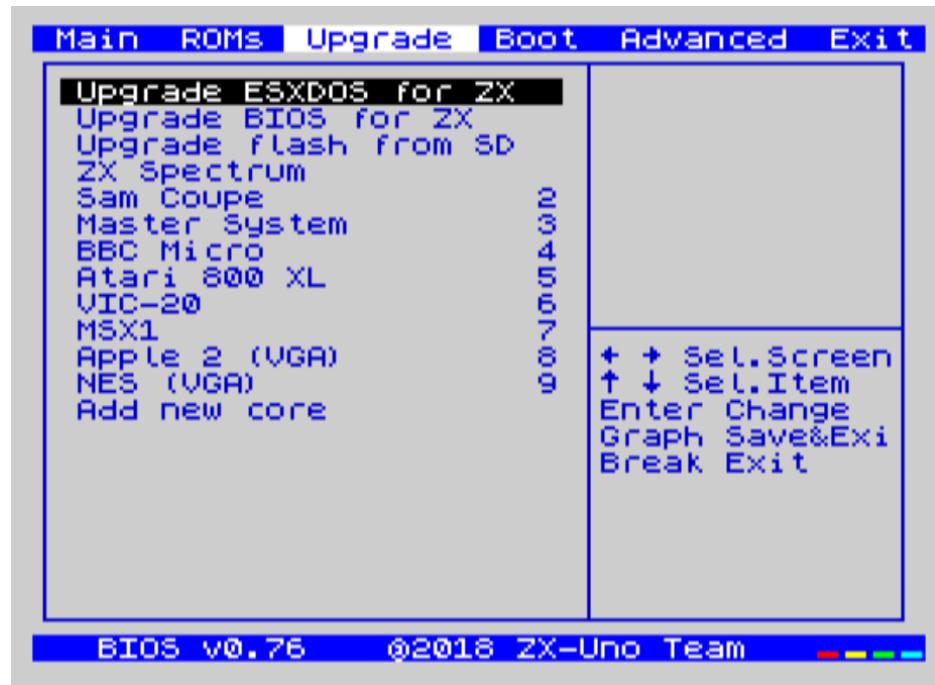
More technical information can be found on [de ZX-Uno Wiki](#).

ROMs



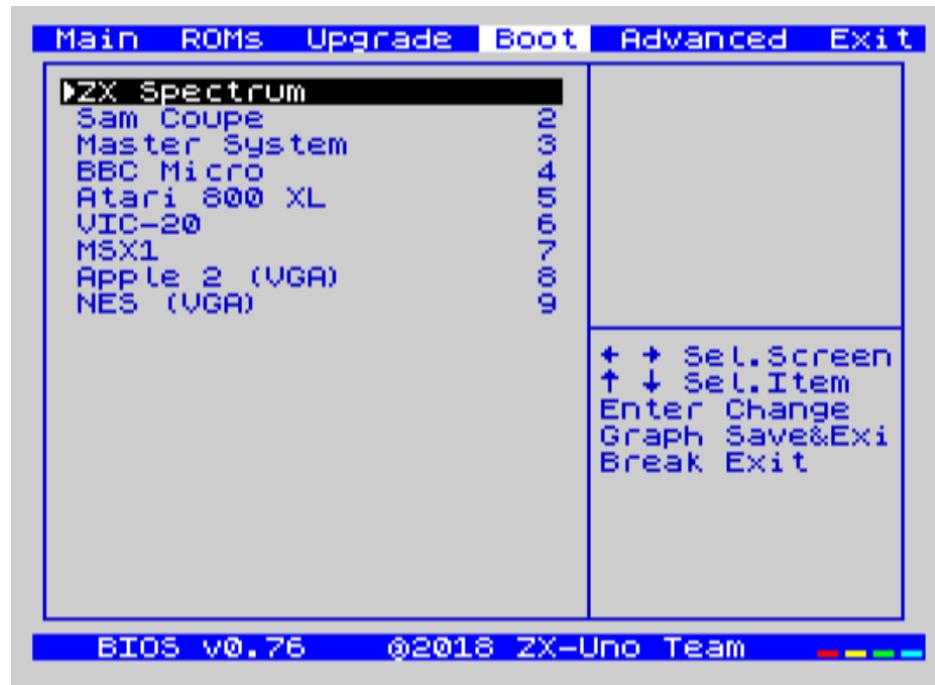
The second screen shows the installed ZX Spectrum ROMs. You can reorder (Move Up, Move Down), rename or delete each of them, as well as choose the one that will be loaded by default at startup (Set Active).

Upgrade



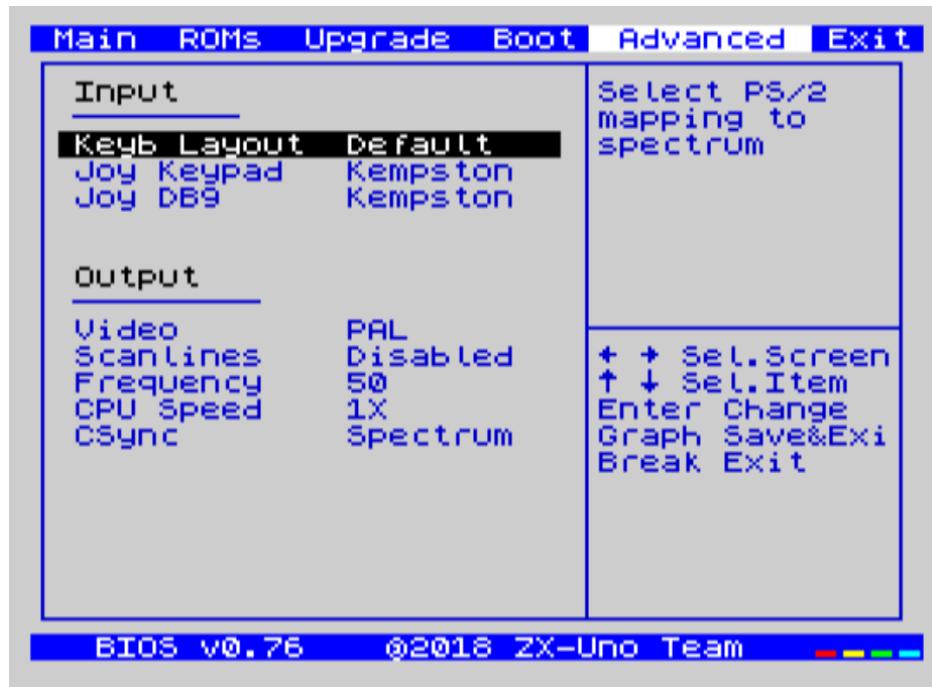
Upgrade screen is used to perform the different updates of the Flash memory content: esxdos, BIOS, Cores, etc. (see [the section corresponding to updates](#) for more information).

Boot



In the *Boot* screen you can choose which one of the installed cores is loaded by default at startup.

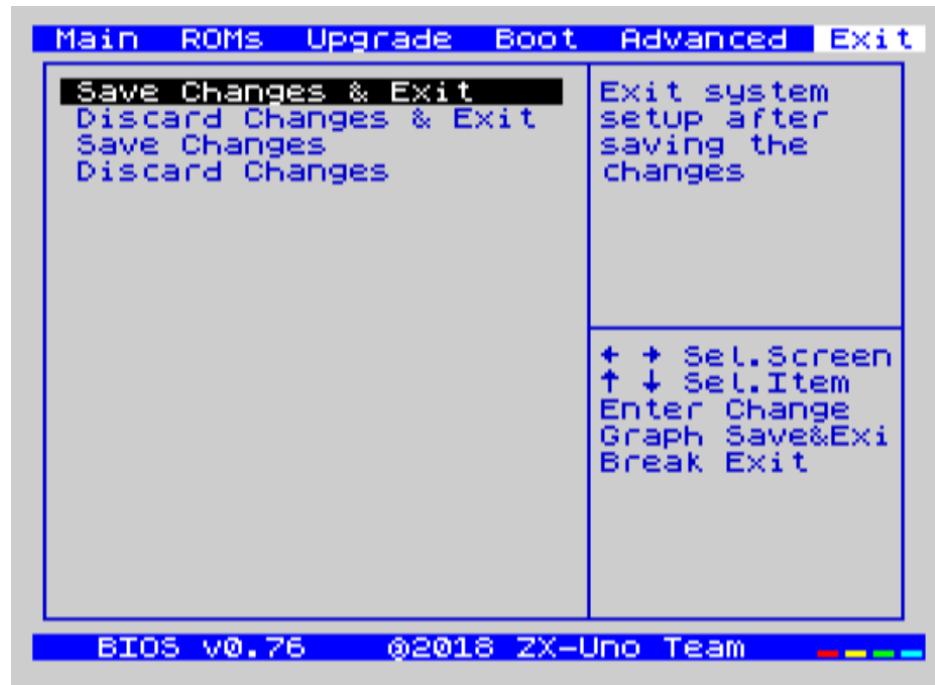
Advanced



The Advanced configuration screen is used to edit the following settings:

- Keyboard layout (Keyb Layout): See [the corresponding section](#) for more information)
- Joystick behavior when emulated with the numeric keypad (Joy Keypad): Kempston, Sinclair Joystick 1, Sinclair Joystick 2, Protek or Fuller
- Behavior of a joystick connected to the port (Joy DB9): Kempston, Sinclair Joystick 1, Sinclair Joystick 2, Protek, Fuller or simulate the keys Q, `A`, 0, `P`, Space and M
- Video output: PAL, NTSC or VGA
- Scanline simulation: Enabled Disabled
- VGA horizontal frequency: 50, 51, etc.
- CPU speed: Normal (1x) or accelerated (2X, 3X, etc.)
- Csync: Spectrum or PAL

Exit



Finally, from the last screen you can:

- Exit BIOS configuration saving changes
- Discard changes and exit
- Save changes without exiting
- Discard Changes

ZX Spectrum

The main core is the one implementing a ZX Spectrum computer. This core is special, and it cannot be substituted for another that is not a ZX Spectrum, since the ZX DOS+ uses it for its operation.

