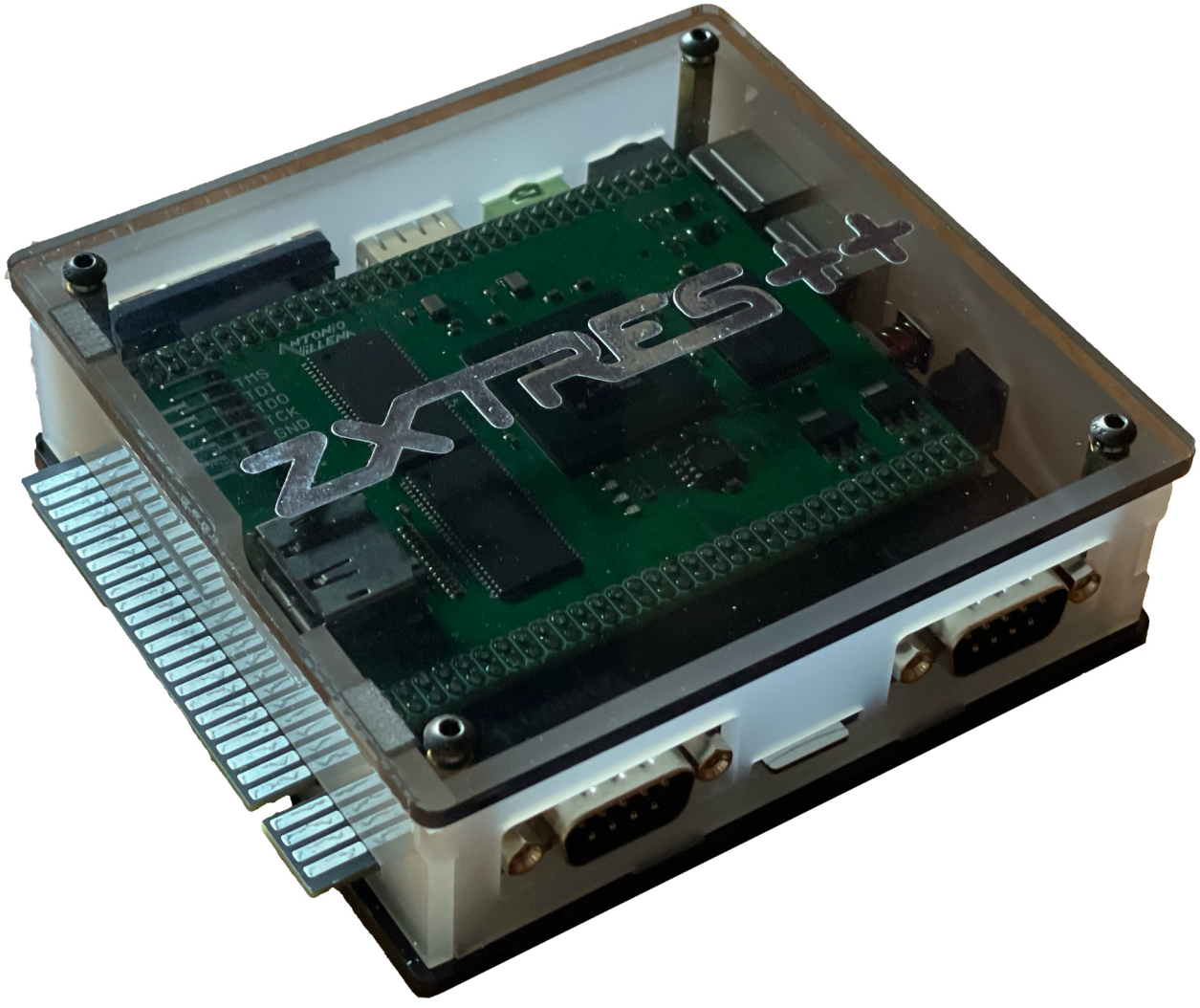
ZXTRES



Manual

Index

Introduction

The ZXTRES, ZXTRES+ and ZXTRES++ are a continuation of the ZX-Uno hardware and software project created by Superfo, AVillena, McLeod, Quest and Hark0. The ZX-Uno team created an FPGA board programmed to behave like a ZX Spectrum computer.

Over time the project grew and it's now possible to use different software configurations (cores) that work like different systems other than the ZX Spectrum. You can choose to start the ZXTRES with your desired configuration from all those available.

The ZXTRES official web page is https://www.example.com. **FIXME**

Most of the functions and features of the ZXTRES, ZXTRES+ and ZXTRES++ are the same, so this document typically refers to the ZXTRES indicating the differences when necessary. In this document, *controller* means joystick or gamepad. Buttons are labelled alphabetically from `A` but labels on individual controllers may differ.

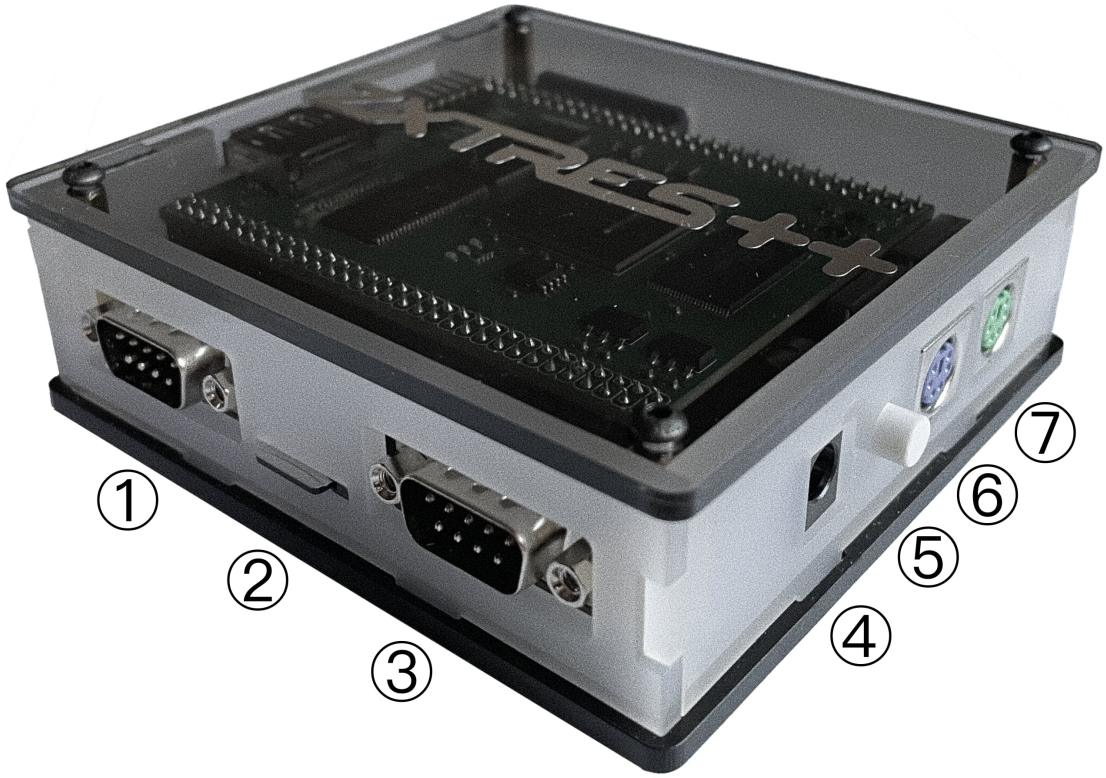
Acknowledgements

Much of the content of this manual is based on information previously shared at:

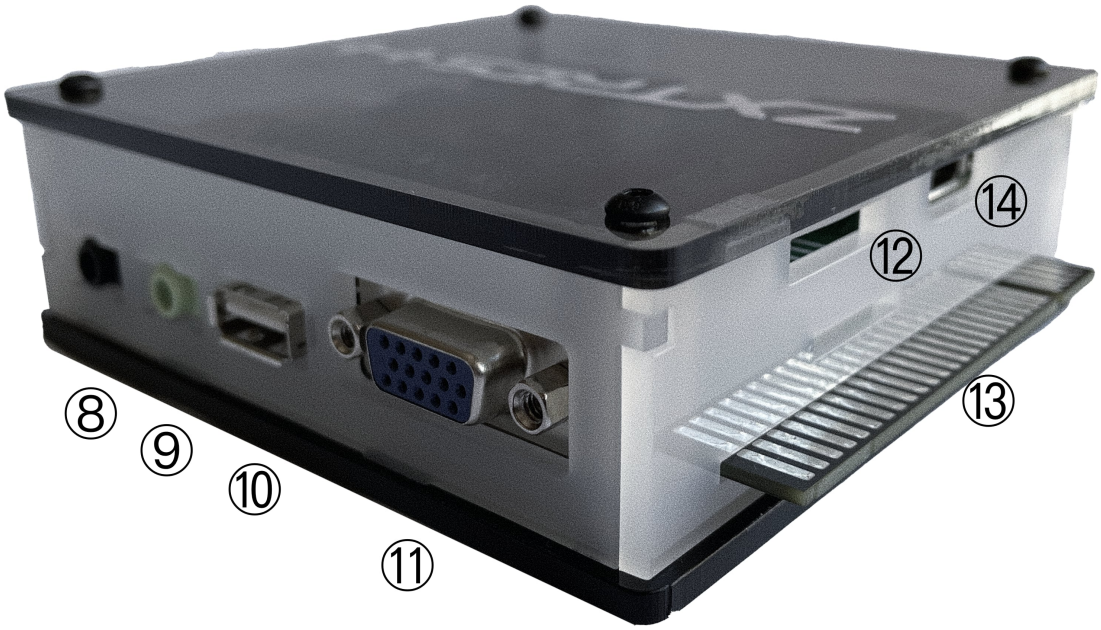
- foroFPGA.
- ZX-Uno forum.
- Several existing FAQs; mostly the original version by @uto_dev and the latest one by @desUBIKado.
- the official Telegram channels for ZX-Uno ZXDOS and ZXTRES.
- ZXTRES official wiki.

Without the previous work of all these people (and more) this manual wouldn't exist.

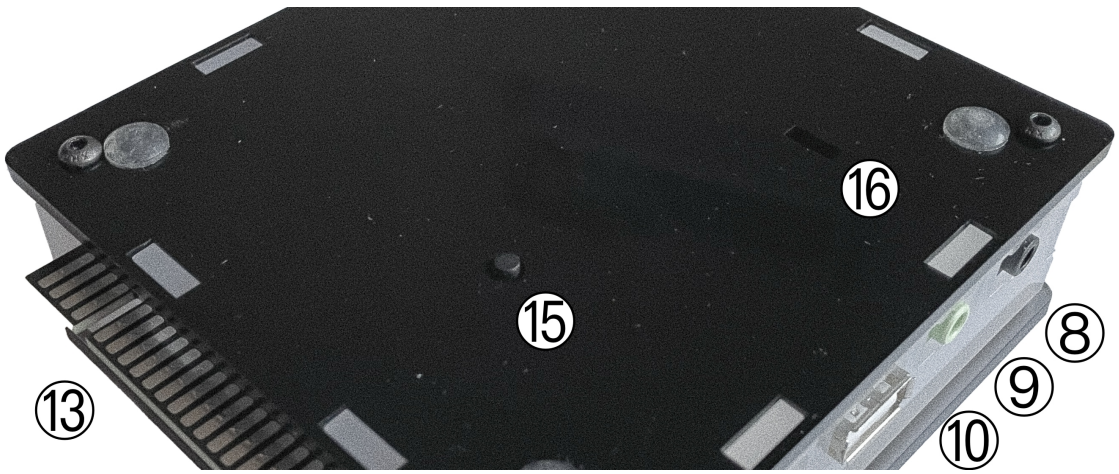
Ports and connectors



1	Left controller port
2	microSD card Slot
3	Right controller port
4	Power socket
5	Power switch
6	PS/2 keyboard port
7	PS/2 mouse port



8	Audio in
9	Audio out
10	USB port (only for use with middleboard installed)
11	RGB/VGA out
12	JTAG access
13	Expansion port
14	DisplayPort out



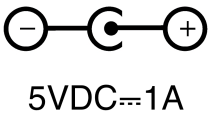
15	Reset button
16	Sound selection switch (DeltaSigma or I2S)

Initial setup

To set up and use the ZXTRES you need at least:

- DisplayPort, VGA or RGB cable and compatible display (the RGB connection can also be used with a VGA to SCART adapter and connected to compatible TVs).
- PS/2 keyboard
- USB charger, TV or other device that provides USB power (5VDC and at least 1A). The connector is a coaxial jack "barrel" plug of 5.5mm outer diameter and 2.1mm inner diameter with positive polarity (centre positive)

It’s important that the source has stable voltage and sufficient current or erratic behaviour may occur (the keyboard or DisplayPort may fail and so on). Some keyboards or peripherals may require a similar power supply but with 2A or more.