These are some of its main characteristics:

- ZX Spectrum 48K, 128K, Pentagon and Chloe 280SE implementation
- ULA with ULAPlus, Timex and Radastan modes (including hardware scroll and selectable palette group)
- Ability to disable memory contention (for Pentagon 128 compatibility)
- Ability to choose the keyboard behavior (issue 2 or issue 3)
- Possibility to choose the timing of the ULA (48K, 128K or Pentagon)
- Control of screen framing, configurable for type of timing, and possibility to choose between original Spectrum synchronisms or progressive PAL standard.
- Timex horizontal MMU support with HOME, DOC and EXT banks in RAM.
- Programmable raster interruption in line number, for any TV line.
- Possibility of activating/deactivating memory bank management registers, for better compatibility with each implemented model
- Ability to activate / deactivate the devices incorporated into the core to improve compatibility with certain programs
- ZXMMC support for + 3e and DIVMMC support for esxdos and compatible firmwares
- Turbo Sound support
- SpecDrum support
- Each channel A, B, C of the two AY-3-8912, beeper and SpecDrum chips can be directed to the left, right, both or neither outputs, allowing the implementation of configurations such as ACB, ABC, etc.
- Real joystick and keyboard joystick support with Kempston, Sinclair 1 and 2, Cursor, Fuller and QAOOPSpC protocol.
- Turbo mode support at 7MHz, 14MHz, 28MHz
- Keyboard support (PS/2 protocol) and user-configurable mapping from within Spectrum itself.
- PS/2 mouse support emulating the Kempston Mouse protocol.
- Possibility of video output in composite video mode, RGB 15kHz, or VGA.
- User selectable vertical refresh rate to improve compatibility with VGA monitors.
- Multicore boot support: from the Spectrum you can select an address of the SPI Flash and the FPGA will load a core from there.

Keyboard

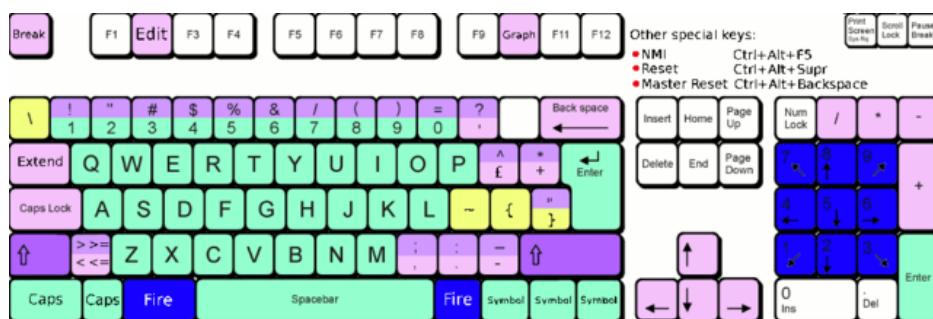
The keyboard map (physical keys of the keyboard assignment to the keystrokes that are presented to the different cores) is changed using the **Advanced** menu of the BIOS. There are three different maps to choose from: Spanish (default), English, and Spectrum (advanced).

You can also change it using the **keymap** utility. Inside **/ bin** you have to create a directory called **keymaps** and copy inside the keyboard map files that you want to use. For example, to switch to the US map you have to write **.keymap us** from esxdos.

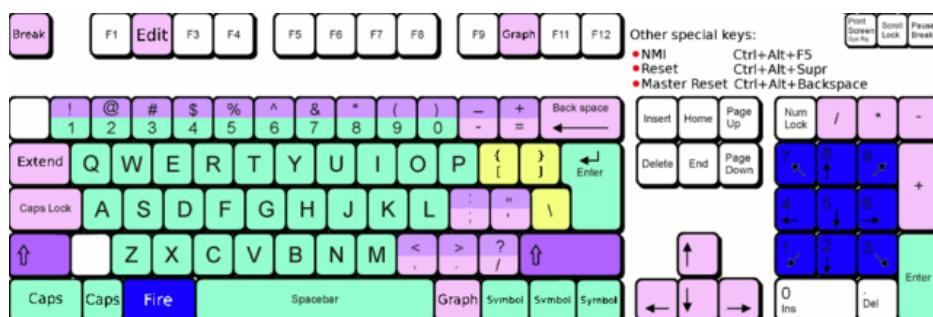
For the map to be preserved after a master reset, it has to be selected as **Default** in the BIOS.

For more information, see [this message in the ZX-Uno forum](#).

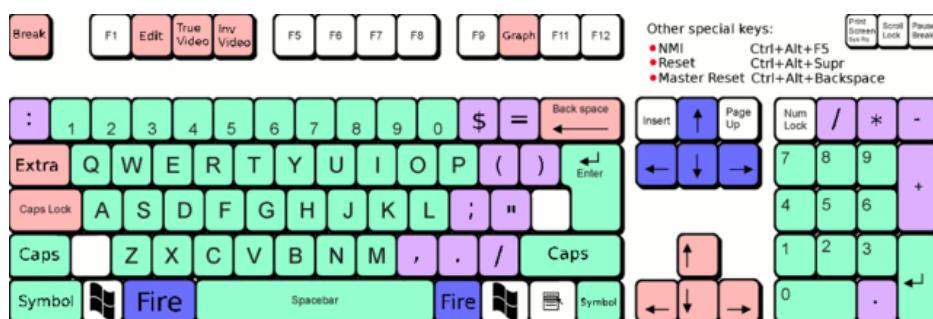
Spanish



English



Spectrum



Special keys and buttons

The following gomaDOS+ key combinations are in ZX keyboard mode. Please check [the corresponding section](#) for more information. You can also use PC XT keyboard mode combinations (like Caps Shift+Symbol Shift+2 instead of Caps Shift+1).

Special keys which can be used during startup:

- F2 (Caps Shift+1 on gomaDOS+) Enter BIOS setup
- Caps Lock or Cursor down (`Caps Shift+2 on gomaDOS+): Core selection menu
- Esc (Caps Shift+Space on gomaDOS+): ZX Spectrum core ROM selection menu
- R: Loads the Spectrum core ROM in "real" mode, disabling esxdos, new graphics modes, etc.
- / (numeric keyboard): Load ZX Spectrum core ROM in "root" mode
- Number from 1 to 9: Load the core in the flash location corresponding to that number

Special keys that can be used while running the main core (ZX Spectrum):

- Esc (Caps Shift+Space on gomaDOS+): BREAK
- F2 (Caps Shift+1 on gomaDOS+): Edit
- F5 (Caps Shift+Symbol Shift+5 on gomaDOS+): NMI
- F7 (Caps Shift+Symbol Shift+7 on gomaDOS+): Play or pause when playing .PZX files
- F8 (Caps Shift+Symbol Shift+8 on gomaDOS+): Rewind .PZX file to the previous mark
- F10 (Caps Shift+9 on gomaDOS+): Graph
- F12 (Caps Shift+Symbol Shift+W on gomaDOS+): Turbo Boost. Speeds up CPU to 28MHz while pressed (beginning with core EXP27).
- Ctrl+Alt+Backspace (Caps Shift+Symbol Shift+B on gomaDOS+): Hard reset. Backspace is the delete key, located in the top-right portion of the keyboard, above Enter.
- Ctrl+Alt+Supr (Caps Shift+Symbol Shift+N on gomaDOS+): Soft reset.
- Scroll Lock (Caps Shift+Symbol Shift+G on gomaDOS+): Switches between composite and VGA video modes.

ROMs

The ZX Spectrum core has can be initialized using different ROM versions (48K, 128K, Plus 2, etc.). These are stored in the flash memory of the ZX DOS+, and you can choose which one to load by pressing the `Esc` key during boot. You can also define the ROM that you want to load by default using the BIOS setup.

See the [updates section](#) for more information on how to expand or modify the ROMs stored in flash memory.

esxdos

Basic Guide

There are two different kind of esxdos commands, the so-called "DOT" commands, which, as the name suggests, begin with a period, and the commands that are extensions to the existing ones in BASIC.

The main "DOT" commands are the following:

- **128**: Para enter 128K mode from within 48K mode
- **cd**: Change current working directory
- **chmod**: Change file attributes
- **cp**: Copy a file
- **divideo**: Play a DivIDEo (.DVO) video file
- **drives**: Show currently available drives
- **dskprobe**: Utility which shows low level content of an storage device
- **dumpmem**: Can dump RAM memory content to a file
- **file**: Tries to recognize the type of data contained in a file (like the UNIX command)
- **gramon**: Monitor to search graphics, sprites, fonts, etc. in RAM memory
- **hexdump**: Shows the contents of a file using hexadecimal notation
- **hexview**: Allow to see and navigate through the contents os a file using hexadecimal notation
- **launcher**: Creates a shortcut (launcher) to open directly a TAP file
- **ls**: Show the content of a directory
- **lstap**: Show the content of a .TAP file
- **mkdir**: Create a directory
- **mktrd**: Create a .TRD disk file
- **more**: Show the content of a text file
- **mv**: Move a file
- **partinfo**: Show partition information of an storage device
- **playpt3**: Play .PT3 music file
- **playsqt**: Play .SQT music file
- **playstc**: Play .STC music file
- **playtfm**: Play .TFC music file
- **playwav**: Play .WAV audio file
- **rm**: Remove a file or a directory
- **snapshot**: Load snapshot file

- **speakcz**: Reads text aloud using czech pronunciation
- **tapein**: Mounts a .TAP file so that it can be used then from BASIC using LOAD sentence
- **tapeout**: Mount a .TAP file so that it can be used then from BASIC using SAVE sentence
- **vdisk**: Mount a .TRD disk file to use with the TR-DOS environment (once all the drives have been mounted, you can enter TR-DOS emulation by typing: **RANDOMIZE USR 15616**)

Some BASIC extended commands are:

- **GO TO** to change the current drive and/or directory (e.g.: **GO TO hd1** or **GO TO hd0"games"**)
- **CAT** to show the content of a drive
- **LOAD** to load a file from a drive (BASIC Program, SCREEN, CODE, etc. for example **LOAD *"Screen.scr" SCREEN\$**)
- **SAVE** to save data in a file (e.g: **SAVE *"Program.bas"**)
- **ERASE** to delete a file

In addition, esxdos also has an NMI manager, an application that loads when NMI (F5) is pressed, and lets you browse the microSD card and load easily files (TAP, Z80, TRD, etc.). Pressing the "H" key invokes a help screen, which shows all the available keys.

ZXDOS+ Commands

As explained in the installation part, there are a series of commands that are exclusive to ZXDOS+:

- **back16m**: Dumps to a **FLASH.ZX1** file, in the root directory of the SD card, the contents of a 16 Meg SPI Flash memory. It must be run while using a "root" mode ROM. After finishing, it is necessary to execute the command **.ls** so that the cache is written to the card
- **back32m**: Creates a **FLASH.ZX2** file, in the root directory of the SD card, with the contents of a 32 Meg SPI Flash memory. It must be run while using a "root" mode ROM. After finishing its execution, you must execute the command **.ls** to finish recording the cache on the microSD card. If not, the length of the file will be wrongly set to 0
- **corebios**: To upddate simultaneously ZX Spectrum core and BIOS
- **dmaplayw**: Plays .WAV file, which has to be 8 bits, unsigned y mand sampled at 15625 Hz
- **esprst**: Resets the WiFi ESP8266(ESP-12) module
- **iwconfig**: To configure the WiFi module
- **joyconf**: Configuration and tests for keyboard and DB joysticks
- **keymap**: Used to load a different keyboard map definition
- **loadpzx**: To load a .PZX tape file
- **playmid**: Plays .MID music files using the MIDI addon
- **playrmov**: Plays [radastanian format video files .RDM](#)). This command does not work on 48K mode.
- **romsback**: Dumps to a **ROMS.ZX1** file, in the root directory of the microSD card, all ZX Spectrum core ROMS which are stored in SPI flash memory. It must be run while using a "root" mode ROM
- **romsupgr**: Load from a **ROMS.ZX1** file, in the root directory of the microSD card, all ZX Spectrum core ROMS into SPI flash memory. It must be run while using a "root" mode ROM
- **upgr16m**: Load the content of a **FLASH.ZX1** file, in the root directory of the microSD card, to a 16 Meg SPI Flash memory. It must be run while using a "root" mode ROM
- **upgr32m**: Write the content of a **FLASH.ZX2** file, in the root directory of the microSD card, to a 32 Meg SPI Flash memory. It must be run while using a "root" mode ROM.
- **zxuc**: Utility to configures al options of BIOS, which also can be stored in the microSD in configuration files that can be loaded later
- **zxunocfg**: Configuration utilility for certain features of ZX-Uno such as timings, contention, keyboard type, CPU speed, video type or vertical frequency

Wi-Fi

Each gomaDOS+, and some models of ZXDOS+, include inside an ESP-12 module with an [ESP8266](#) Wi-Fi chip, that can be easily used with a ZX Spectrum core (e.g., EXP27 160820 core) which has synthesized an [UART](#) device, that allows communication with the module.

There are two "DOT" commands for configuring software access to the module. Then can be downloaded from [GitHub official repository](#):

- [esprst](#), which restarts the module
- [iwconfig](#), to register the Wi-Fi network name (SSID) and password, keeping them in the file [/sys/config/iw.cfg](#).

For example:

```
.iwconfig mywifi mypassword
```

Network tools for ZX-Uno pack

These are programs, developed by Nihirash and that are available to [download from his web](#).

- [netman](#): Utility to configure the ESP Wi-Fi chip for other programs from Nihirash. Does not work in 48K mode
- [uGophy](#): [Gopher](#) client. Does not work in 48K mode
- [irc](#): [Internet Relay Chat](#) client. Works better at 14 Mhz
- [wget](#): Utility to download files with HTTP (does not work with HTTPS)
- [platoUNO](#): [PLATO](#) client. Also works better at 14 Mhz. For more information about PLATO, check [IRATA.ONLINE](#) web

FTP-Uno

FTP cliente developed by Yombo, available [at GitHub](#).

Configuration steps:

1. Edit [FTP.CFG](#) file with all the required information (SSID and password, FTP server, etc.)
2. Copy [FTP.CFG](#) inside [/SYS/CONFIG/](#) in microSD card
3. Also copy [ftpUno.tap](#) to any place in the card
4. Start up ZXDOS+ y load the tape file [ftpUno.tap](#)

UART Terminal

Program example included with [ZXYLib C library](#), developed by yombo, that let's you send directly typed characters using the UART, and also see the result. Available to download [at this link](#).

Once the file **UARTTERM.tap** is in the card and loaded, you can type several specific commands for ESP8266 chip. For example:

- **AT**. To check if ther is communication. **OK** would be the result if everything is fine
- **AT+RST**. To restart the chip. Exactly what **esprst** command does
- **AT+GMR**. To see some information, like firmware version, etc.
- **AT+CWMODE_CUR=1**. Put temporarily the chip into Wi-Fi client mode, until next restart
- **AT+CWMODE_DEF=1**. Put temporarily the chip into Wi-Fi client mode, and save it as default
- **AT+CWJAP_CUR="<WiFiNetwork>","<WiFiPassword>"**, where **<WiFiNetwork>** Wi-Fi ID of the network to connect to, and **<WiFiPassword>** the access password, connects temporarily to that network
- **AT+CWJAP_DEF="<WiFiNetwork>","<WiFiPassword>"**, connects to the network, and saves the settings as default in the chip flash memory
- **AT+CWAUTOCONN=1** sets the chip to connect automatically on boot to the default network (**AT+CWAUTOCONN=0** disables it)

You can see all the available commands reading the [official documentation](#).

Making RDM (RaDastan Movie) files

The **PLAYMOV** "DOT" command plays radastanian format video files. To convert your own videos, you need **makevideoradas**, a utility that is available at [SVN repository](#).

If using Windows, there is already an executable file (**makevideoradas.exe**). For Linux or MacOS, you must have installed command line developer utilities in order to compile an executable

```
gcc makevideoradas.c -o makevideoradas
```

Apart from **makevideoradas**, you need another two tools: **ffmpeg** and **imagemagick**. These can be installed with a package manager (**apt**, **yum**, **pacman**, **brew**, etc.) or downloading the source code and compiling.

Now, the first step to convert our video (for example **myvideo.mp4**), is exporting the frames as 128x96 pixel BMP image files. We create a temporary file (**img** for this example), to store them.

```
mkdir img  
(...)/ffmpeg -i myvideo.mp4 -vf "scale=128:96,fps=25" -start_number 0  
img/output%05d.bmp
```

Now we transform the **BMP** files to 16 colours (v3) **BMP** files.

```
(...)/magick mogrify -colors 16 -format bmp -define bmp:format=bmp3 img/*.bmp
```

Finally, we assemble the **.RDM** file (in this example **myvideo.rdm**) and cleanup the temporary files and directory.

```
(...)/makevideoradas img/output  
mv img/output.rdm ../myvideo.rdm  
rm -rf img
```

There is more information about all this process at [this thread in Zona de Pruebas forums](#).

Upgrade

BIOS

To update the BIOS, a file named **FIRMWARE.ZX2** (for a ZX DOS+ with an FPGA LX16 board) or **FIRMWARE.ZXD** (for a ZX DOS+ with an FPGA LX25 board) must be obtained. The latest version of the firmware files can be downloaded from [the official repository](#)



Updating the firmware (BIOS) is delicate. It should not be done if it is not necessary. If doing so, ensure that the ZX DOS+ has uninterrupted power (such as a UPS or a laptop USB with battery).

Copy the file to the root of the MicroSD card, turn on and press **F2** to enter BIOS, select **Upgrade**, choose "*Upgrade BIOS for ZX*", and then "*SDfile*". The system will read the file **FIRMWARE…** and notify when finished.

ROMs

The flash memory of a ZX DOS+ has reserved 64 slots, 16K each, to store ZX Spectrum ROM images. Thus, an original ZX Spectrum ROM (16K) will take one slot, a ZX Spectrum 128K ROM (32K) will be two slots, and a ZX Spectrum +2A ROM (64K) will need 4 slots.

You can add a new ROM pressing the key **N** at the BIOS [ROMs screen](#), connecting an audio cable to the board, and playing a ROM audio tape. ROM audio tapes can be made from a **.tap** file built with the [GenRom](#) utility, available at [ZX-Uno Code Repository](#).

To update at once all the ROMs installed for ZX Spectrum, a file named **ROMS.ZX1** must be obtained, which must be copied to the MicroSD card. Boot the ZX DOS+ using a "rooted" ROM, and then just enter the command **.romsupgr**. This will burn all the ROMs, which will be available for use.



At this moment, **romsupgr**, only works correctly with files using a maximum of 35 slots.



Remember that if the ZX DOS+ is started by pressing the **/** key (on the numeric keyboard) ([Symbol Shift+V](#) in gomaDOS+), then the default ROM of the ZX Spectrum core will be loaded in "root" mode.

To do the opposite process (save the ROMs in a **ROMS.ZX1** file), you can use the `` .romsback`` command.



At this moment, **romsback**, only stores correctly the first 35 used slots.

ROMS.ZX1 files can be easily edited with the [http://guest:zxuno@svn.zxuno.comsvn/zxuno/software/ZX1RomPack/\[ZX1RomPack\]](http://guest:zxuno@svn.zxuno.comsvn/zxuno/software/ZX1RomPack/[ZX1RomPack]) utility. Although it is a Windows program, it works perfectly, for example using [Wine](#) or similar programs, either on MacOS or Linux.

Cores

There are a number of available slots where you can store cores (the number depends on the size of the SPI Flash of the ZX DOS+ model), the first slot being reserved for the main ZX Spectrum (this does not prevent having more ZX Spectrum cores in other slots as well of the first).

Official cores are [available to download](#) from GitHub repository.

To update or install a new core there are several possibilities.

The easiest way is to obtain the latest version of the file that defines the core, which will be a file that must be named `COREnn.ZX2` (for a ZX DOS + with an FPGA LX16 board) or `COREnn.ZXD` (for a ZX DOS + with an LX25 board), where `nn` is the slot number where to install (for example `CORE2.ZX2` or `CORE2.ZXD` for slot 2).



Starting with BIOS version 0.80, files are named using the `COREXXy.ZXn` convention where `XX` *always* is a two-digit number. Thus, an old `CORE4.ZXD` file has to be renamed as `CORE04.ZXD`. The `y` part of the name is ignored, so longer and more descriptive names can be used (such as `CORE04_example.ZXD`).

Copy the file to the root of the microSD card, turn on and press `F2` to enter BIOS. Choose `Upgrade`, select the row corresponding to the chosen core number (for example, 2 - just after Spectrum), press enter and then "SD file". The system will read the file `COREnn ..` and warn when it is updated, although first it will ask for the name (to be shown in the list to choose from at startup and in the BIOS list).



The ZX Spectrum core update is exactly the same as other cores, but instead of the name `CORE1.ZX2` or `CORE1.ZXD`, it has to be a file called `SPECTRUM.ZX2` or `SPECTRUM.ZXD`.

esxdos

To update esxdos to a new version, the distribution must be obtained from [the official website](#).

Once downloaded and extracted, the contents of `BIN` and `SYS` directories have to be copied to the root of the card, merging the existing ones (to preserve the exclusive ZX DOS+ commands).

Copy `ESXMMC.BIN` (or `ESXMMC.ROM`, depending on version) to the root of the microSD card.