To take advantage of its full potential you may also need:

- Atari standard controller such as a Sega Mega Drive (Gensis) controller.
- Audio cable with a stereo 3.5mm jack on one side and both audio channels split into two mono outputs on the other side if you want to use an audio player or recorder such as a Miniduino (see more information later), a modern computer or a cassette tape recorder. The right sound channel is used as input (EAR) and the left channel can be used as output (MIC).
- microSD card with 32GB capacity or less.
- PS/2 mouse.
- Speakers to connect to the audio output or a stereo jack converter to two red and white RCA connectors to connect to a TV,

microSD card formatting

This table shows the requirements of cores that use the microSD card.

Core	FAT 16	FAT 32	+3e	Primary Partition Type	Extra Partitions	Access	Notes
ColecoVision	Yes	Yes	No	Any	No	Only ROMs (`ROM`)	
Neo-Geo	Yes	Yes	No	Any	No	Only ROMs (`NEO`)	Requires BIOS
ZX81	Yes	Yes	No	Any	No	Only images (`O` and `P`)	
zxsp	Yes	Yes	Yes	Any	No	Disk Images (`VHD`)	Requires ROM
ZX Spectrum EXP	Yes	Yes	Yes	Any	Yes	Full	Using SPI Flash esxdos

FAT16 partitions have a maximum size of 4GB.

When naming a partition to be used with esxDOS you can't also use it as a folder name on that partitio. Otherwise an error occurs when trying to access the contents (don't name the partition as `BIN SYS` or `TMP`).

The ZX Spectrum core can also have the first partition in +3DOS format and then the second one in FAT16 or FAT32 format to use with the +3e ROM.

Windows

For simple configuration of microSD cards of the correct size (2GB or less for FAT16 or 32GB or less 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 can use the command line tool `diskpart` or the Windows Disk Management GUI.

For example, to format a microSD card shown as disk 6 when executing `list disk` from `diskpart` with only one FAT16 partition (if the microSD card size is less than 4GB):

```
select disk 6
clean
create part primary
active
format FS=FAT label=ZXTRES
exit
```

To create two FAT16 partitions (for example to use MSX core) and have the rest of space as another FAT32 partition (for microSD cards more than 8GB in size):

```
select disk 6
clean
create part primary size=4000
set id = 06
active
format fs=FAT label=ZXTRES quick
create part primary size=4000
format fs=FAT label=EXTRA quick
create part primary
format fs=FAT32 label=DATA quick
exit
```

To create one FAT32 4GB partition (for example to use with Amstrad CPC 6128 core) and then have the rest of space available as a second FAT32 partition (for microSD cards more than 4GB in size):

```
select disk 6
clean
create part primary size=4000
set id = 0b
active
format fs=FAT32 label=ZXTRES unit=4k quick
create part primary
format fs=FAT32 label=EXTRA quick
exit
```

macOS

For simple configuration of microSD cards of the correct size (2GB or less for FAT16 or 32GB or less 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 microSD card shown as `disk6` with only one FAT16 partition (if the microSD card size is less than 2GB):

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

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

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

To create two FAT16 partitions (for example to use MSX core) and have the rest of space as another FAT32 partition (for microSD cards more than 8GB in size):

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

`diskutil` can't create FAT16 partitions that are bigger than 2GB and then format them. That's why in this example you must format them only after creating the partitions.

To create one FAT32 4GB partition (for example to use with the Amstrad CPC 6128 core) and then make the rest of space available as a second FAT32 partition (for microSD cards of more than 4GB):

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

In this example because the partition has a size of exactly 4GB, macOS uses a cluster size of 4096 bytes which is the one required for the Amstrad CPC 6128 core. For a smaller size you may need to format the first partition again. For example:

```
diskutil unmountDisk /dev/disk6
newfs_msdos -F 32 -v ZXTRES -b 4096 /dev/rdisk6s1
```

The Spotlight feature in macOS enables you to search the items on the microSD card creating a number of hidden files. You can switch off the indexing with these commands (assuming that the SD partition is called `ZXTRES`):

```
mdutil -i off /Volumes/ZXTRES
cd /Volumes/ZXTRES
rm -rf .{,_.}{fseventsd,Spotlight-V*,Trashes}
mkdir .fseventsd
touch .fseventsd/no_log .metadata_never_index .Trashes
cd -
```

Linux

There are many tools for Linux that can format or partition a microSD card (`fdisk` `parted` `cfdisk` `sfdisk` or `GParted` to name a few). Note that the partition scheme must always be MBR and the first partition (the one to be used for esxDOS) must be the primary partition.

For example to format a microSD card shown as `sdc` with only one FAT16 partition (if the microSD card size is less than 4GB):

```
sudo fdisk --compatibility=dos /dev/sdc
```

```
(...)
Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (62-31116288, default 62):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (128-31116288, default 31116288):
Created a new partition 1 of type 'Linux'

Command (m for help): t
Selected partition 1
Hex code (type L to list all codes): 6
Changed type of partition 'Linux' to 'FAT16'.

Command (m for help): a
Partition number (1, default 1): 1
The bootable flag on partition 1 is enabled now.

Command (m for help): p
Disk /dev/sdc
Disklabel type: dos
Disk identifier

Device     Boot   Start     End  Sectors   Size Id Type
/dev/sdc1           62 31116288  31116288 984,9M 6 FAT16
```

Format a FAT partition (requires root permission):

```
sudo mkfs.fat -F 16 -n ZXTRES -s 128 /dev/sdc1
```

Keyboard

PS/2 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).

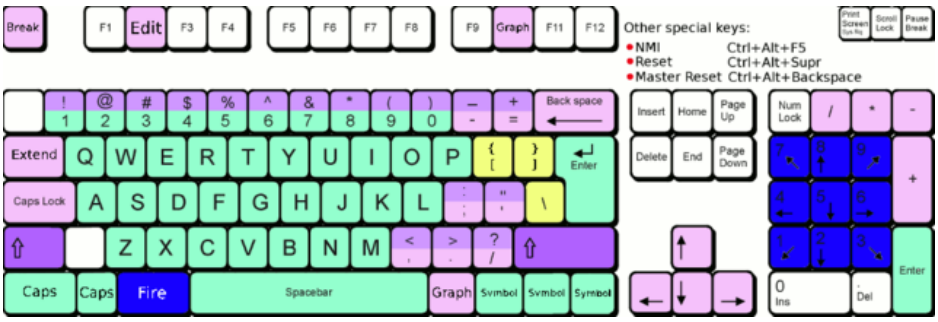
You can also change it using the `keymap` utility. Inside `/bin` you can create a folder called `keymaps` and copy the keyboard map files that you want to use inside it. For example to switch to the US map, enter `.keymap us` from esxDOS.

For the map to be preserved after a hard reset it must be selected as `Default` in the BIOS.

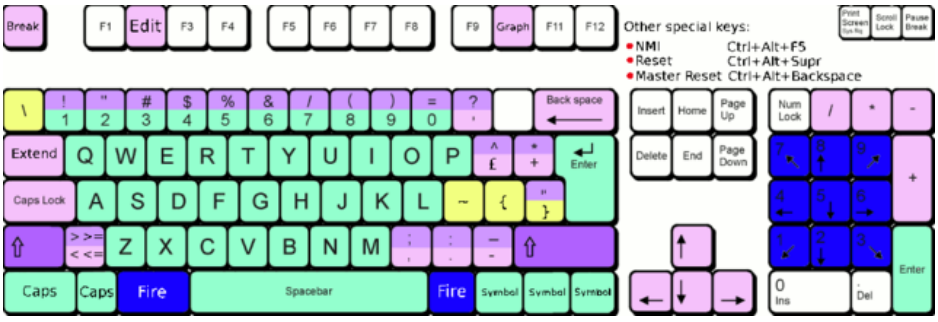
For more information see this message in the ZX-Uno forum.

Note, SE Basic IV uses its own native system to set the keyboard map and has its own layouts.

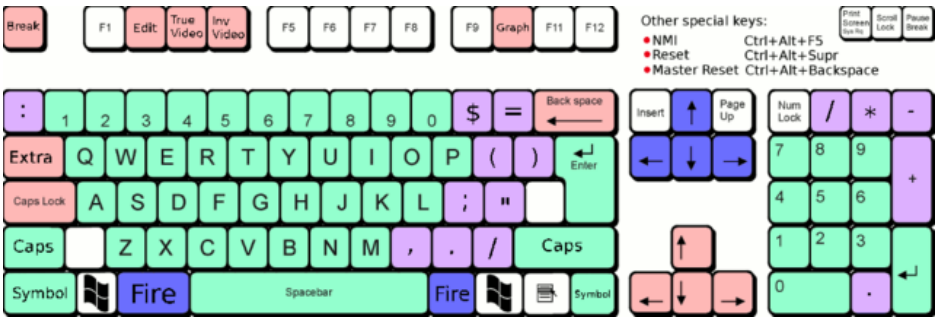
English



Spanish



Spectrum



Special keys and buttons

Special keys that can be used during startup:

- `Esc` or controller button `B` (if a controller with two or more buttons is connected): ZX Spectrum core ROM selection menu.
- `F2`: Enter BIOS setup.
- `1` to `9`: Load the core in the flash location corresponding to that number. On the latest BIOS versions `9` is used to load the core installed to the temporary slot used by the ZX3 plugin.
- `R`: Load the ZX Spectrum core ROM in "real" mode; switching off esxDOS, new graphics modes and so on.
- `Caps Lock`, `Cursor Down` or controller `down` (if connected): Core selection menu.

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

- `Esc`: Break.
- `F2`: Edit.
- `F5`: NMI.
- `F7`: Play or pause when playing `PZX` files.
- `F8`: Rewind a `PZX` file to the previous mark.
- `F10`: Graph(ics).
- `F12`: Turbo boost (speeds up CPU to 28MHz).
- `Ctrl+Alt+Backspace`: Hard reset. Backspace is the delete key located in the top-right portion of the keyboard above `Enter`.
- `Ctrl+Alt+Supr`: Soft reset.
- `Scroll Lock`: Switches between RGB and VGA video modes. DisplayPort is always enabled.
- `Home`: Switches between the several DisplayPort deinterlacing modes (Blend Off Auto and On). This option is only available for ZXTRES+ and ZXTRES++ core versions.
- `End`: Select one of the monochrome colour modes.

esxDOS

esxDOS is a firmware for the divIDE/divMMC hardware interfaces (that ZXTRES implements). This enables 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 dot (`.`) for example `.ls`, `.cd`, `.mv` and so on.

For it to work it's 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 ZXTRES is 0.8.9 and it can be downloaded from the official website.

After you've downloaded and extracted the `ZIP` archive, you must copy the folders `BIN`, `SYS` and `TMP` and all their contents to the root of first partition of the microSD card.

If everything was done correctly, when you start the ZX Spectrum core you'll see esxDOS detect the microSD card and load the required components to work.

You should add the ZXTRES-specific esxDOS commands. These can be obtained from the project source page (here, here and here):

```
back16m
backzx2
backzxd
corebios
dmaplayw
esprst
iwconfig
joyconf
keymap
loadpzx
loadtap
playmid
playrmov
romsupgr
upgr16m
upgrzx2
upgrzxd
zxuc
zxunocfg
```

It's explained later what each of these commands does.

BIOS

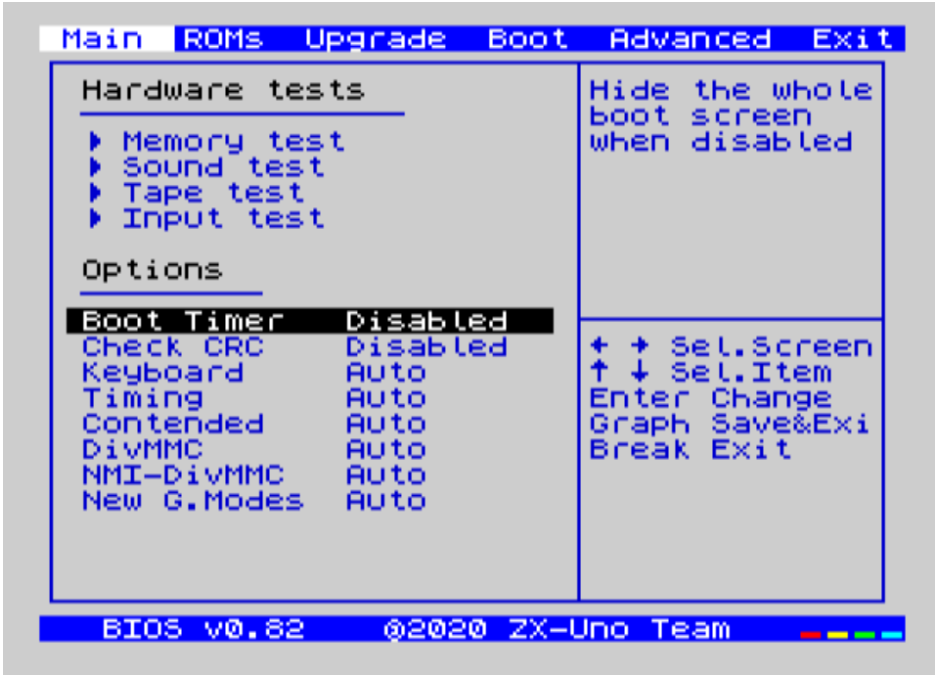
Press the F2 key during boot to access the BIOS setup. The BIOS firmware is the first program that runs when the ZXTRES is powered on. The main purpose of BIOS is to start and test the hardware and load one of the installed cores.

Using left and right cursor keys you can navigate through the BIOS setup screens. With up and down keys you can choose the different elements of each screen. With the Enter key you can activate and choose the options for each of these. The Esc key is used to close open option windows without applying any action.

Other special keys that can be used during startup:

- Esc or controller button B (if a controller with two or more buttons is connected): ZX Spectrum core ROM selection menu.
- F2 Enter BIOS setup.
- 1 to 9: Load the core in the flash location corresponding to that number. On the latest BIOS versions 9 is used to load the core installed to the temporary slot used by the ZX3 plugin.
- Caps Lock or Cursor down or controller down (if connected): Core selection menu.
- R: Load the ZX Spectrum core ROM in "real" mode, switching off esxDOS, new graphics modes and so on.

Main

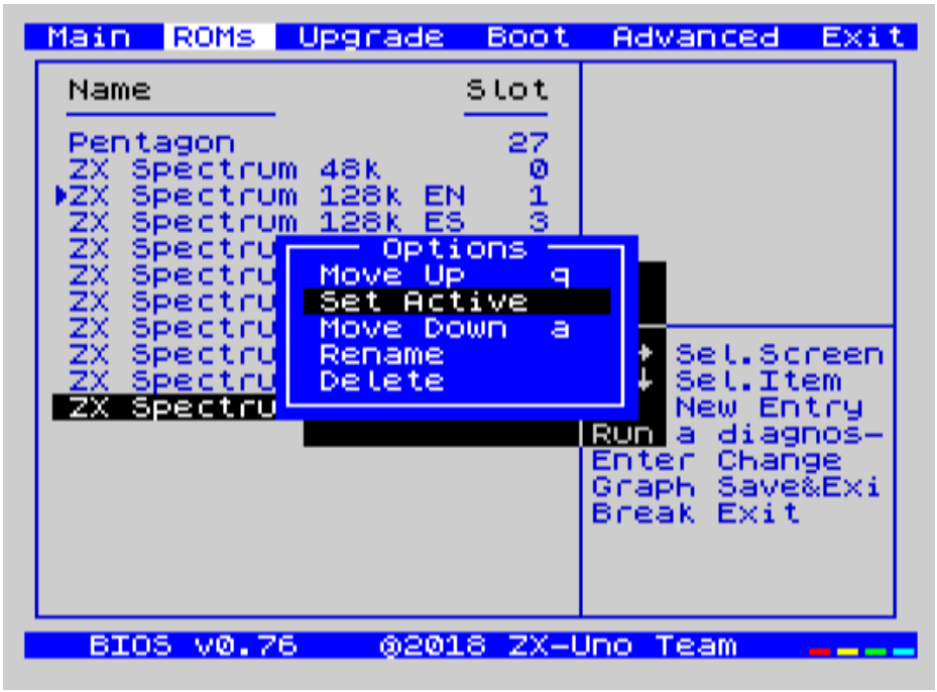


From the *Main* screen you can run several tests and define the default behaviour for:

- 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: Set keyboard map.
- Timing: ULA Behaviour (48K, 128K or Pentagon).
- Contended: Set lower RAM contention (on or off).
- DivMMC: Enable or switch of divMMC.
- NMI-DivMMC: Enable or swtich off divMMC NMI support (used by the NMI browser).
- New Graphic Modes: (ULAplus, Timex, Radastan).

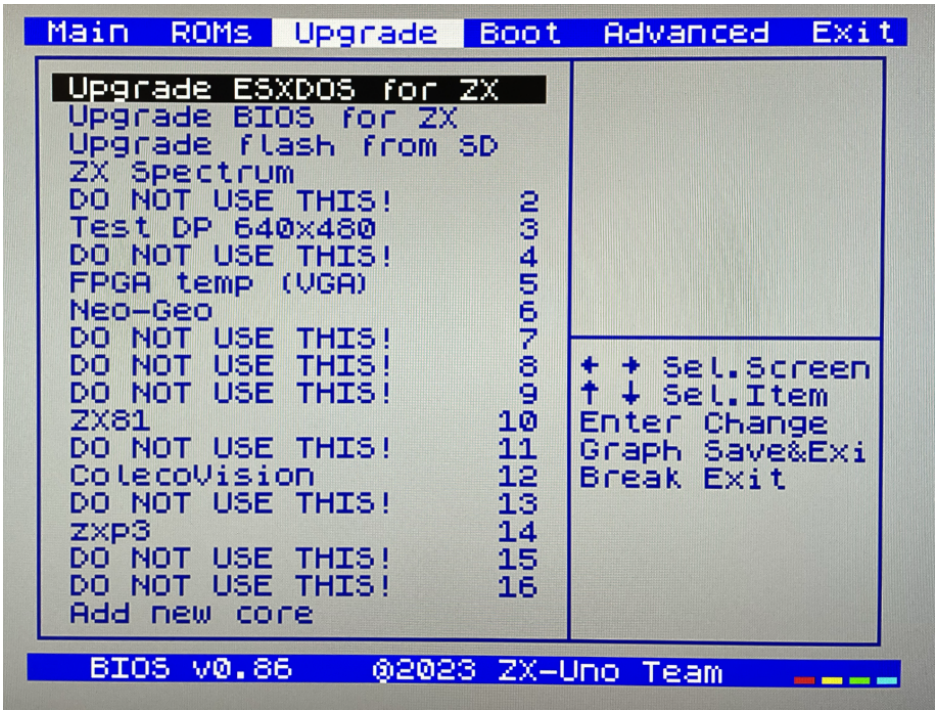
More technical information can be found at the ZX-Uno Wiki.

ROMs



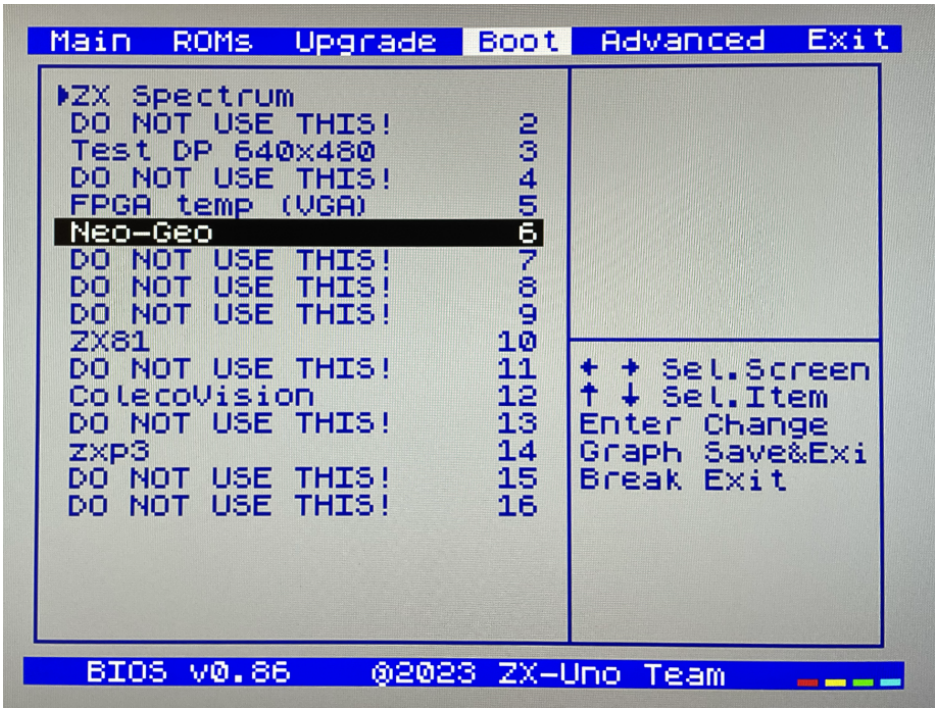
The *ROMs* screen shows the installed ZX Spectrum core ROMs. You can reorder (move up or move down), rename or remove each of them. You can also choose the one that is loaded by default at startup (Set Active).

Upgrade



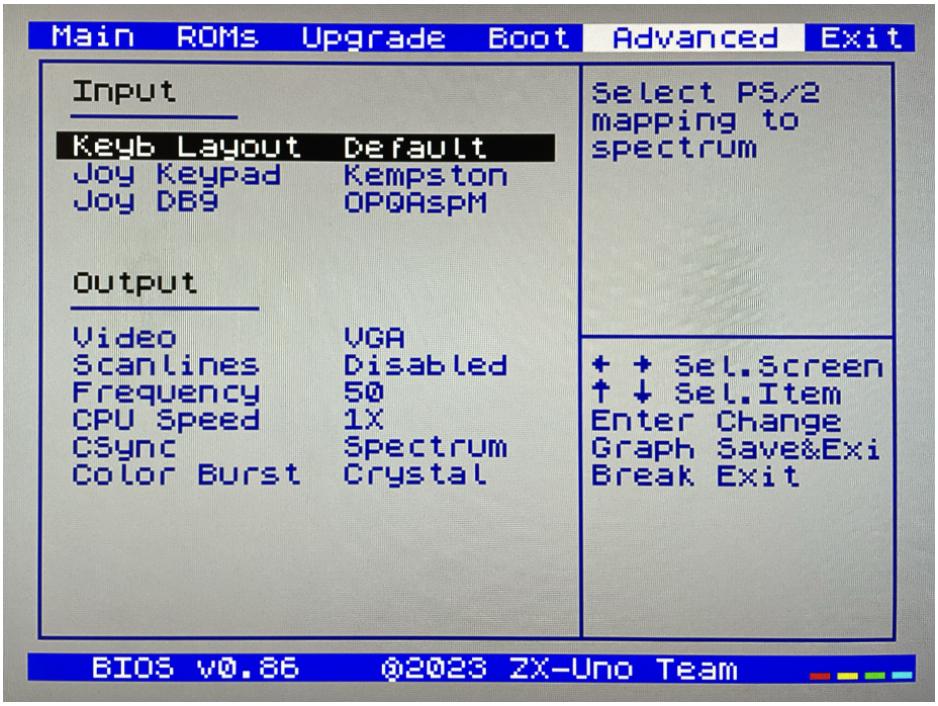
The *Upgrade* screen is used to perform updates to the Flash memory content; esxDOS, BIOS, cores and so on. For more information, see the section corresponding to upgrades.

Boot



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

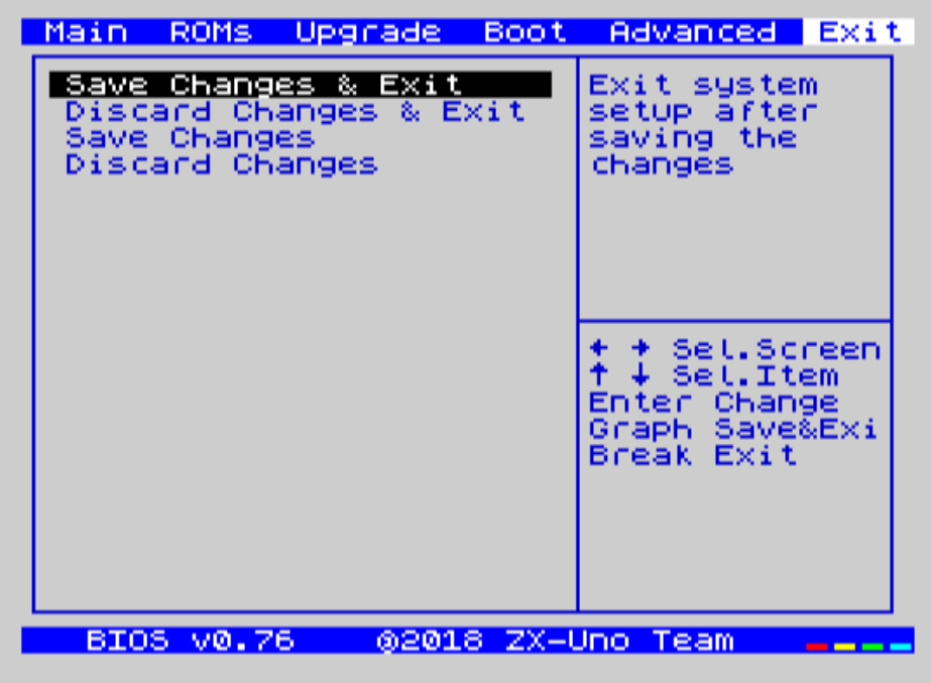
Advanced



From the *Advanced* screen you can configure:

- Keyboard layout (Keyb Layout): For more informaiton, see the corresponding section.
- Controller behaviour connected to the right port (DE9) and also the emulated controller using the numeric keypad (Joy Keypad): Kempston, Sinclair 1, Sinclair 2, Protek, Fuller or simulate the keys `Q`,` A` `O`,` P` `Space` and `M`.
- behaviour of a controller connected to the left port (DE9): Kempston, Sinclair 1, Sinclair 2, Protek, Fuller or simulate the keys `Q`,` A` `O`,` P` `Space` and `M`.
- Video output: PAL, NTSC or VGA (DisplayPort is always active).
- Scanline simulation: enabled or switched off.
- VGA horizontal frequency: 50, 51 and so on.
- CPU speed: Normal (1X) or accelerated (2X, 3X and so on).
- Csync: Spectrum or PAL.