Start ZX DOS + with the card inserted and press `F2` to access BIOS setup. Select the `Upgrade` menu and choose "Upgrade esxdos for ZX". In the dialog that appears choose "SD file" and, when it asks "Load from SD" answer "Yes" to the question "Are you sure?". The content of the file `ESXDOS...` will be read, written to the flash storage and you will be notified when it is updated.

Do a Hard-reset, or turn it off and on.

If everything has been done correctly, when you turn on the ZX DOS+ you will see how esxdos detects the card and loads the necessary components to work, showing the new version at the top.

Flash Memory

You also can update all the FPGA flash memory. At this moment, from the BIOS you can only use 16MiB image files. To use a 32MiB image, you must use `esxdos UPGR32M` command and a file named `FLASH.ZX2`.

Copy the image file (16MiB) `FLASH.ZXD` to the root of the microSD card.

Turn on the ZXDOS+ and press the **F2** key (**Caps Shift+1** on gomaDOS+) during boot to access the BIOS setup. Select the menu **Upgrade** and then choos the option "*Upgrade flash from SD*". Press Enter, choose **Yes**, and press Enter again to start the Flash writing process.

Do a Hard-Reset or turn of and on again.



This process can't be undone, and it will replace all the previously installed cores, the BIOS, the ZX Spectrum ROMs and their configuration with the data in the image file.

Other cores

ZX Spectrum Next

[ZX Spectrum Next](#) is an FPGA based project, which wants to be the evolution of the Sinclair ZX Spectrum line of computers. It brings new features while keeping hardware and software compatibility with previous ZX Spectrum computers.

Specially thanks to avlixa, ther exists a ZX Spectrum Next core synthesized for ZXDOS+.

The core, for the moment does not havd any of these features:

- Raspberry Pi
- Internal beeper
- EDGE expansion Connector
- RTC module
- Membrane keyboard
- Flashing additional cores or upgrading the Next core from within the Next core
- MIC out
- HDMI Video
- UART communication using the joystick port

The user manual is available to download at [the official web page](#).

microSD card format

You have to use a microSD card with the first partition formatted as FAT16 or FAT32, and inside, the standard esxDOS distribution, matching ZX DOS+ BIOS version (see [esxdos corresponding section](#) for more info).

Download NextZXOS distribution [from the official page](#).

Extract NextZXOS in the root of the microSD card, and then edit `config.ini` under `c:/machines/next` to include the line `ps2=0` if it doesn't exist or edit the existing line from 1 to 0. This effectively switches the dual PS/2 port to keyboard first as the Next Firmware (TBBLUE.FW) switches the primary input to mouse. Also edit the line `intbeep=0` to disable the internal beeper (this last step is not necessary on gomaDOS+).

If it wasn't already, [install ZX Spectrum Next core](#) into ZX DOS+.

Keyboard

Special keys and buttons

The following gomaDOS+ key combinations are in ZX keyboard mode. Please check [the corresponding section](#) for more information. You can also use PC XT keyboard mode combinations.

Take into account that `Ctrl+Alt+Delete` does not work with the ZX Spectrum Next core. You have to power cycle if you want to use another core. Also, there is no Reset or Drive button.

While the core is running:

- `F1 (Caps Shift+Symbol Shift+1 on gomaDOS+)`: Hard Reset
- `F2 (Caps Shift+Symbol Shift+2 on gomaDOS+)`: Scandoubler. Doubles the resolution. Should be off for SCART
- `F3 (Caps Shift+Symbol Shift+3 on gomaDOS+)`: Change vertical frequency between 50Hz and 60Hz
- `F4 (Caps Shift+Symbol Shift+4 on gomaDOS+)`: Soft Reset
- `F7 (Caps Shift+Symbol Shift+7 on gomaDOS+)`: Scanlines
- `F9 (Caps Shift+Symbol Shift+9 on gomaDOS+)`: NMI
- `F10 (Caps Shift+Symbol Shift+0 on gomaDOS+)`: divMMC NMI. Simulates Drive button. If used with Caps Shift it forces a rescan of drives and a reload of the boot screen under esxDOS

Basic Guide

On first boot, some help screens will show up. After pressing **Space** key, NextZXOS Startup Menu appears.

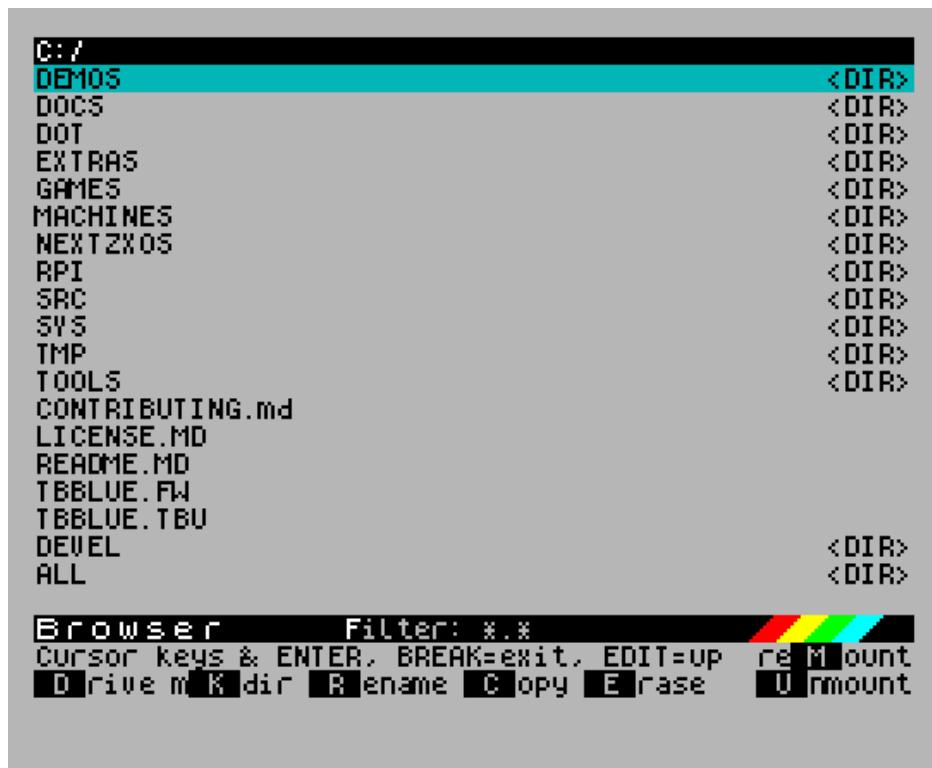


You can navigate the menu with the cursor keys, **5**, **6**, **7** and **8** keys, or a joystick (if configured as Kempston, MD or cursor). **Enter** or the joystick button chooses one element.

More... shows a second menu with more options.



If you choose **Browser**, NextZXOS Browser will start, and then you can see the contents of the microSD card and load a file (TAP, NEX, DSK, SNA, SNX, Z80, Z8, etc.).



At the time of writing, the ZX Spectrum Next core for ZX DOS+ does not support the use of a Raspberry Pi-based accelerator, so it is not possible to load TZX files.



It is not possible to load TRD files directly from the Browser (NextZXOS must be configured to load a "personality" with esxdos).

For more information, see the [official user manual](#).

MSX

MSX1FPGA is a project to clone MSX1 in FPGA. The original development is by Fabio Belavenuto and is available [at GitHub](#).

Some of its features are:

- MSX1 at 50Hz or 60Hz
- 128K Nextor (MSX-DOS2 evolution) ROM with SD driver
- Reconfigurable keyboard map
- Scanlines
- Joystick support

microSD format

You have to use a microSD card with the first partition in FAT16 format. You can also use a second FAT16 partition for MSX software, and leaving the first one only for the system startup.

You need to get:

- Basic SD project files SD [from GitHub](#)
- Nextor driver ([NEXTOR.SYS](#)) and ROM ([NEXTOR.ROM](#)) [also from GitHub](#)
- MSX1 ROM ([MSX_INT.rom](#), [MSX_JP.rom](#) or [MSX_USA.rom](#)) [at the same repository](#)

Copy the contents of the [SD directory](#) in the root of the first partition of the microSD.

Copy [NEXTOR.SYS](#) to the same place.

Copy [NEXTOR.ROM](#) inside the [MSX1FPGA](#) directory.

Copy one MSX1 ROM ([MSX_INT.rom](#), [MSX_JP.rom](#) or [MSX_USA.rom](#)) inside the [MSX1FPGA](#) directory, but renaming it to [MSX1BIOS.ROM](#).

The file [/MSX1FPGA/config.txt](#) keeps the core configuration, using this format:

```
11SP01
|||||
|||||+-Scanlines: 1=Enabled, 0=Disabled
|||||---Turbo: 1=Initialize with turbo enabled
|||---Colour System: N=NTSC, P=PAL
||+---Keymap: E=English, B=Brazilian, F=Frances, S=Spanish, J=Japanese
|+---Scandoubler(VGA): 1=Enabled, 0=Disabled
+---Nextor: 1=Enabled, 0=Disabled
```

If it wasn't already, [install MSX core](#) into ZX DOS+.

Keyboard

Special keys and buttons

The following gomaDOS+ key combinations are in MSX keyboard mode. Please check [the corresponding section](#) for more information. You can also use PC XT keyboard mode combinations.

While running the core:

- **Print Scr**: Changes between VGA and RGB mode
- **Scroll Lock** (**Caps Shift+Symbol Shift+G** on gomaDOS+): Enables or disables scanlines
- **Pause**: Changes between 50Hz and 60Hz
- **F11** (**Caps Shift+Symbol Shift+Q** on gomaDOS+): Enables and disables turbo mode
- **Ctrl+Alt+Supr**: Soft Reset
- **Ctrl+Alt+F12**: Hard Reset
- **Ctrl+Alt+Backspace** (**Caps Shift+Symbol Shift+B** on gomaDOS+, ZX Spectrum keyboard mode): Restarts the FPGA
- **Left ALT**: MSX GRAPH
- **Right ALT**: MSX CODE
- **Page Up**: MSX SELECT
- **Start**: MSX HOME (**Shift+HOME**: CLS)
- **End**: MSX STOP
- **Ñ** or **Windows**: MSX DEAD



In BASIC use **CTRL+STOP** (**Ctrl+End**) keys to stop the execution of a program.



To change the video mode between 50Hz and 60Hz (and thus play at correct speed PAL games), you can use also use **DISPLAY.COM**, which can be downloaded [here](#).

Basic Guide

To go to BASIC from MSX-DOS you must execute **BASIC** command.

To go to MSX-DOS from BASIC, execute **CALL SYSTEM**.