Exit



From the *Exit* screen you can:

- Exit BIOS configuration saving changes (in some cases a power cycle is also required).
- 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 can't be replaced with another that's not a ZX Spectrum because the ZXTRES uses it for its operation.

Some of its main characteristics include:

- ZX Spectrum 48K, 128K, +3, Pentagon and Chloe 280SE implementation.
- ULA with ULAplus, Timex and Radastanian modes (including hardware scroll and selectable palette group).
- Memory contention select (for Pentagon 128 compatibility).
- Keyboard behaviour select (issue 2 or issue 3).
- ULA timing select (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 EX banks in RAM.
- Programmable raster interrupt on any TV line.
- Memory bank management register select for better compatibility with each implemented model.
- Activate or deactivate the devices incorporated into the core to improve compatibility with certain programs.
- ZXMMC and divMMC support for +3e, esxDOS and compatible firmwares (such as UnoDOS 3).
- TurboSound-AY support.
- SpecDrum support.
- Each channel (A, B and C) of the two AY-3-8912, beeper and SpecDrum chips can be directed to the left, right, both or neither outputs enabling the implementation of configurations such as ACB, ABC and so on.
- Real controller and keyboard-emulated controller support with Kempston, Sinclair 1 and 2, Cursor, Fuller and QAOPSpcM protocol.
- Turbo mode support at 7MHz, 14MHz and 28MHz.
- Keyboard support (PS/2 protocol) and user-configurable mapping from within the ZX Spectrum core itself.
- PS/2 mouse support emulating the Kempston Mouse protocol.
- Video output in RGB 15kHz, VGA and DisplayPort.
- User selectable vertical refresh rate to improve compatibility with VGA monitors.
- Multicore boot support: from the ZX Spectrum core you can select an address of the SPI Flash and the FPGA will load a core from there.
- Different colour modes including monochrome.
- I^2S and DeltaSigma audio output.

- MIDI Support (General MIDI) using the middleboard.
- `PZX` file loading from microSD card emulating tape audio.
- Multiple deinterlacing modes for DisplayPort including an option to blend the colours. This is only available for ZXTRES+ and ZXTRES++ core versions.

ROMs

The ZX Spectrum core can be initialized using different ROM versions (48K, 128K, +2 and so on). These are stored in the flash memory of the ZXTRES 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.

For more information on how to expand or modify the ROMs stored in flash memory, see the updates section.

DerbyPro

DerbyPro or Derby++ is an enhanced firmware ROM for the ZX Spectrum based on v1.4 of the Derby development ROM. The Spectrum 128 (codename "Derby") was a Spanish machine commissioned by Investronica and launched in 1985. It came with a keypad that provided additional editing keys. In 1986 the UK version came out with a simplified version of 128 BASIC and no keypad. Derby++ is developed from the Spanish ROM to include the benefits of both versions without the drawbacks and support for new hardware developments.

Features include:

- 100% binary compatible 48K mode.
- 6-channel PLAY commmand.
- Access the esxDOS NMI browser from the boot menu.
- Debugged 128 BASIC with additinoal commands and full scren string editor.
- esxDOS support in 128 BASIC.
- Menu access to TR-DOS.
- PALETTE command for ULAplus.
- Run most Spectrum software without the need to switch configuration in the BIOS.

You can download the ROM, a user manual and other files from the official Facebook Public Group.

Because it's a 64K ROM with support for new hardware these flags can be used when adding it to the SPI flash:

Flag	Meaning
`d`	Enable divMMC
`n`	Enable NMI divMMC (esxDOS Menu)
`t`	Use 128K timings

CargandoLeches

CargandoLeches is a set of ZX Spectrum ROMs that started as a project to load games in any Spectrum model 15 to 20 times faster. No tape is needed but a digital audio source such as a computer, mobile device, MP3 player and so on is required. The new ROM detects the loading method and reverts to the original ROM code if required. This is handled transparently with no user or program intervention.

From version 2.0 the project changed from a single ROM to more; each one with different options. This way you can choose a different mix of options that may include:

- Enable or switch off Sinclair BASIC token expansion.
- POKE editor.
- Reset & Play (After a sofware reset of the core the system is ready to load from tape).
- Ultrafast loading.

The whole ROM set is available to download from the repository in GitHub here.

Depending on which ROM you choose the flags when adding to the SPI flash may vary. For example, for the ROM `48le_ea_re_po` (with all features enabled) these flags can be used (you can't enable NMI-DivMMC because the POKE editor uses the NMI):

Flag	Meaning
`d`	Enable divMMC
`h`	Switch off ROM high bit (1FFD bit 2)
`l`	Switch off ROM low bit (7FFD bit 4)
`x`	Switch off Timex mode

POKEs

When using a ROM with POKE option enabled:

1. After the game is loaded, press `F5` (NMI button). A dialog is displayed in the upper left corner of the screen
2. Enter the POKE address and press `Enter`.
3. Enter the POKE value and press `Enter` again.
4. Repeat steps 2 and 3 until all desired POKEs are entered. To finish and return to the game press `Enter` twice.

Preparing ultrafast loading tapes

The ROMs with ultrafast loading enabled need special tape audio data that is made from normal loading TAP files without protections or turbo loading.

To create an ultrafast loading tape you need the leches and CgLeches command line utilities. Those can be obtained for Windows from the official repository. You can also obtain an unofficial version for macOS from this other repository.

Otherwise you can compile from the source code at the official repository. For example, in Linux to compile using gcc you only need these commands:

```
gcc leches.c -o leches
gcc CgLeches.c -o CgLeches
```

To create an ultrafast loading tape you must use the CgLeches command from a terminal giving at least the path to the original TAP file and the new file to create (WAV or TZX). There are also some other optional parameters such as the loading speed between 0 and 7 (where 0 is fastest but also more incompatible), if you want to create a mono or stereo file (when making a WAV) and more.

To make a WAV file with an ultrafast loading tape from the file Valley.tap with loading speed 5 you could enter:

```
(...) CgLeches Valley.tap Valley.wav 5
```

This way the file Valley.wav can be played from a computer or another device and load using the ROM (see the section about loading from tape for more info).

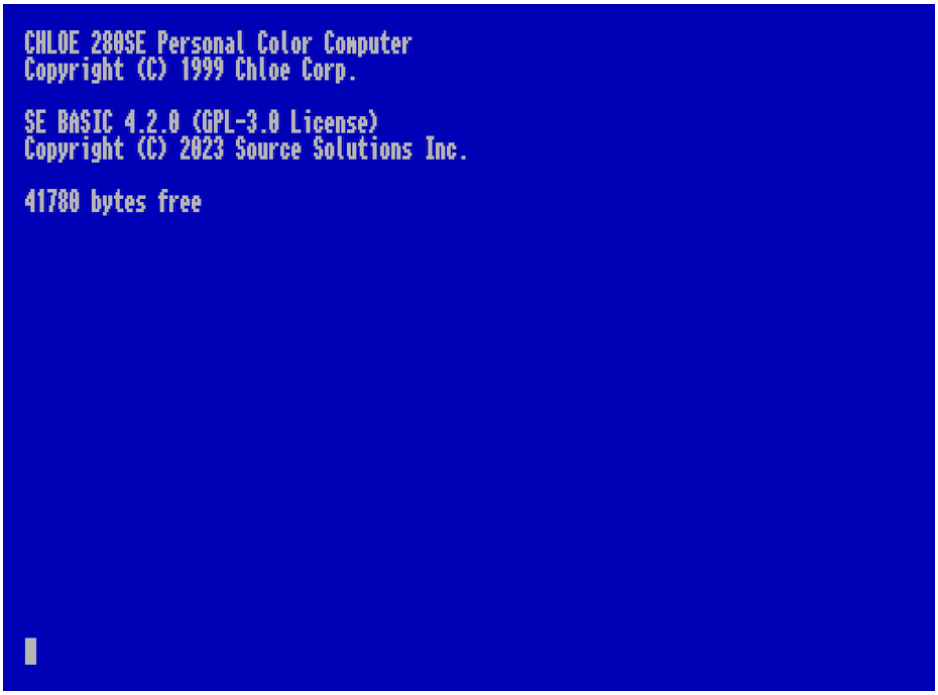
Due to hardware limitations, TZX files made with CgLeches don't work with a Miniduino although they usually work with PlayTZX.

SE Basic IV

SE Basic IV is a free open-source BASIC interpreter for the Z80 architecture. Although it aims for a high degree of compatibility with Microsoft BASIC, there are some differences. It's designed to run on the Chloe 280SE but it's also compatible with the ZX Spectrum core of the ZXTRES.

SE BASIC began developement in 1999 as the firmware for the ZX Spectrum SE, the ancestor of the Chloe 280SE. Early versions were patches applied to the original Spectrum ROM. From version 1, it used its own assembly file. From version 2, it added support for ULAplus.

Version 3 (OpenSE BASIC) replaced the original ROM code with an open source version derived from the ZX81 and SAM Coupé ROMs. It's still maintained as an open source replacement firmware for the Spectrum, and is inlcuded in the main Debian repository for use with emulators.



Version 4.0 added support for 80 column mode. Version 4.1 was an unsuccessful attempt to refactor the code. Starting in 2019, the latest version (4.2 Cordelia) was rebuilt from the ground up to take full advantage of the ZX Spectrum core of the ZX-Uno (and ZXTRES). While earlier versions retained a high level of compatiblity with Sinclair BASIC and software, this version has no support for Sinclair software and is closer in dialect to Atari BASIC.

Version 4.2 requires that divMMC support is enabled with esxDOS or UnoDOS 3 installed. However, "dot" commands and the NMI browser are not supported.

Features include:

- 40 column (16 colour) and 80 column (2 colour) paletted video modes.
- Always-on expression evaluation (use variables as filenames).
- Application package format with support for turning BASIC programs into apps.
- Automatic data typing.
- Bitwise logic (AND, NOT, OR, XOR).
- Built-in help system.
- Choice of Microsoft (LEFT$, MID$, RIGHT$) or Sinclair (TO) string slicing.
- Composable characters (supports Vietnamese).
- Disk-based filesystem (no tapes).
- Error handling (ON ERROR…, TRACE).
- Flow control (IF…THEN…ELSE, WHILE…WEND).
- Full random file access from BASIC (OPEN, CLOSE, SEEK).
- Full-size keyboard support (DEL, HOME, END and so on).
- Graphics commands in 40 column mode (CIRCLE, DRAW, PLOT).
- Localisation of character sets, error messages, and keyboard layouts.
- Long variable names.
- Motorola style number entry (%; binary, @; octal, $; hexadecimal).
- NMI BREAK.
- On-entry syntax checking.
- PLAY command with 6-channel PSG and MIDI support.
- Recursive user-defined functions.
- Smart firmware updates.
- Token abbreviation and shortcuts (&; AND, ~; NOT; |; OR, ?; PRINT, '; REM').
- Undo NEW (OLD).
- User-defined channels.
- User-defined character sets (256 characters).
- User-defined macros.
- User-defined screen modes.

For the smart firmware update option to work, SE Basic IV must be installed in the second and third 16K ROM slots.

Using the smart firmware update feature replaces the version of esxDOS you're using with the latest version of UnoDOS 3.