MSXCTRL

An exclusive utility of MSX1FPGA core, which lets you control all the core options that were previously available only by editing the configuration file or with some key combination.

When running **MSXCTRL** all the use parameters are shown:

```
MSXCTRL.COM - Utility to manipulate MSX1FPGA core.  
HW ID = 06 - ZX-Uno Board  
Version 1.3  
Mem config = 82  
Has HWDS = FALSE
```

Use:

```
MSXCTRL -h -i -r -b -[5|6] -m<0-2>  
      -c<0-1> -d<0-1> -t<0-1>  
      [-w<filename> | -l<filename>]  
      -k<0-255> -e<0-255> -p<0-255>  
      -s<0-255> -o<0-255> -a<0-255>
```

MSXCTRL -h show help for a parameter. For example, **MSXCTRL -i** show the current configuration, **-t 1** sets turbo mode on, etc.

Other

There are different ways to load games depending on the kind of file: .CAS, .DSK o ROM (see [this ZX-Uno forums thread](#) for more info).

The spanish keymap officially available can be replaced with a better one. See [here](#) for more information.

Amstrad CPC

ZXDOS+ Amstrad CPC core is based on the [FPGAmstrad](#) project by Renaud Hélias.

Some of its features are:

- VGA: 640x480 VGA centered at 60Hz
- Disk selection: The first disk image detected is inserted on startup, and pressing a key makes a reset and loads the next one

microSD card format

You have to use a microSD card with the first partition in FAT32 format, 4GB in size, and with 4096 bytes per cluster.

You also need the following ROM files (they are available [at the original project Wiki](#)) or from the [GitHub repository](#): - OS6128.ROM - BASIC1-1.ROM - AMSDOS.ROM - MAXAM.ROM

It is also recommended to copy one or more disk image files ([DSK](#)) with the software that you want to run.

Copy all [ROM](#) and [DSK](#) files to the root directory of the FAT32 partition.

Keyboard

Special keys and buttons

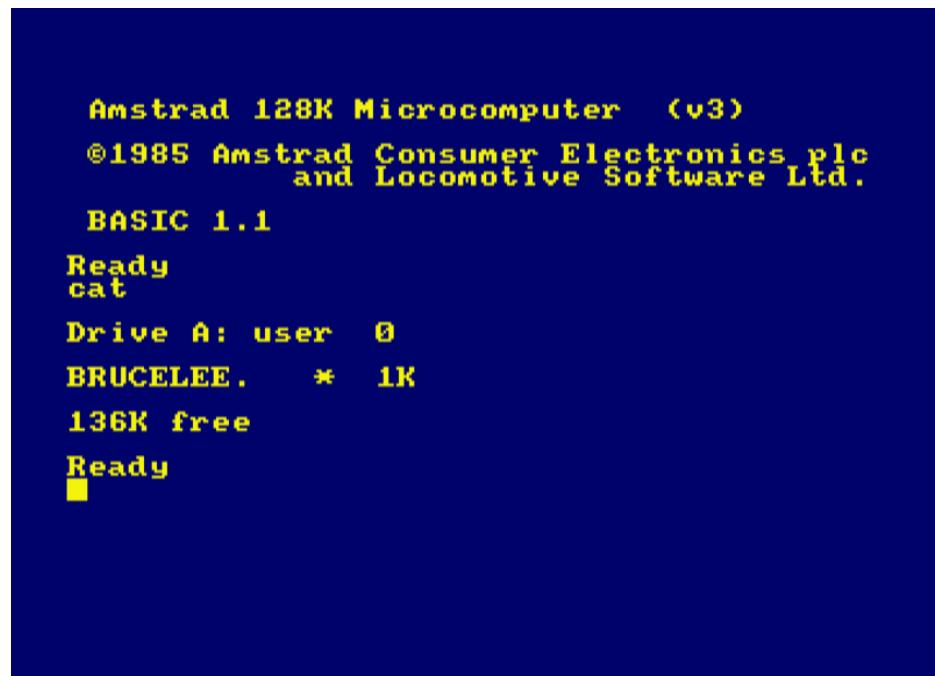
The following gomaDOS+ key combinations are in [Amstrad CPC](#) keyboard mode. Please check [the corresponding section](#) for more information. You can also use [PC XT](#) keyboard mode combinations.

During core execution:

- [Page Up](#) ([Caps](#) [Shift+Symbol](#) [Shift+E](#) on gomaDOS+): Reset the Amstrad computer and load the next [DSK](#) file alphabetically
- On a PS/2 keyboard, only the left shift key works properly

Basic Guide

Use the **CAT** command to see the contents of the currently loaded DSK file.



```
Amstrad 128K Microcomputer (v3)
©1985 Amstrad Consumer Electronics plc
and Locomotive Software Ltd.

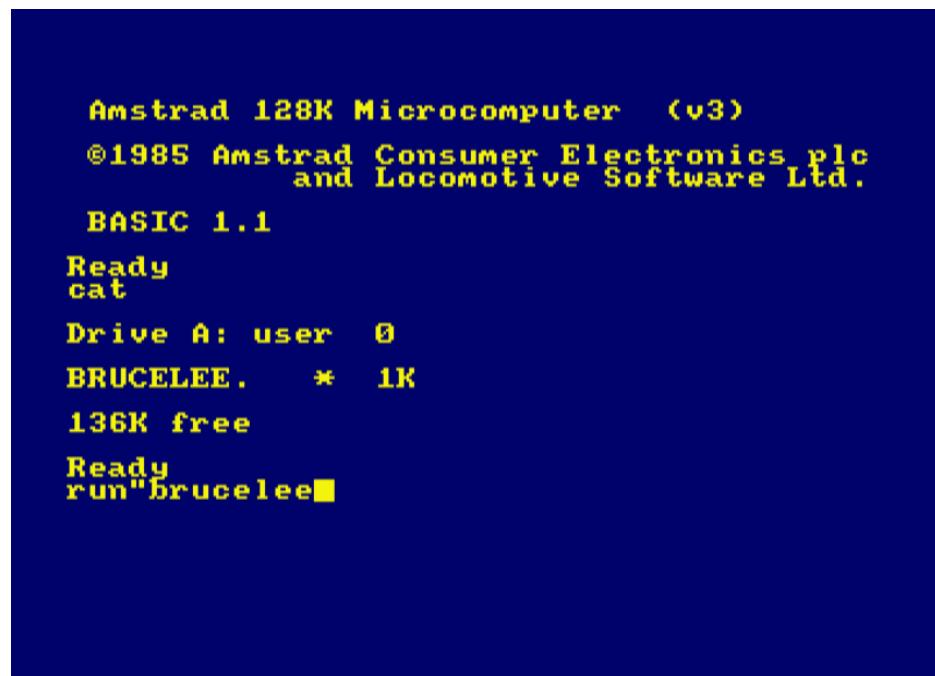
BASIC 1.1

Ready
cat

Drive A: user 0
BRUCELEE.* 1K
136K free

Ready■
```

Type the command **RUN"<name>** to load a program from disk



```
Amstrad 128K Microcomputer (v3)
©1985 Amstrad Consumer Electronics plc
and Locomotive Software Ltd.

BASIC 1.1

Ready
cat

Drive A: user 0
BRUCELEE.* 1K
136K free

Ready
run"brucelee■
```

Press **Page Up** key to reset and load the next **DSK** file.

Acorn Atom

Acorn Atom was a home computer made by Acorn Computers Ltd. The ZXDOS+ core (based on the ZX-Uno core made by Quest) is an adaptation of the [AtomFPGA](#) project. You can get more information at [ZX-Uno Forums](#).

microSD card format

You have to use a microSD card with the first partition in FAT16 format.

Download the latest version of Atom Software Archive [from GitHub](#).

You can set up the files in the microSD in two different ways:

1. Extract all the contents of the archive to the root of the SD card. **SYS** directory contents are compatible with esxdos **SYS** directory, so you can merge both into one.
2. Have less files an directorios in the root directory. Create a directory named **ATOM** in the SD root, and copy inside all the uncompressed archive content, except for the directory **MANPAGES** which must also be in root. Then, extract and the files from **trick_ATOM_folder** archive (available [at ZX-Uno Forum](#)), replacing any file with the same name. You will get a file and directory structure like this:

```
/  
+-ATOM/  
|   +-AA/  
|   (...)  
|   +-AGD/  
|   |   +-SHOW2  
|   |   +-SHOW3  
|   (...)  
|   +-MENU  
|   (...)  
|   +-TUBE/  
|   |   +-BOOT6502  
|   (...)  
  
+-MANPAGES/  
|   +-CPM.MAN  
|   +-FLEX.MAN  
|   (...)  
  
+-MENU
```

Keyboard

Special keys and buttons

The following gomaDOS+ key combinations are in **Acorn Electron** keyboard mode. Please check [the corresponding section](#) for more information. You can also use **PC XT** keyboard mode combinations.

While the core is running:

- **Shift+F10**: Shows Atom Software Archive Menu
- **F10 (Caps Shift+Symbol Shift+0** on gomaDOS+): Soft Reset
- **F1 (Caps Shift+Symbol Shift+1** on gomaDOS+): Turbo mode 1Mhz
- **F2 (Caps Shift+Symbol Shift+2** on gomaDOS+): Turbo mode 2Mhz
- **F3 (Caps Shift+Symbol Shift+3** on gomaDOS+): Turbo mode 4Mhz
- **F4 (Caps Shift+Symbol Shift+4** on gomaDOS+): Turbo mode 8Mhz

The keyboard uses the following mapping:



Basic Guide

Sometimes, after starting up the core, a screen full of `@` appears. Ejecting and inserting, or only inserting, the microSD card will fully start the system.



Once it's running, press **Shift+F10** to show a menu where you can choose and load Atom Software Archive programs from the card.

Commodore 64

The Commodore 64 (C64, CBM 64/CBM64, C=64,C-64, VIC-641), was an [8-bit home computer](#) manufactured by Commodore International.

The ZX DOS+ core is developed by Neuro.

microSD card format

You can use a microSD card with the first partition formatted as FAT16 or FAT32. Disk image ([D64](#)) and tape ([TAP](#)) files can be loaded from the SD card.

See the [corresponding section](#) for instructions of how to install the Commodore 64 core in ZX DOS+.