Other ROMs

Here are flag settings that work when adding to the SPI flash some other known custom ROMs:

ROM Name	Flags
Arcade Game Designer 0.1	thl17x
Gosh Wonderful ROM v1.33	dnhl17x
Looking Glass 1.07	dnhl17x
ZX82 by Daniel A. Nagy	dnhl17
ZX85 by Daniel A. Nagy	dntmh1

microSD advanced format (+3e)

The ZX Spectrum +3e ROM can be used with the ZX Spectrum core. This is an improved Sinclair ZX Spectrum +3 ROM that can use microSD cards and other media.

The +3e uses its own partition format (called IDEDOS) to split the hard disk into several partitions to store data. ROM version 1.28 and later can share IDEDOS partitions with MBR partitions. Otherwise you must reserve the whole microSD card for the IDEDOS partitions.

This partition scheme can only be used with the ZX Spectrum core.

Each partition in IDEDOS can be between 1 and 16MB (16 million bytes) in size and each disk can have between 1 and 65535 partitions. This means that the maximum space used in a microSD card is about 1TB.

This is one method to split a microSD card into two or three parts with the first partition IDEDOS (1GB) the second one FAT16 (4GB) and the third one FAT32 (using the remaining space in the microSD card).

exsDOS and other programs can be installed into the second partition as explained earlier.

Windows

You can use Windows Disk Management utility. The steps are:

1. Remove all partitions from the microSD card.
2. Create a new extended partition using the desired space for IDEDOS.
3. Create a primary partition 4GB in size and format as FAT16.
4. Optionally create another primary partition using the remaining space and format as FAT32.

macOS

You need to use the command line. The first task is to find out which device is the disk to format:

```
diskutil list
```

For this example it's disk 6:

```
(...)
/dev/disk6 (external, physical):
   #:                       TYPE NAME                    SIZE       IDENTIFIER
   0:     FDisk_partition_scheme                        *15.9 GB    disk6
   1:                 DOS_FAT_32 UNKNOWN                 15.9 GB    disk6s1
```

Instruction steps:

1. Unmount the disk and edit the partition sceme (the second step requires admin privileges):

```
diskutil unmountDisk /dev/disk6
sudo fdisk -e /dev/rdisk6
```

```
fdisk: could not open MBR file /usr/standalone/i386/boot0: No such file or directory
Enter 'help' for information
fdisk: 1> erase
fdisk:*1> edit 1
Partition id ('0' to switch off)  [0 - FF]: [0] (? for help) 7F
Do you wish to edit in CHS mode? [n]
Partition offset [0 - 31116288]: [63] 128
Partition size [1 - 31116287]: [31116287] 2017152

fdisk:*1> edit 2
Partition id ('0' to switch off)  [0 - FF]: [0] (? for help) 06
Do you wish to edit in CHS mode? [n]
Partition offset [0 - 31116288]: [2017280]
Partition size [1 - 29099135]: [29099135] 7812504

fdisk:*1> flag 2
```

```
fdisk:*1> edit 3
Partition id ('0' to switch off)  [0 - FF]: [0] (? for help) 0B
Do you wish to edit in CHS mode? [n]
Partition offset [0 - 31116288]: [9829784]
Partition size [1 - 21286504]: [21286504]

fdisk:*1> print
         Starting       Ending
```

```
 #: id  cyl  hd sec -  cyl  hd sec [     start -       size]
------------------------------------------------------------------------
 1: 7F 1023 254  63 - 1023 254  63 [       128 -    2017152] <Unknown ID>
 2: 06 1023 254  63 - 1023 254  63 [   2017280 -    7812504] DOS > 32MB
 3: 0B 1023 254  63 - 1023 254  63 [   9829784 -   21286504] Win95 FAT-32
 4: 00    0   0   0 -    0   0   0 [         0 -          0] unused

fdisk:*1> write
fdisk: 1> quit
```

2. Format the FAT partitions (admin privileges required):

```
diskutil unmountDisk /dev/disk6
sudo newfs_msdos -F 16 -v ZXTRES -c 128 /dev/rdisk6s2
sudo newfs_msdos -F 32 -v EXTRA -c 128 /dev/rdisk6s3
```

3. Confirm that the new partition scheme was applied:

```
diskutil list
```

```
(...)
/dev/disk6 (external, physical):
   #:                       TYPE NAME                    SIZE       IDENTIFIER
   0:     FDisk_partition_scheme                        *15.9 GB    disk6
   1:                       0x7F                          1.0 GB     disk6s1
   2:                 DOS_FAT_16 ZXTRES                4.0 GB     disk6s2
   3:                 DOS_FAT_32 EXTRA                    10.9 GB    disk6s3
```

Linux

You can use the command line. First find out the device to erase:

```
lsblk
```

For this example it's sdc:

```
NAME         MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
(..)
sdc          179:0    0 15,8G  0 disk
└──sdc1       179:1    0 15,8G  0 part
```

Instructions:

1. Verify that the disk isn't mounted and edit the partition scheme (this step requires root privileges):

```
sudo fdisk --compatibility=dos /dev/sdc
```

```
Welcome to fdisk
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (62-31116288, default 62): 128
Last sector, +/-sectors or +/-size{K,M,G,T,P} (128-31116288, default 31116288):
2017152

Created a new partition 1 of type 'Linux'

Command (m for help): t
Selected partition 1
Hex code (type L to list all codes): 7f
Changed type of partition 'Linux' to 'unknown'.

Command (m for help): n
Partition type
   p   primary (1 primary, 0 extended, 3 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (2-4, default 2):
```

```
First sector (45-31116288, default 45): 2017280     .
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2017153-31116288, default 31116288):
7812504

Created a new partition 2 of type 'Linux'

Command (m for help): t
Partition number (1,2, default 2): 2
Hex code (type L to list all codes): 6

Changed type of partition 'Linux' to 'FAT16'.

Command (m for help): a
Partition number (1,2, default 2): 2

The bootable flag on partition 2 is enabled now.

Command (m for help): n
Partition type
   p   primary (2 primary, 0 extended, 2 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (3-4, default 3): 3
First sector (45-31116288, default 45): 9829784     .
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2017153-31116288, default 31116288):
31116288

Created a new partition 3 of type 'Linux'

Command (m for help): t
Partition number (1-4, default 3): 3
Hex code (type L to list all codes): b

Changed type of partition 'Linux' to 'W95 FAT32'.

Command (m for help): p
Disk /dev/sdc
Disklabel type: dos
Disk identifier

Device     Boot   Start     End  Sectors   Size Id Type
/dev/sdc1            128 2017152  2017025 984,9M 7f unknown
/dev/sdc2  *    2017280 7626751  7812504   2,7G  b FAT16
/dev/sdc3       9829784 7626751 21286504    21G  b W95 FAT32
```

2. Format both FAT partitions (requires root privileges):

```
sudo mkfs.fat -F 16 -n ZXTRES -s 128 /dev/sdc2
sudo mkfs.fat -F 32 -n EXTRA -s 128 /dev/sdc3
```

3. Confirm that the partition scheme was changed:

```
lsblk
```

```
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
(...)
sda       179:0    0 15,8G  0 disk
 ├──sda1   179:1    0    1G  0 part
 ├──sda2   179:2    0    4G  0 part
 ├──sda3   179:3    0 10,8G  0 part
```

+3e

After the microSD card is ready to use you can start the ZX Spectrum core with a +3e ROM and format the IDEDOS part.

The first step is determine the disk geometry. With the microSD card inserted into the ZXTRES enter the command:

```
CAT TAB
```

This gives a result showing the number of cylinders heads and sectors.

With this information you estimate the size of your partition using cylinders. For example, if the number of cylinders is 32768 and you want to use 1GB of a 16GB microSD card, the number of cylinders needed would be 32768/16=2048. This way the IDEDOS partition can be formatted using that number:

```
FORMAT TO 0,100,2048
```

The first value (0) is the drive to use (the first one). The second value is the maximum number of IDEDOS partitions. The third one is the number of cylinders to use.

After formatting, you can create new partitions. For example, to create a 16MB partition called "Software", a 4GB partition called "Swap" (to use as swap disk) and an 8MB partition called "Utils":

```
NEW DATA "Software",16
NEW EXP "Swap1",4
NEW DATA "Utils",8
```

For more information about the different +3e disk commands refer to this page at World of Spectrum.

esxDOS commands

Overview

There are two different kind of esxDOS commands: the so-called "dot" commands that, as the name suggests, begin with a dot (`.`), and extensions to existing BASIC commands.

The main "dot" commands are:

- `128`: Enter 128 mode from within 48 mode.
- `cd`: Change current working folder.
- `chmod`: Change file attributes.
- `cp`: Copy a file.
- `divideo`: Play a divIDEo (`DVO`) video file (divIDE only).
- `drives`: Show currently available drives.
- `dskprobe`: Utility that shows low level content of an storage device.
- `dumpmem`: Can dump RAM memory content to a file.
- `file`: Tries to recognise the type of data contained in a file (like the UNIX command).
- `gramon`: Monitor to search graphics sprites fonts and so on 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 folder.
- `lstap`: Show the content of a `TAP` file.
- `mkdir`: Create a folder.
- `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 folder.
- `snapload`: Load snapshot file.
- `speakcz`: Read 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 (after all 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 or folder (for example: `GO TO hd1` or `GO TO hd0"GAMES"`).
- `CAT` to show the content of a drive.
- `LOAD` to lad a file from a drive (BASIC Program SCREEN CODE and so on for example `LOAD *"Screen.scr" SCREEN$`).
- `SAVE` to save data in a file (for example, `SAVE *"PROGRAM.BAS"`).
- `ERASE` to remove a file.

In addition esxDOS supports an NMI browser that loads when the NMI is activated (`F5` is pressed). This enables you to browse the microSD card and easily load files (`TAP`, `Z80`, `TRD` and so on). In the default NMI browser, pressing the `H` key invokes a help screen that shows all available key commands.

The NMI browser shows file and folder entries in the order stored in the internal FAT table and not alphabetically. If you want to see them ordered you must reorder the microSD card structure with a utility such as FATsort, YAFS, SDSorter or another application.

Don't use any FAT reordering utility if the microSD card is also being used with a PC XT core because it may stop DOS from booting.

ZXTRES Commands

As noted in the installation section, there are a several "dot" commands that are exclusive to the ZXTRES:

- `back16m`: Dumps to a `FLASH.ZX1` file in the root folder of the microSD card the contents of a 16 Meg SPI Flash memory. After the command is done, you must enter `.ls` so that the cache is written to the microSD card. Otherwise the length of the file is wrongly set to 0.
- `backzx2` or `backzxd`: Creates a `FLASH_32.ZX2` or `FLASH_32.ZXD` file in the root folder of the microSD card with the contents of a 32 Meg SPI Flash memory. After the command is done, you must enter `.ls` so that the cache is wrtten to the microSD card. Otherwise the length of the file is wrongly set to 0.
- `corebios`: Simultaneously update the ZX Spectrum core and BIOS.
- `dmaplayw`: Play a `WAV` file that is 8-bits unsigned and sampled at 15625 Hz.
- `esprst`: Reset the WiFi ESP8266(ESP-12) module.
- `iwconfig`: Configure the WiFi module.
- `joyconf`: Configure and test for keyboard and DE9 controllers.
- `keymap`: Load a different keyboard map definition.
- `loadpzx`: Load a `PZX` tape file.
- `loadtap`: Load a `TAP` file using the `PZX` integration.
- `playmid`: Play a `MID` music files using the MIDI addon.
- `playrmov`: Play radastanian format video files `RDM`). This command doesn't work in 48K mode.
- `romsupgr`: Load from a RomPack filel called `ROMS.ZX1` in the root folder of the microSD card all ZX Spectrum core ROMS into SPI flash memory.
- `upgr16m`: Load the content of a `FLASH.ZX1` file in the root folder of the microSD card to a 16 Meg SPI Flash memory.
- `upgrzx2` or `upgrzxd`: Write the content of a `FLASH_32.ZX2` or `FLASH_32.ZXD` file in the root folder of the microSD card to a 32 Meg SPI Flash memory.
- `zxuc`: Configure all options of BIOS that also can be stored in the microSD in configuration files that can be loaded later.
- `zxunocfg`: Configurae certain features such as timings contention keyboard type CPU speed video type or vertical frequency.

The `romsback` command is designed for the ZX-Uno and ZX-Dos and must not be used with the ZXTRES.

Creating RaDastanian movie files

The `playrmov` "dot" command plays Radastanian format (`RDM`) video files. To convert your own videos you need `makevideoradas`, a utility that's available at this SVN repository.

If you're using Windows there's already an executable file (`makevideoras.exe`). For Linux or macOS you must have the command line developer utilities installed to compile an executable.

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

Apart from `makevdideoradas` you need another two tools: `ffmpeg` and `imagemagick`. These can be installed with a package manager (`apt yum pacmam brew` and so on) or downloading the source code and compiling.