Keyboard

Special keys and buttons

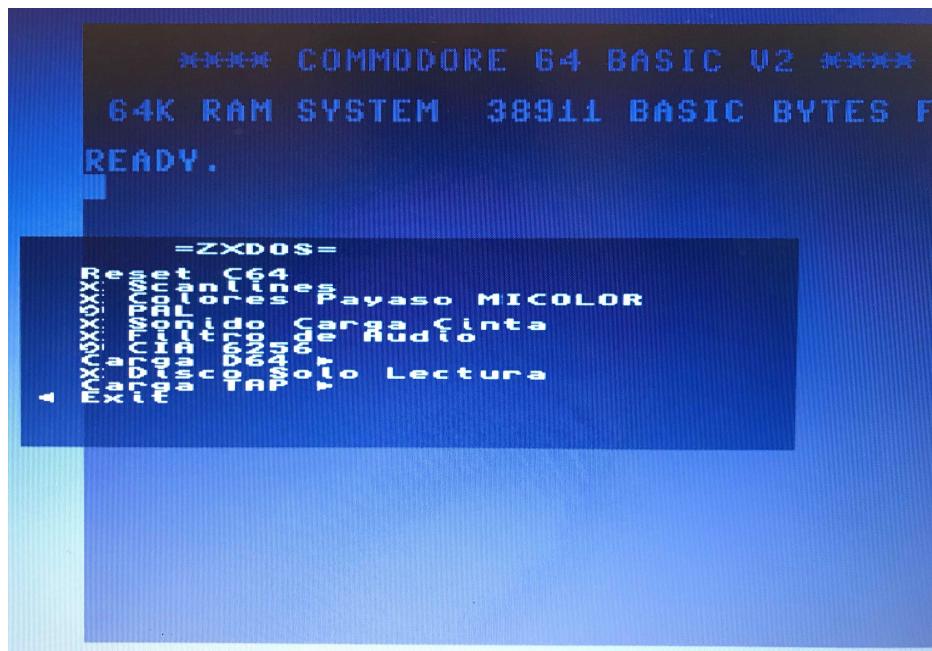
The following gomaDOS+ key combinations are in [Commodore 64](#) keyboard mode. Please check [the corresponding section](#) for more information. You can also use [PC XT](#) keyboard mode combinations.

While the core is running:

- **F12** ([Caps Shift+Symbol Shift+W](#) on gomaDOS+): Shows options menu
- **Scroll Lock** ([Caps Shift+Symbol Shift+G](#) on gomaDOS+): switches between VGA and RGB modes
- **Esc** ([Caps Shift+Space](#) on gomaDOS+): RUN/STOP ([Shift+RUN/STOP](#): Load from tape)

Basic Guide

After pressing F12 (Caps Shift+Symbol Shift+W on gomaDOS+), the option menu is shown.



The menu offers the following options

- Core reset
- Enable o disable scanlines
- Change colour palette (Colores Payaso MICOLOR)
- Enable or disable PAL mode
- Enable or disable tape loading sound (Sonido Carga Cinta)
- Enable or disable audio filter (Filtro de Audio)
- Load D64 file from SD (Carga D64)
- Load TAP file (Carga Tap)

After a disk is inserted, normally, you can use `LOAD "*",8,1` and press `Enter` to load the software inside. Once `READY` is shown on screen, type `RUN` and press `Enter` to execute it.

If there was more than one program in the disk, type `LOAD "$"` and press `Enter`. Then, type `LIST`, and press `Enter`, to see a list with the files in the disk. Now, to load one of them, type `LOAD "<name>",8` (where `<name>` is the name of the file to load) and press `Enter`. Once `READY` is shown on screen, type `RUN` and press `Enter` to execute it. If this didn't work try again with the command `LOAD "<name>",8,1`.

To load from tape, you can type `LOAD` and press `Enter`, or just press `Shift+Esc` (`Shift+RUN/STOP`).

Phoenix

Space-Themed shooter video game released in arcades by Amstar Electronics.

Some of the features of the ZXDOS+ core are:

- Two different video modes: RGB/PAL60Hz and VGA 60Hz
- Scanlines on VGA mode
- Controls can be optionally rotated 90°

microSD format

This core does not use the microSD card.

Keyboard

Special keys and buttons

While the core is running:

- **Q** and **A** or **Left Cursor** and **Right Cursor** (or a joystick): Movement control
- **Z** or **X** **Left Windows Key** and **Space** (or joystick buttons 1 and 2): Fire 1 and 2, also to insert coin and **Start**
- **F2** (**Caps Shift+Symbol Shift+B** on gomaDOS+): Switches between VGA and RGB modes
- - (numeric keyboard): Enable or disable scanlines
- **Tab** (**Caps Shift+Enter** on gomaDOS+, **PC XT** keyboard mode): Enables or disables 90° rotation of the direction of controls

Basic Guide

By default, the core starts with normal controls, configured for vertical displays. If you have an horizontal display, the image will be rotated. To ease the control, and make it more natural and according to what you see, when typing **Tab**, up-down directions are switched with left-right. This is both for joystick and keyboard controls.

Pong

Pong was one of the earliest arcade video games manufactured by Atari.

Some features of this core are:

- Two different video modes: RGB/PAL60Hz and VGA 60Hz
- 7 game variants
- Support for 2 or 4 players
- Support for Joysticks, keyboard, mouse and rotary encoder controls (see [here](#) for more information)
- Several colour modes

microSD format

This core does not use the microSD card.

Keyboard

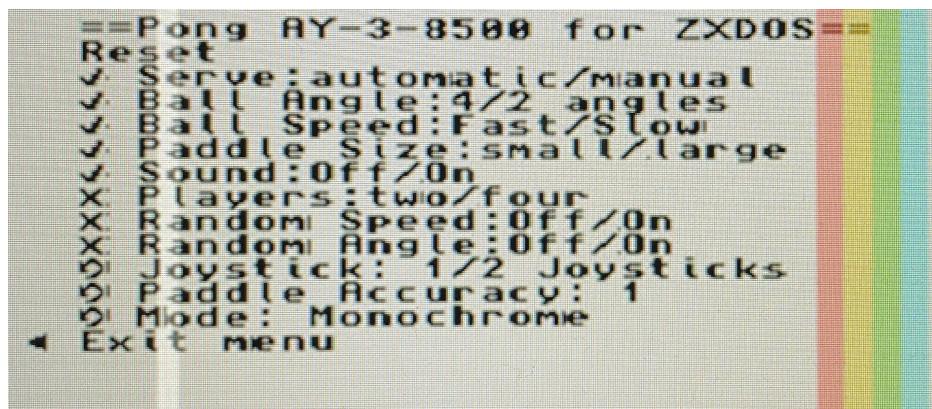
Special keys and buttons

While the core is running:

- **Esc** or joystick button 2 (or **Caps Shift+Space** on gomaDOS+, **PC XT** keyboard mode): Show or hide configuration menu
- **Ctrl+Alt+Backspace** (**Caps Shift+Symbol Shift+B** on gomaDOS+, **ZX Spectrum** keyboard mode): Hard reset
- **Scroll Lock** (**Caps Shift+Symbol Shift+G** on gomaDOS+, **ZX Spectrum** keyboard mode): switch between VGA and RGB mode
- **F3** o **F12** (**Caps Shift+Symbol Shift+3** or **Caps Shift+Symbol Shift+W** on gomaDOS+): Restart game
- Number between **1** and **7**: Change the game variant
- Joystick 2 (right): Control right pad (Player 1).
- Joystick 1 (left): Control left pad (Player 2)
- **Cursor up** and **Cursor down** or **O** and **K**: Control right pad (Player 1 in 2 player mode and player 3 in 4 player mode)
- **Q** and **A**: Control left pad (Player 2 in 2 player mode and player 4 in 4 player mode)
- **Z**, **M** or joystick button 1: Manual serve
- Cursor keys (**Caps Shift+5**, **Caps Shift+6**, **Caps Shift+7** and **Caps Shift+8** on gomaDOS+, **PC XT** keyboard mode) and **Enter** to use the menu

Basic Guide

Pressing **Esc** or joystick button 2 (**Caps Shift+Space** on gomaDOS+, **PC XT** keyboard mode) shows or hides the configuration menu. Cursor keys (**Caps Shift+5**, **Caps Shift+6**, **Caps Shift+7** and **Caps Shift+8** on gomaDOS+, **PC XT** keyboard mode) and **Enter** to select and choose menu options.



The following options are available:

- Serve mode
- Ball Angle
- Ball Speed
- Paddle Size
- Sound
- Number of players
- Speed mode
- Angle mode
- Joystick, mouse, etc. controls
- Paddle accuracy
- Colour mode
- Exit

NES

Nintendo Entertainment System (also known as Nintendo NES or just NES) is the [second home video game console produced by Nintendo](#).

The ZX DOS+ core has been made by Nihilash, based on [the previous version for ZX-Uno](#) by DistWave y Quest.

Some features of this core are:

- HQ2X filters that "removes pixels" from the image
- Scanlines simulation
- Made with NES NTSC clock timings, so only USA ROMs run fine. PAL ROMs run faster than they should
- You can load ROMs from the SD
- You need, at least, one gamepad or joystick connected, and it must have several buttons
- Only VGA video mode is supported, with non-accurate timings, so it may not work with some displays

microSD card format

You need a microSD card with the first partition in FAT16 format to store ROM image files of the games to load. ROM files can be inside subdirectories.

See the [corresponding section](#) for instructions of how to install the NES core in ZX DOS+.

Keyboard

Special keys and buttons

While the core is running:

- **Esc** or joystick button 2 (or **Caps Shift+Space** on gomaDOS+, **PC XT** keyboard mode): Show or hide configuration menu
- Cursor keys (**Caps Shift+5**, **Caps Shift+6**, **Caps Shift+7** and **Caps Shift+8** on gomaDOS+, **PC XT** keyboard mode), and **Enter** to use the menu
- **Ctrl+Alt+Backspace** (**Caps Shift+Symbol Shift+B** on gomaDOS+, **ZX Spectrum** keyboard mode): Hard reset

Basic Guide

Pressing **Esc** or joystick button 2 (**Caps Shift+Space** on gomaDOS+) shows or hides the configuration menu. To navigate the menu and activate or choose any option, use the cursor keys (**Caps Shift+5**, **Caps Shift+6**, **Caps Shift+7** and **Caps Shift+8** in gomaDOS+, **PC XT** keyboard mode) and **Enter**.



The following options are available:

- Reset NES
- Scanlines
- HQ2X Filter
- P1 Select
- P1 Start
- Load ROM
- Exit

Colecovision

Colecovision is Coleco Industries' home video-game console that was released in August 1982.

ZXDOS+ core is based on [ZX-Uno version](#) by Fabio Belavenuto.

Some features of this core are:

- BIOS ROM is loaded from microSD card
- Supports multicart ROM, also loaded from microSD
- Only works with VGA

microSD card format

You need a microSD card with the first partition in FAT16 format to store ROM image files of the games to load and other needed files. These can be downloaded from [the original project in GitHub](#).