The first step to convert your video (for example `myvideo.mp4`) is exporting the frames as 128x96 pixel BMP image files. You can 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 you can transform the `BMP` files to 16 colours (v3) `BMP` files.

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

Last you can assemble the `RDM` file (in this example `myvideo.rdm`) and cleanup the temporary files and folder.

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

For more information about this process refer to this thread in Zona de Pruebas forums.

Upgrade

BIOS

To update the BIOS, a file called `FIRMWARE.ZX3` must be obtained. The latest version of the firmware files can be downloaded from the official repository.

Updating the firmware (BIOS) is delicate. It shouldn't be done if it's not necessary. When doing so, ensure that the ZXTRES has uninterrupted power (such as a UPS or a laptop USB with battery).

Copy the file to the root of the microSD card, power on and press `F2` to enter BIOS. Select `Upgrade`. Choose *"Upgrade BIOS for ZX"* and then *"SDfile"*. The system reads the file `FIRMWARE···` and notifies you when it's done.

ROMs

The flash memory of a ZXTRES has 64 reserved slots of 16K each to store ZX Spectrum core ROM images. Thus an original ZX Spectrum ROM (16K) uses one slot, a ZX Spectrum 128 ROM (32K) uses two slots and a ZX Spectrum +3 ROM (64K) uses four slots.

You can add a new ROM pressing the key `N` at the BIOS ROMs screen, connecting an audio cable to the board and loading a ROM from an audio player. ROM audio tapes can be made from a `TAP` file built with the `GenRom` utility available at the ZX-Uno Code Repository.

To update all ROMs installed for the ZX Spectrum core in one go, a RomPack file called `ROMS.ZX1` must be obtained that must be copied to the microSD card. Boot the ZXTRES and then enter `.romsupgr`. This overwrites the existing set of ROMs with those contained in the file.

Currently, `romsupgr` only works correctly with RomPack files containing a maximum of 35 slots.

RomPack files can be easily edited with the ZX1RomPack utility. Although it's a Windows program it works perfectly for example using Wine or similar programs either on Linux and macOS versions with 32-bit Intel support..

Cores

A core is a file with the information needed to configure the FPGA to behave like a specific system (ZX Spectrum and so on). In the ZXTRES this file can be loaded from several different places: the SPI Flash memory, a microSD card or from an external device (PC and so on) using a special cable.

microSD card

Loading from the ZX Spectrum core

From the main ZX Spectrum core it's possible to load other cores.

Bob Fossil NMI browser

To use the Bob Fossil NMI browser to load cores you need:

- The latest stable version (http://www.thefossilrecord.co.uk/wp-content/uploads/zx/BROWSE_latest.zip).
- The ZX3 plugin that can load Cores in ZX3 format https://github.com/zxdos/zxuno/blob/master/SD/BIN/BPLUGINS/ZX3.

Copy the corresponding `ZX3` file to the desired location of the microSD card as well as the appropriate ZX3 plugin (in the folder `BIN\BPLUGINS`).

Press `F5` to open Bob Fossil's NMI browser and get to the location of the Core with extension `ZX3`, select it and press `Enter`.

If everything worked correctly, the bottom of the screen indicates the flashing progress (it's recorded in a temporary slot of the flash memory).

SPI Flash Memory

There are 27 spaces where you can store cores, with the first spaces being reserved for the main ZX Spectrum (this doesn't prevent having more ZX Spectrum cores in other spaces as well of the first ones).

Official cores are available to download from GitHub repository.

To update or install a new core in the SPI Flash there are several possibilities.

The first options is to obtain the latest version of the files that define the core. If the space used is greater than 1179648 bytes it must be split accordingly into several files. Each of these pieces must be a file called `COREXXy.ZX3` where `XX` is *always* a two digit number. The `y` part of the name is ignored so you can use longer and more descriptive names (for example `CORE04_example_part1.ZX3`).

Copy the files to the root of the microSD card, power on and press `F2` to enter the BIOS. Choose `Upgrade`, select the row corresponding to the chosen core space (for example 4), press enter and then *" SD file "*. The system reads the file `COREnn ..` and notifies you when it's updated. However, first it asks for the name (to be shown in the list to choose from at startup and in the BIOS list). For cores using more than one space, typically the name of the core is only used for the first space and the remaining spaces are registered with some text warning not to use them. After it's installed you can use the core on boot by choosing the first space used by the core.

The main ZX Spectrum core update is exactly the same as other cores but for the first part instead of the name `CORE1.ZXX` it must be a file called `SPECTRUM.ZX3` with a special format.

esxDOS

To update esxDOS to a new version the distribution must be obtained from the official website.

After you've downloaded and extracted the `ZIP` archive, the contents of the `BIN` and `SYS` folders must be copied to the root of the microSD card partition merging with the existing ones (to preserve the exclusive ZXTRES commands).

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

Power on the ZXTRES with the microSD 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···` is read and written to the flash storage and you are notified when it's updated.

Do a hard reset or power cycle the ZXTRES.

If everything was done correctly, when you start the ZX Spectrum core you'll see esxDOS detect the microSD card and load the required components to work, showing the new version at the top.

Flash Memory

You also can update all 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 `UPGRZXD` command and a file called `FLASH.ZXD`.

Copy the image file (16MiB) `FLASH.ZX3` to the root of the microSD card.

Power on the ZXTRES and press the `F2` key 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 power cycle the ZXTRES.

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

Other cores

ColecoVision

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

The ZXTRES core is based on ZX-Uno version by Fabio Belavenuto.

Some characteristics 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

To store ROM image (games) and other files, use a microSD card with the first partition in FAT16 or FAT32 format.

They can be downloaded from the original project in GitHub.

After copying the files to the microSD card you must add also the file `MULTCART.ROM` that can be downloaded from https://t.me/zxtresfpga.

See the corresponding section for instructions of how to install the ColecoVision core in the ZXTRES.

Keyboard

Special keys and buttons

When the core is active:

- 'Esc': Soft reset.
- `0` to `9`: Button 0 to 9 for player 1 and player 2.
- Cursor or `Q`, `A`, `E`, `R` or left controller directions: Directional controls for player 1.
- `U`, `J`, `O`, `P` or right controller directions: Directional controls for player 2.
- `Z` or controller button `A`: Main fire button `1` for player 1.
- `M` or controller button `B`: Main fire button `1` for player 2.
- `X` or controller button `A`: Secondary fire button `1` for player 1 and player 2.
- `T`: Button '*'.
- `Y`: Button '#'.

Overview

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

From the multicart menu use the directional controls to choose a ROM and then push button `A` to load. Pressing 'Esc' restarts the core and reloads the ROM selection menu.

Neo-Geo

Neo-Geo is the name of a 16-bit cartridge-based system for arcade as well as home video game consoles released in 1990 by the Japanese video game company SNK. The Neo-Geo system was created as both a platform for arcade machines (MVS or Multi Video System) and as a home game console (AES or Advanced Entertainment System).

The ZXTRES version (by somhi) is based on the DeMiStified version of the original version for MiSTer FPGA.

Some core charactersistics are:

- Compatible with Sega Mega Drive (Genesis) controllers.
- MVS and AES support.
- RGB output only.
- Support for ROMS (not encrypted) in `NEO` format.
- Support for Universe BIOS.

microSD card format

To store the ROM image files, use a microSDcard with the first partition in FAT16 or FAT32 format.

After the files have been copied to the microSD card, you need a BIOS (for example Universe BIOS), with the name `neogeo.rom`, in the root.

If not already there, install or run the Neo-Geo core on the ZXTRES.

Keyboard

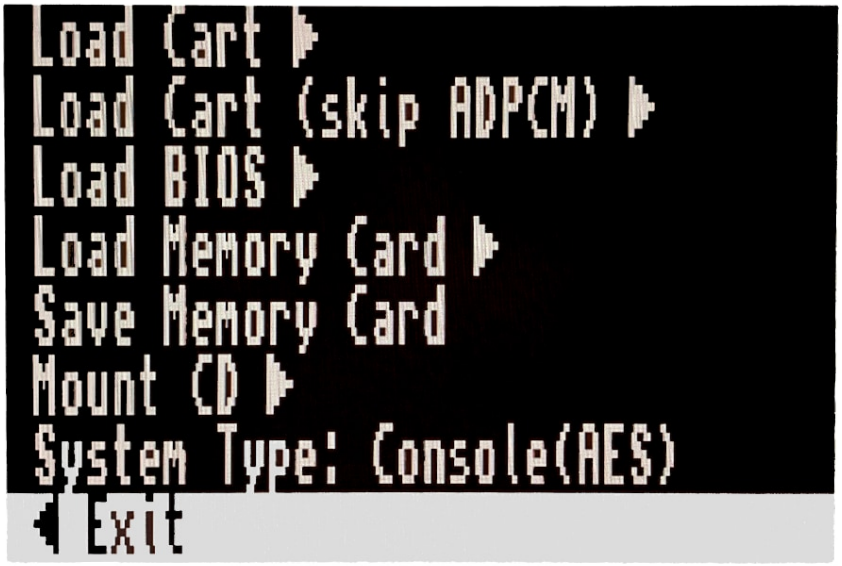
Special keys and buttons

When the core is active:

- `F12` displays the core control menu.
- Cursor or a controller connected to the left port: Player 1 direction controls.
- `Right Ctrl` or controller 1 button `A`: Player 1 button `A`.
- `Right Alt` or controller 1 button `B`: Player 1 button `B`.
- `Right Win` or controller 1 button `C`: Player 1's button C.
- `Right Shift` or controller 1 button `D`: Player 1's D button.
- `Start`: Start button of player 1.
- `W`, `A`, `S`, `D` or a controller connected to the right port: Player 2 Directional Controls.
- `Left Ctrl` or controller 2 button `A`: Player 2's A button.
- `Left Alt` or controller 2 button `B`: Player 2's B button.
- `Left Win` or controller 2 button `C`: Player 2's button C.
- `Left Shift` or controller 2 button `D`: Player's D button 2.
- `Caps Lock`: Start button of player 2.

Overview

When the correct files are present on the microSD card and the core is started, a blank screen is displayed. Press `F12` to display the menu with the different core options.



These are the main ones:

- `Load Cart`: To load from the microSD card a .neo file.
- `Load Cart (skip ADPCM)`.
- `Load BIOS`: To load from the microSD card a BIOS file other than `neogeo.rom`.
- `Load Memory Card`.
- `Save Memory Card`.
- `Mount CD`: Currently unavailable.
- `System Type`: MVS or AES
- `CD Speed`: Currently unavailable.
- `CD Region`: Currently unavailable.
- `CD lid`: Currently unavailable.
- `Video Mode`: NTSC or PAL.
- `Scanlines`: To add a scanline effect, if desired.
- `Blend`: To activate, if desired, an image smoothing effect.
- `Swap Joystick`: To swap the controls of player 1 and player 2.
- `Input`: Currently unavailable.
- `[DIP]`: Currently unavailable.
- `Exit`: Closes the menu.

Test DP

The purpose of this core is to test the VGA, RGB and DisplayPort video outputs by applying different effects.

Its main characteristics are:

- 15 kHz RGB video output (using the VGA port).
- DisplaPort video output.
- Monochrome green amber white and colour modes.
- Scanlines.
- VGA video output.

microSD card format

This core doesn't use the microSD card.

Keyboard

Special keys and buttons

When the core is active:

- 1: Changes the VGA output to RGB 15 kHz.
- 2: Toggles scanlines on or off.
- 3: Toggles the display between colour, monochrome, green, amber and white modes.

The previously mentioned effects with keys 2 and 3 are not visible on the original 15 kHz output.

Overview

When the core is started, it sends the video signal using both VGA and DisplayPort. The refresh rate is about 64 Hz.

The three LEDs on the ZXTRES board have these meanings:

- The one closest to the edge should be on all the time. This is the DONE LED and it's managed by the FPGA itself not the core.
- The middle one indicates when lit that there's a valid transmission link between the FPGA and the DisplayPort monitor. This means that the link is good that the training was successful and that it's currently sending a video image to the monitor. If it's off it means that the link could not be established (for example because the cable was removed or the monitor is switched off or perhaps because the DisplayPort input is not selected on that monitor).
- The one on the other end should be blinking at a rate of about one blink per second. This is a "pulse" of the pixel clock indicating that both the VGA and DisplayPort outputs are generating

an image. If this LED doesn’t blink no image of any kind can be seen on either VGA or DisplayPort, only RGB at 15 kHz. Under normal circumstances whether a DisplayPort monitor is plugged in or not this LED should be blinking.

ZX81

The ZX81 was a home computer designed by Sinclair Research to be a low-cost introduction to home computing for the general public.

The ZXTRES version was made by avlixa based on Grant Searle's ZX80 page.