See the [corresponding section](#) for instructions of how to install the Colecovision core in ZXDOS+.

Keyboard

Special keys and buttons

While the core is running:

- Cursor or **Q, A, E, R** or joystick 1: Directional controls for player 1
- **Z** or joystick 1 main fire button: Fire Button 1 for player 1
- **U, J, O, P** or joystick 2: Directional controls for player 2
- **M** or joystick 2 main fire button: Fire button 1 for player 2
- **X** or joystick 1 secondary fire button: Fire button 1 for player 1 and player 2
- **0** to **9**: Button 0 to 9 for player 1 and player 2
- **T**: Button '*'
- **Y**: Button '#'
- 'Esc' (or **Caps Shift+Space** on gomaDOS+, **PC XT** keyboard mode): Soft Reset

Basic Guide

On startup, BIOS ROM is loaded from the card, and then the multicart ROM.



At multicart menu, use the directional controls to choose one ROM, and then fire button 1 to load. Pressing 'Esc' (**Caps Shift+Space** on gomaDOS+, **PC XT** keyboard mode) restarts the core and loads the ROM selection menu again.

Atari 2600

Atari 2600 is a home video game console originally branded as the Atari Video Computer System (Atari VCS).

ZXDOS+ core version is developed by avlixa.

Some of the features of the core are:

- RGB and VGA support
- Support for joysticks, keyboard, mouse and rotary encoder controls (see [here](#) for more information)

microSD card format

You need a microSD card with the first partition in FAT16 format to store ROM image files of the games to load.

See the [corresponding section](#) for instructions of how to install the Atari 2600 core in ZXDOS+.

Keyboard

For gomaDOS+, it is recommended to change the keyboard mode to **Atari 800** (**Caps Shift + Symbol Shift + U** and then **4**) o **PC XT** (**Caps Shift + Symbol Shift + U** and then **9**).

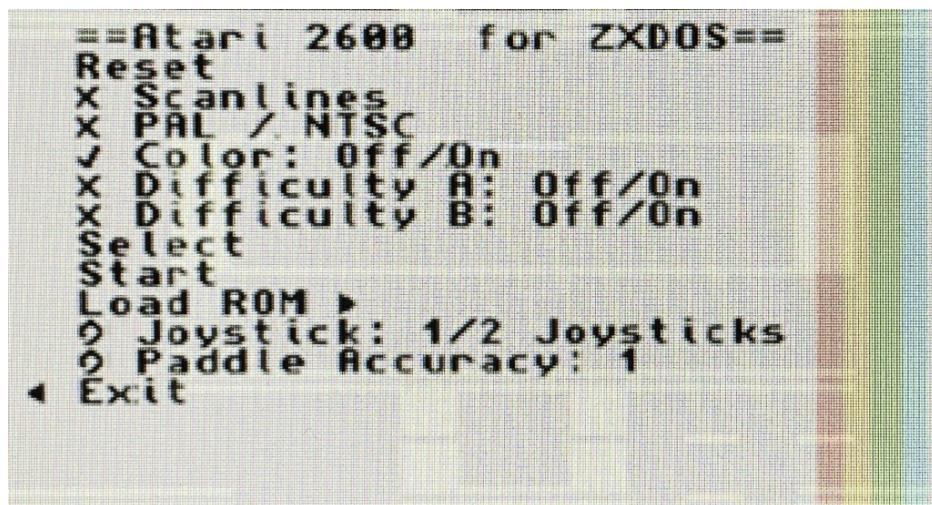
Special keys and buttons

During the core execution:

- **W, A, S, D** or joystick 1: Directional controls for player 1
- **F** or joystick 1 fire button: Player 1 fire button
- **I, J, K, L** or joystick 2: Directional controls for player 2
- **H** or joystick 2 fire button: Player 2 fire button
- **Scroll Lock** (**Caps Shift+Symbol Shift+G** on gomaDOS+): change between RGB and VGA video mode
- **Ctrl+Alt+Backspace** (**Caps Shift+Symbol Shift+B** on gomaDOS+): Hard reset.

Basic Guide

Pressing **Esc** or joystick button 2 (**Caps Shift+Space** on gomaDOS+, **Atari800** keyboard mode) shows or hides the configuration menu. Cursor keys (**Caps Shift+5**, **Caps Shift+6**, **Caps Shift+7** and **Caps Shift+8** on gomaDOS+, **Atari800** keyboard mode) and **Enter** to select and choose menu options.



The following options are available:

- Reset core
- Scanlines
- RGB Mode (PAL/NTSC)
- Paddle Size
- Sound
- Color
- Difficulty A
- Difficulty B
- Select
- Start
- Load ROM
- Joystick
- Paddle Accuracy
- Exit

Other Hardware

Rotary Encoders

Pong and Atari 2600 cores support the use of quadrature [rotary encoders](#) as control devices. They can be connected to the joystick ports. Although the testing has been done with 600 ppr encoders, lower ppr encoders, like 400 or 300, should also work.

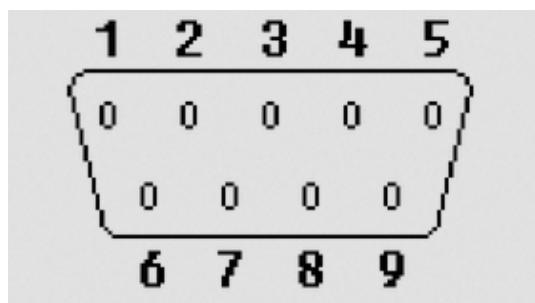
You can also use an Atari 2600 [paddle](#) driving controller. In this case the playing experience is bad, since they have few ppr and you must do several full rotations. When using them, it's recommended to set the accuracy setting to 8, to have enough speed.

Connection

Both ZX DOS+ and gomaDOS+ have joystick pin 5 connected to positive VCC, used as main power, and pin 8 as GND. The rotary encoders to use must support voltage from 3.4v to 5v.

A rotary encoder has 5 wires: Earth Ground (not connected), Vcc (+), GND ([0V](#)'or '[-](#)), A and B.

[A](#) y [B](#) are connected to pins 1 and 2 for the first encoder, 3 and 4 for the second one. This way you can have up to 4 encoders connected using both joystick ports.



This way, the connections should be:

1. Line [A](#) encoder 1
2. Line [B](#) encoder 1
3. Line [A](#) encoder 2
4. Line [B](#) encoder 2
5. Vcc([+](#))
6. Fire 1
7. NC
8. [GND](#)
9. Fire 2

Pong Core Configuration

Follow these directions to choose the configuration:

- For 1 or 2 endoders on joystick port 2 de joystick, select **1/2 Paddle in J2** option
- For 2 encoders, one for each joystick port, select **2/4 Paddle in J1&J2** option. This is also valid to connect two Atari 2600 driving paddles
- For 4 encoders, two for each joystick port, select **2/4 Paddle in J1&J2** option
- For 1 or 2 encoders on joystick port 2 along with a mouse (in this case the encoders are for players 2 and 4), select **Mouse PS/2** option

It is recommended to wait, and make the connection after selecting the chosen option, since the encoders interfere with the up/down directions of the joystick, blocking access to the menu. Another option is to add a on/off switch for the encoder that will disable the power.

Troubleshooting

Firmware recovery

Sometimes (e.g. when installing an experimental core or when upgrading the ZX Spectrum Next or the BIOS) it may happen that the ZX DOS+ stops booting. The board LEDs are on, but there is no display, and it doesn't do anything when trying the different key combinations to access BIOS setup, etc.

When this happens, there are several recovery methods that let you install again the firmware.

Recovery using a Raspberry Pi

Hardware required:

- Raspberry Pi (with SD card, keyboard, display, power supply, etc.) and with internet connection
- 5 [jump wires](#) (if possible, female on both sides) or, instead a USB blaster cable
- One [hex key](#) with the right socket size for ZX DOS+ cover screws, or appropriate screwdriver to open a gomaDOS+ (this isn't necessary if using a USB blaster)
- microSD for ZX DOS+/gomaDOS+ with the first partitiion formated as FAT16 or FAT32
- Keyboard (not needed for gomaDOS+) and display for ZX DOS+

Software required:

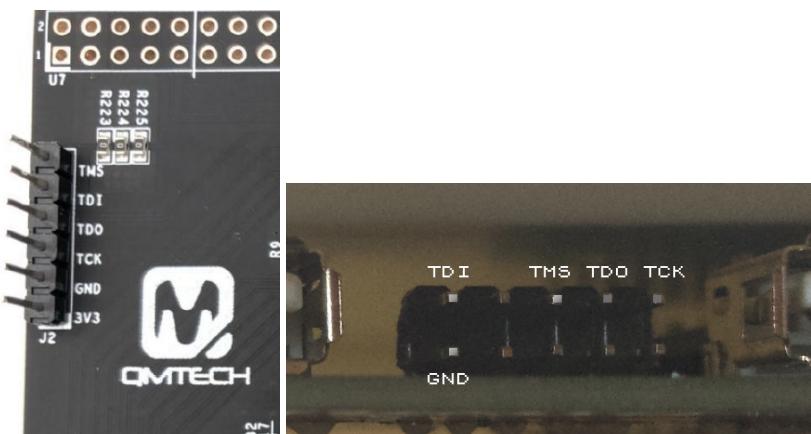
- Flash image and recovery file for ZX DOS+ (LX25), from the [official repository](#)

Instruction Steps:

1. Install Raspberry Pi OS (formely known as Raspbian) to the Raspberry Pi SD card (using [the official download](#), [NOOBS](#), [PINN](#), etc.)
2. Install Open OCD:

```
sudo apt-get update
sudo apt-get install git autoconf libtool make pkg-config
sudo apt-get install libusb-1.0-0 libusb-1.0-0-dev telnet
sudo apt-get install libusb-dev libftdi-dev
git clone git://git.code.sf.net/p/openocd/code openocd-code
cd openocd-code/
./bootstrap
./configure --enable-usb_blaster --enable-sysfsgpio --enable-bcm2835gpio
make
sudo make install
cd ..
rm -rf ./openocd-code
```

3. Connect USB Blaster or jump wires if using GPIO. In this case, open the ZX DOS+ or gomaDOS+ case and connect the FPGA JTAG lines (**TMS**, **TDI**, **TDO**, **TCK** y **GND**), using the wires, to the Raspberry Pi [GPIO](#) pins.