Features:

- 8KB with CHR$128/UDG addon (not tested).
- 16k/32k/48k RAM packs.
- Chroma 81 (colour support).
- Controller types: Cursor, Sinclar, ZX81 and ZXpand.
- Load alternative ROMs.
- PAL/NTSC timings.
- Program loading using the audio input.
- QS CHRS (not tested).
- Turbo in Slow mode: NoWait, x2 and x8.
- Turbo loading of `O` and `P` files.
- YM2149 sound chip (ZON X-81 compatible).
- ZX80/ZX81 selectable (ZX80 currently working only in RGB mode).

microSD card format

To store ROM and tape files, use a microSDcard with the first partition in FAT16 or FAT32 format.

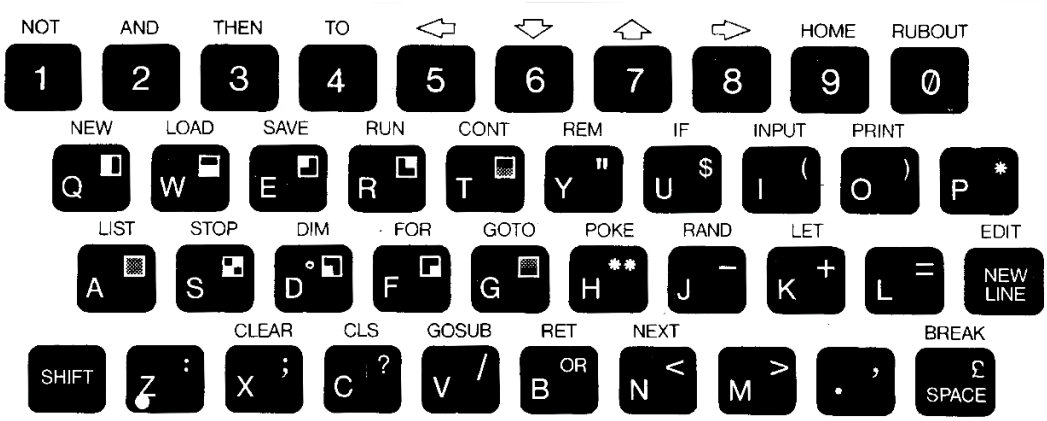
You can copy a file called `ZX8X.ROM` (available at the official repository into folder `/zx81/roms`: it's a concatenation of ZX81 rom (8k) + ZX80 rom (4k).

See the corresponding section for instructions on how to install the ZX81 core in ZXTRES.

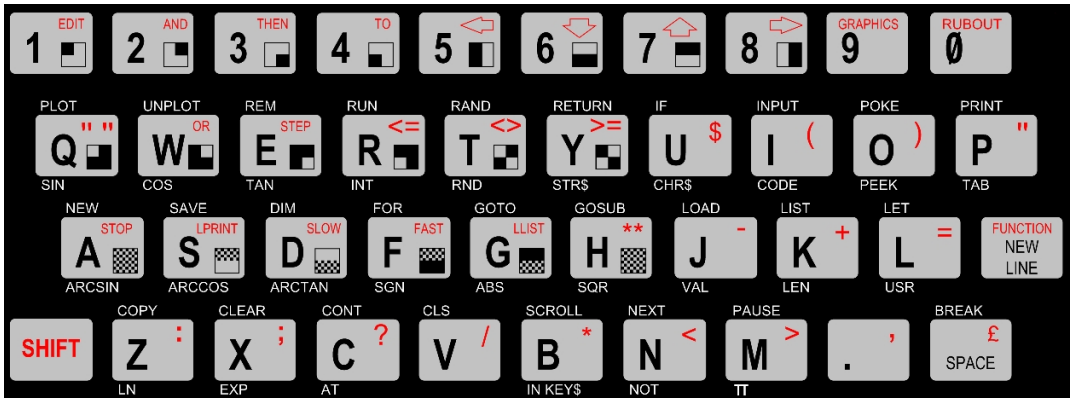
Keyboard

The PS/2 keyboard isn't mapped and the original machine keys layout is kept. For example to obtain a " you must type `Shift+P` or `Shift+0` to delete.

ZX80



ZX81



Special keys and buttons

When the core is active:

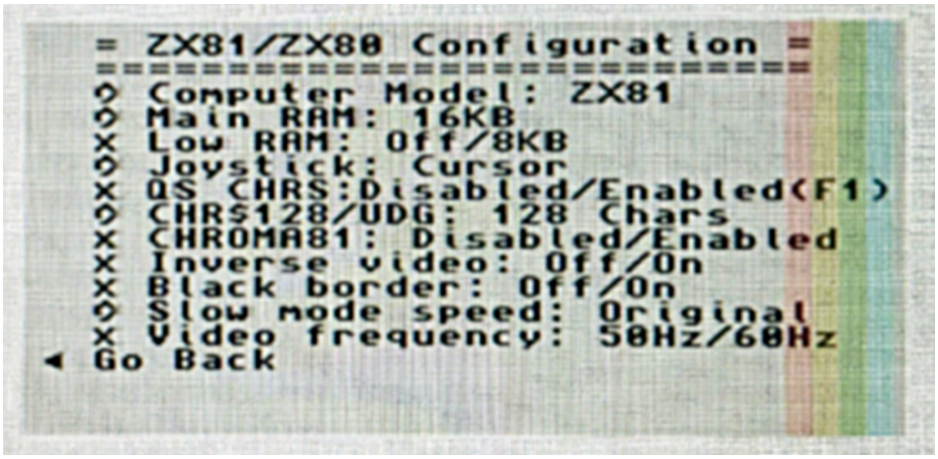
- `F1`: Enable or switch off the alternative chararacters.
- `F5` or controller button `A`: Show or hide configuration menu.
- `F9`: Enable or switch off the MIC audio output (some games make annoying sounds when enabled).
- `F10`: Enable or switch off playing the audio input through the audio output to hear loading sounds while loading.
- `Scroll Lock`: Switch between RGB and VGA video output.
- `Ctrl+Alt+Supr`: Soft reset.
- `Ctrl+Alt+Backspace`: Hard reset.

Overview

Press `F5` or controller button `A` to show or hide the configuration menu. Use the cursor keys and `Enter` to select menu options.

The available options are:

- Reset.
- Load Tape.
- Load ROM.
- Configuration Options.
- Exit.



- Computer Model: ZX80, ZX81.
- Main RAM: 16K, 32K.
- Low RAM: Off, 8KB.
- Joystick: Cursor, Sinclair, ZX81.
- QS CHRS: Enabled, Disabled.
- CHR$128/UDG: 128 chars, 64 chars, Disabled.
- Chroma81: Enabled, Disabled.
- Inverse Video: Off, On.
- Black Border: Off, On.
- Slow mode speed: Original, No Wait, x2.
- Video frequency: 50Hz, 60Hz.

You can load a tape file selecting it from the menu then enter the command `LOAD""` and `Enter`.

Some monitors stop playing audio if the video signal is lost. You should connect headphones or a external speaker if you want to hear the sound while loading a tape.

`P` files with colourization and char are supported.

For colourization to work CHROMA81 should be enabled before loading. For alternate chars QS CHRS should be enabled before loading.

The recommended options for most games are:

Main RAM: 16KB. Low RAM: 8KB. CHR$128: 128 chars. QS CHRS: Enabled. CHROMA81: Enabled.

zxsp

Other hardware

Loading from tape

Some cores can load from an external device such as a cassette tape player, just like the original machines.

Besides the microSD card you must connect an appropriate audio cable into the ZXTRES audio input. It must have a 3.5mm stero jack on one side and two mono outputs on the other side (one for each audio channel). The right audio is connected to the audio player (this is not necessary with a miniduino because it already uses only the right audio channel when playing).

Cassette tape player

This works exactly the same way as when using it with the original computers:

1. Connect the audio cable.
2. Type on the computer or select the tape loading option. For examle, for ZX Spectrum 48K press `J` (`LOAD`), `""` and `Enter` to start loading.
3. Start playing the tape (you may need to try several times, adjusting the player volume).

Computer

Depending on the operating system (Windows, macOS or Linux) there are several programs that can either play a tape file (`TAP TZX PZX` and so on) and output the sound through a headphone output or create an audio file (`WAV VOC AU` and so on) that can be played using a music or audio program.

PlayTZX

This program for Windows, macOS and Linux can directly play a `TZX` tape file through the computer's audio output.

You can download the application for Windows from World of Spectrum Classic and for Mac from this GitHub repository) or compile the source code as explained later.

1. Connect the audio cable between the computer audio output and ZXTRES audio input (remember to use only the right mono channel to the PC Mac and so on output).
2. Type on the computer or select the tape loading option. For examle for ZX Spectrum 48K typing `J` then twice `"` and then `Enter` to do the classic `LOAD "" + Enter`.
3. Start playing a tape file with this command (you may need to try several times adjusting the player volume).

```
./playtzx <tape file path>
```

If everything worked correctly, you'll see at the shell the name of the different tape data blocks while the sound is played and the ZXTRES core loads the program.

On Linux the program uses as output the device `/dev/dsp` this may require you to load a module like `snd_pcm_oss` (on systems using ALSA).

Compile source code (macOS and Linux)

Beofre compiling, ensure that the developer tools are installed on the system including a C compiler (`gcc` `clang` command line developer tools for Mac and so on) and GNU Autotools.

Download the source code from this repository), extract the contents if required, in the terminal navigate to the folder and enter:

```
aclocal && autoconf && autoheader && automake --add-missing
./configure
make
```

If everything worked correctly, a new file called `playtzx` is created that you can copy anywhere and then use. You can remove the compilation folder.

Mobile phone tablet MP3 player and so on

There are only a few apps (or none) that can directly play a tape file on a mobile device so in many cases the only option is to convert it to an audio file before playing it.

PlayZX is an app for Android that can play tape files through the headphone output.

The latest devices with headphone output are typically designed to work with impedances of only a few ohmis. This may sometimes not be enouth for the ZXTRES audio input.

In these cases you should (if possible) to switch off headphone volume limitations or use a headphone amplifier that can give a higher impedance.

Audio file conversion

These are some programas that exist which can export tape files to audio files.

Tapir is a GUI program for Windows (but that can also run with Wine on Linux or versions of macOS with 32-bit Intel support) that can load `TZX` and `TAP` files and export to `WAV` audio

`tape2wav` from Fuse Utilities is a command line utility that can export from `TZX` `PZX` and `TAP` to `WAV`.

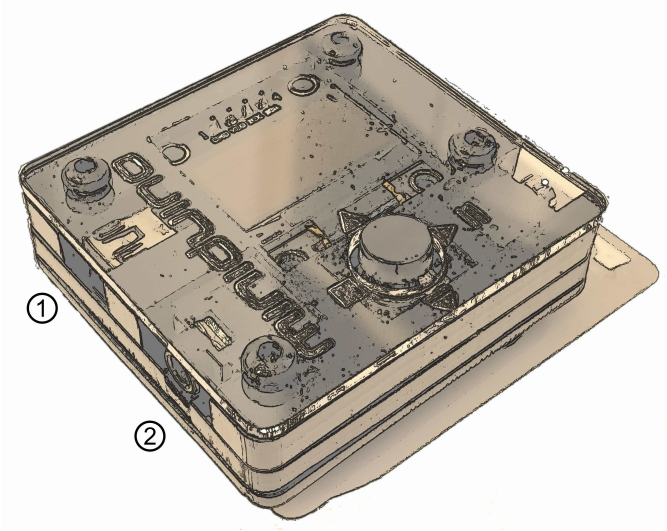
`pzx2wav` in PZX Tools is another command line utility that exports to `WAV`.

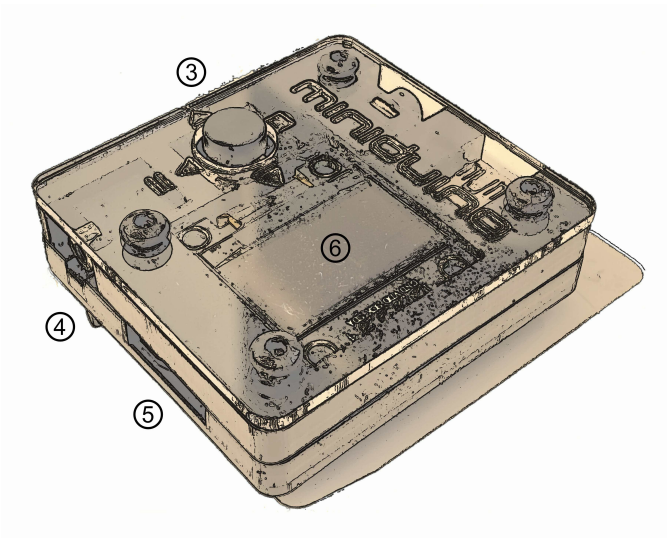
Miniduino

Miniduino is a tape file audio player, based on an STM32F103C8T6 microcontroller or ATMega38P with the Maxduino firmware preinstalled.