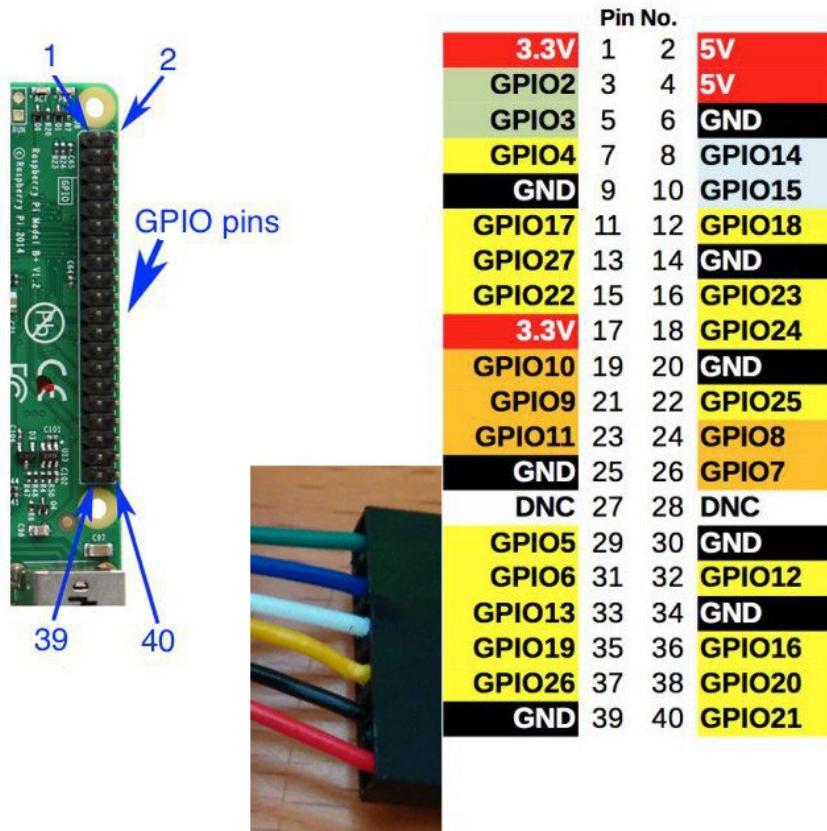


DO NOT connect the 3V line



When using USB Blaster, a gomaDOS+ is ready to connect directly the 2x5 connector. For a ZX DOS+, it will be necessary to prepare the cables, comparing those last two images.

Is using a GPIO connection, take note of the chosen pins, making sure that **GND** is connected with **GND**.



In this example, the **31**, **33**, **35**, **37** and **39** pins will be used (corresponding to **GPIO #6**, **GPIO #13**, **GPIO #19**, **GPIO #26** and **GND**), like this:

ZXDOS+ JTAG	GPIO	Raspberry Pi Pin
TMS	GPIO#6	31
TDI	GPIO#13	33
TDO	GPIO#19	35
TCK	GPIO#26	37
GND	GND	39

4. Copy to the Raspberry Pi the file named `recovery.zxd.bit` previously downloaded from the [official repository](#). For our example, it will be at `/home/pi/zxdosplus/unbrick/`
5. If using GPIO, make a copy of Open OCD configuration file, to the same directory where `recovery.zxd.bit` is.

```
cp /usr/local/share/openocd/scripts/interface/raspberrypi2-native.cfg
/home/pi/zxdosplus/unbrick/
```

6. For GPIO connection, edit `raspberrypi2-native.cfg` copy, updating `bcm2835gpio_jtag_nums` (uncommenting, if necessary), with your JTAG and GPIO connection numbers, at the line `bcm2835gpio_jtag_nums`. For our example:

```
# Header pin numbers: 37 31 33 35  
bcm2835gpio_jtag_nums 26 6 13 19
```

7. Comment, if it wasn't already, the line `bcm2835gpio_swd_nums` (not necessary for USB Blaster connection):

```
#bcm2835gpio_swd_nums 11 25
```

8. Add, to the end of the file, the line `adapter speed 250` (again, not necessary for USB Blaster):

```
adapter speed 250
```

9. Turn on the ZX DOS+ or goma DOS+.

10. Make sure that, on the Raspberry Pi, we are in the directory where `recovery.zxd.bit` is, and execute the command that loads the BIOS on recovery mode, using the path to the previously edited `raspberrypi2-native.cfg`.

For GPIO connection:

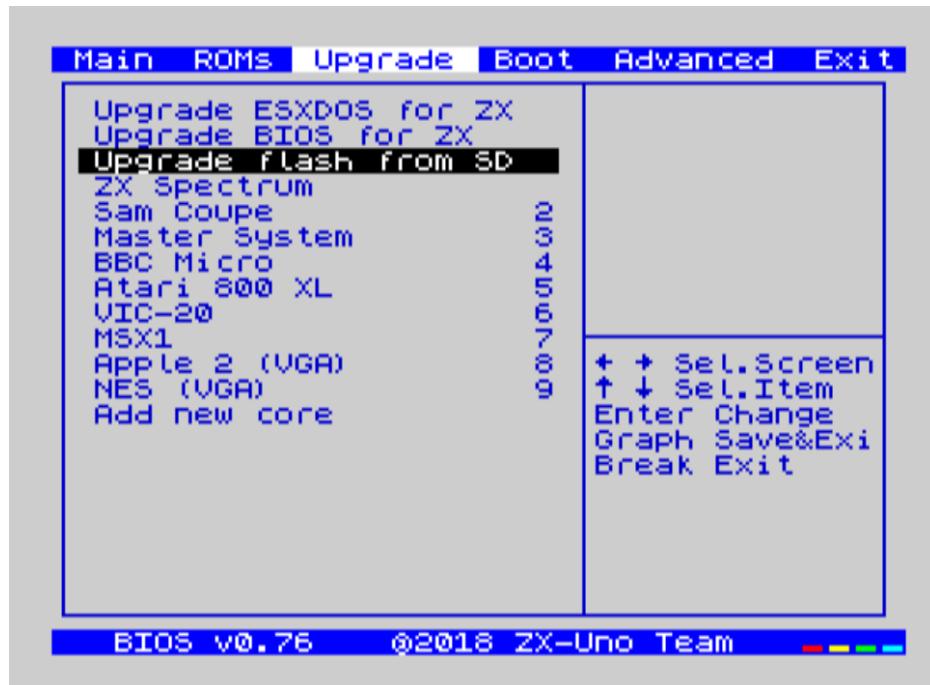
```
cd /home/pi/zxdosplus/unbrick  
sudo openocd -f /home/pi/zxdosplus/unbrick/raspberrypi2-native.cfg -f  
/usr/local/share/openocd/scripts/cpld/xilinx-xc6s.cfg -c "init; xc6s_program xc6s.tap;  
pld load 0 recovery.zxd.bit ; exit"
```

For USB Blaster connection:

```
sudo openocd -f /usr/local/share/openocd/scripts/interface/altera-usb-blaster.cfg -f  
/usr/local/share/openocd/scripts/cpld/xilinx-xc6s.cfg -c "init; xc6s_program xc6s.tap;  
pld load 0 recovery.zxd.bit ; exit"
```

11. If all goes well, we will see that the FPGA LED change their state and the BIOS is shown on the display.

If there is no image on the display, press **Scroll Lock** (**Caps Shift+Symbol Shift+G** on gomADOS+): to switch between RGB and VGA modes, just in case the recovery BIOS did start in the wrong mode for our setup.



12. Insert in the ZXDOS+ the microSD card formatted as FAT16 o FAT32, and with the [FLASH.ZXD](#) file downloaded previously.
13. If using a USB Blaster connection, unplug the connector.

14. Select the option **Upgrade Flash from SD**. Press Enter, choose **Yes**, and press Enter again to start the Flash writing process.



This process can't be undone, and it will replace all the previously installed cores, the BIOS, the ZX Spectrum ROMs and their configuration with the data in the image file.



Usually, the recovery image is set to use a PS/2 keyboard so, for a gomaDOS+, some key combinations, like **Caps Shift + 5**, etc may not work. In this case, you have to change the keyboard mode to **PC XT**(**Caps Shift + Symbol Shift + U** and then **9**), to make them work temporarily.

15. After some minutes, the process will end, and, after turning the ZXDOS+ off and on, it should start fine.



If no image is shown, press again **Scroll Lock** (**Caps Shift+Symbol Shift+G** on gomaDOS+): to switch between RGB and VGA modes. In this case, you should have to enter the BIOS and change [the right advanced setting](#) that matches your display.

For a gomaDOS+, since the recovery image uses a PS/2 configuration as default, follow this steps to set up the BIOS correctly:



1. If you see no image, switch between composite and VGA mode (**Caps Shift+Symbol Shift+G**)
2. Change to **PC XT** keyboard mode (**Caps Shift + Symbol Shift + U** and then **9**)
3. Reboot gomaDOS+ without losing the temporary keyboard mode (**Caps Shift + Symbol Shift + B**)
4. Quickly, press **Caps Shift + 1**
5. Again, if there's no image, switch between composite and VGA mode (**Caps Shift+Symbol Shift+G**)
6. Navigate through BIOS and turn on these options:
 - **Advanced → Keyboard Layout: Spectrum**
 - **Advanced → Video: VGA** (only if there was no image)
7. Save changes:
 - **Exit → Save changes and exit**
8. Completely turn off gomaDOS` and turn it on again

References

[ZX-Uno](#)

[ZX-Uno FAQ](#)

[Guía rápida del ZX-Uno](#)

[Core ZX Spectrum](#)

[Layouts de teclado](#)

[Firmware de teclado para ZX Go+](#)

[zxunops2](#)

[Almost \(In-\) Complete List of esxDOS DOT-Commands](#)

[WiFi \(RetroWiki\)](#)

[WiFi en ZX-Uno](#)

[Core de ZX-Uno Test UART \(WiFi\)](#)

[Network tools for ZX-Uno pack](#)

[ESP8266 AT Instruction Set](#)

[Core ZXNEXT en ZX DOS](#)

[ZX Spectrum Next en ZX DOS](#)

[Core MSX](#)

[MSX1FPGA](#)

[MSX Pack](#)

[Nextor para MSX](#)

[Nextor User Manual](#)

[MSX-DOS](#)

[Atom Software Archive en carpeta ATOM](#)

[Teclado Core Atom](#)

[Core de NES para ZX-Uno](#)

[ColecocoFPGA on GitHub](#)

[Programming a Spartan 6 with a Raspberry Pi](#)

Tutorial para desbriquiar el ZX-Uno con una Raspberry

Como programar un UnAmiga con la Raspberry Pi (o Linux) con el USB-Blaster y OpenOCD