Maxduino works in a similar way to cassette tape players, using digital tape files formats such as TAP and TZX (ZX Spectrum), O (ZX80), P (ZX81), CDT (Amstrad CPC), CAS(MSX) TSX (MSX, Acorn, etc). It's also possible to play AY music files as if they were tapes, to load them from SpecAY in a ZX Spectrum.

Ports and buttons





1	Power
2	Audio output
3	Control button
4	Motor control
5	SD card slot
6	Screen

Configuration

An SD card is required to store the tape files to play. Fast cards (Class 10 or greater) aren't recommended because there can be problems while reading the data. High capacity (SDXC or greater) cards aren't recommended either.

The SD card must have the first partition formatted as FAT16 or FAT32.

Besides the card, you must connect an appropriate audio cable to audio input. It must have a 3.5mm stereo jack on one side, and two mono output on the other side (one for each audio channel). The right audio mono is connected to the Miniduino.

If you have a device that can use motor control, you can also use a cable with a 2.6mm jack.

Copy the tape files (`TAP`, `TZX`, `O`, `P`, `CAS`, `TSX` and so on) to the first partition of the SD card. They can be organised using folders or directories.

The player shows file and folder entries in the order stored in the internal FAT table, not alphabetically. If you want to see them ordered you must reorder the SD card structure with a utility such as FATsort, YAFS, SDSorter or another application.

Use

After the SD card with the data files is inserted, power it on by connecting the included USB power cable.

To show the optional menu, hold down the control button:

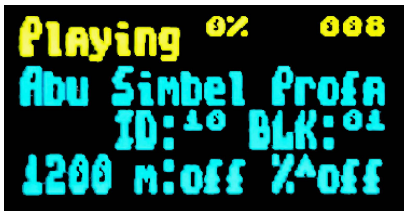
- Baud Rate: Configures turbo speed baud rates when playing 4B blocks in MSX files (`CAS` and `TSX`).
- Motor Ctrl: Enable this option when a control cable is connected to a proper device (Amstrad, CPC, MSX and so on).
- Converter (TSXCzxpUEFWS): Enables turbo loading `CAS` and `TSX` files, changes signal for Spectrum and Amstrad CPC files or change parity when playing Acorn Electron and BBC Micro `UEF` files.
- (Skip BLK)): To switch off (Skip ON) or enable an automatic pause when 2A blocks are found.

Outside the options menu, the control button is used as a four directional control joystick that has two different behaviours depending on whether the player is stopped or paused.

When the player is stopped (file and directories browser):

- Up and Down move through the current files and folders list.
- Left (Stop) goes one level up in the folder tree.
- Right (Play/Pause) enters a folder or, if the selection is a file, tries to play it.

When a file is playing you can stop it with the left button (Stop) or pause using the right button (Play/Pause).



When in pause (tape block browser:

- Up and Down move through the tape block files already played (useful for multiload titles or to load a previous level block).
- Left (Stop) cancels the player and goes back to file and folder browser mode.
- Right (Play/Pause) continues playing from the selected block.
- Press down the control button to enable or disable turbo mode for MSX.

Making TZX or TSX files from other formats

While some tape file formats (Commodore, Camputers Lynx and so on) are not supported by Maxduino, there are some utilities that can, more or less successfully, embed audio data in a TSX or TZX file, which then can be used with Miniduino.

MakeTSX

You can use this command with NataliaPC's MakeTSX to create a TSX file with embedded audio:

```
...MakeTSX -b15 -wav audio_file.wav -tsx new_file.tsx
```

RetroConverter

Jorge Fuertes' RetroConverter can create a TZX file:

```
...retroconv audio_file.wav new_file.tzx
```

Maxduino firmware upgrade

The Maxduino firmware is periodically updated and improved. You can track the changes and improvements either at the Va de Retro forums or at the GitHub project page. To take advantage of this improvements, the Miniduino flash image must be flashed with the updated firmware version.

There are two Miniduino models; one based on the STM32 microcontroller and the ther on the ATMega328P.

STM32 Model

Environment setup

Firmware flashing is done from a computer (Windows, macOS or Linux) with Arduino IDE installed.

You must install SDFat (1.1.4) software library selecting the menu option Program → include library → manage libraries.

Minidiuno microcontroller support must also be added. This is done in two steps:

1. Add ARM Cortex M3 support from menu Tools → board → board manager, and installing "Arduino SAM boards (Cortex-M3)".
2. Add STM32 microcontroller support; download the file available at this link.

Extract the contents to the current user folder in:

```
...Arduino/hardware/Arduino_STM32
```

On Windows, install the USB device controller running (with elevated privileges:

```
 ...\drivers\win\install_drivers.bat
```

On Linux, install with root privileges the necessary `udev` rules:

```
...tools/linux/install.sh
```

On macOS, if Miniduino doesn't appear as a USB device in Arduino ID when connected it may be necessary to install libusb.

Last, on Mac or Linux, the file `maple_upload` inside `Arduino_STM32` must be edited with a text editor. Those lines do not work:

```
if [ $# -eq 5 ]; then
    dfuse_addr="--dfuse-address $5"
else
    dfuse_addr=""
fi
```

They must be changed to:

```
dfuse_addr=""
```

Upgrade

After the environment is ready, download the software from the official repository in GitHub.

The Miniduino player with STM32 microcontroller is only supported from version 1.65 and up.

Load the project file with Arduino IDE (for example `MaxDuino_v1.69.ino`).

Ensure that all logo entries in `userSTM32Config.h` file are commented out except for Miniduino.

```
...
//#define tanque4
//#define tanque1
//#define dostanques
//#define cablemax
//#define sony
#define miniduino
...
```

Connect the Miniduino device to the computer using the USB cable, and find the assigned port, typically called something like "Maple Mini" (for example: COM5 Maple Mini)

Fom the "Tools" menu set these options:

```
Board: Generic STM32F103C Series.
Variant: STM32F103C8 (20k RAM, 64k Flash).
Upload Method: STM32duino bootloader.
CPU Speed: 72Mhz (Normal).
Optimize: Smallest (default).
Port: <Previously identified port>.
```

Last, click on the firmware load button and wait for a few seconds while the project is compiled

and loaded into the device.

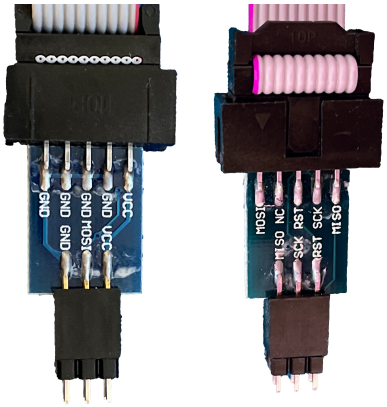
If everything has been done correctly the Miniduino will restart and show on the screen the new firmware version.

ATMega328P Model

Environment setup

Requirements:

- One hex key with the right socket size for the cover screws
- USBasp flash programmer



Also, firmware flashing is done from a computer (Windows, Mac, Linux) with Arduino IDE installed.

You must install SDFat (1.1.4) software library selecting the menu option Program → include library → manage libraries.

Upgrade

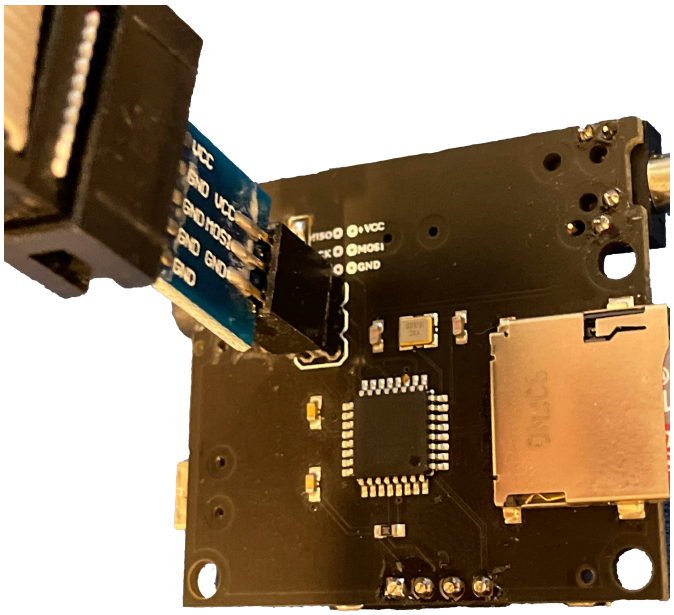
After you have the environment ready, download the software from the official repository in GitHub

Load the project file with Arduino IDE (for example `MaxDuino_v1.69.ino`).

Check in the file `userconfig.h` that all logo entries are commented except for Miniduino and, if not, change them.

```
...
//#define tanque4
//#define tanque1
//#define dostanques
//#define cablemax
//#define sony
#define miniduino
...
```

Connect the Miniduino device to the USBasp programmer, making sure that the connector is in the right position (i.e VCC with VCC, MOSI with MOSI, GND witch GND, etc.), and connect the USB adapter to the computer



Set the following options in the "Tools" menu:

```
Board: Arduino Pro or Pro Mini
Processor: ATmega328P (5V,16 Mhz)

Programmer: "USBasp"
```

Last, hold down the 'Shift' key on the computer while clicking the firmware load button. Wait for a few seconds until the project is compiled and loaded into the device.

If everything was done correctly the Miniduino will restart and show on the screen the new firmware version.

Troubleshooting

Firmware image management

There are several tools that you can use to create or edit the contents of `ZX1` and `ZX3` files.

zx123_tool

This tool enables you to analyse, extract and inject data in SPI flash image files for ZX-Uno, ZXDOS, ZXTRES and similar devices.

It requires Python 3. Depending on the operating system you may need to install it.

With Python 3 installed, you only need to download the latest version of the tool from the official repository following this link.

After you've extracted the tool, you can run it from the command line. The command varies depending on the operating system.

Typically, on Windows it's:

```
py -3 zx123_tool.py
```

Otherwise, it's typically:

```
python3 ./zx123_tool.py
```

You also need an SPI flash image file. This can be obtained from within the ZX Spectrum core with one of the commands `back16m` `backzx2` or `backzxd`. After you've obtained the exteacted file from the microSD card you can "clean" it leaving only the ZX Spectrum core and the first Spectrum ROM:

```
... zx123_tool.py -i FLASH.ZXD -w -o FLASHempty.ZXD
```

Where `FLASH.ZXD` is the path to the original file and `FLASHempty.ZXD` is the path to the new "clean" file.

List the contents of an image

To view the contents of an image file called `FLASH.ZXD` (installed cores and some configuration information):

```
... zx123_tool.py -i FLASH.ZXD -l
```

To show the contents of the same file including ZX Spectrun ROMs information:

```
... zx123_tool.py -i FLASH.ZXD -l -r
```

Change the BIOS of an image

To change the BIOS inside a file called `FLASH.ZXD` using the BIOS file called `FIRMWARE.ZXD`:

```
...zx123_tool.py -i FLASH.ZXD -a BIOS,FIRMWARE.ZXD
```

You can modify some parameters. For example with the options; `-m` for video mode: 0 (PAL), 1 (NTSC), or 2 (VGA), `-k` for the keyboard layout: 0 (Auto), 1 (ES), 2 (EN) or 3 (Spectrum).

To change the BIOS of a file called `FLASH.ZXD` using the BIOS file `FIRMWARE.ZXD` and also set the video mode to VGA:

```
...zx123_tool.py -i FLASH.ZXD -a BIOS,FIRMWARE.ZXD -m 2 -k 3
```

There are also options to set the BIOS boot delay time, the default core and the default Spectrum ROM. For more information, refer to the documentation.

Add a Spectrum ROM to an image

To add a Spectrum ROM file called `48.ROM` with the name `Spec48` and using the slot number five:

```
...zx123_tool.py -i FLASH.ZXD -a ROM,5,xdnlh17,Spec48,48.rom
```

Refer to the documentation for all possible options when adding a Spectrum ROM.

Among the information you provide when adding a ROM there are some flags. These configure the hardware options used when loading the ROM:

`i`	Keyboard issue 3 enabled (instead of issue 2).
`c`	Switch off memory contention.
`d`	Enable divMMC.
`n`	Enable NMI divMMC (esxDOS NMI browser).
`p`	Use Pentagon timings.
`t`	Use 128K timings.
`s`	Switch off divMMC and ZXMMC ports.
`m`	Enable Timex Horizontal MMU.
`h`	Switch off ROM high bit (1FFD bit 2).
`l`	Switch off ROM low bit (7FFD bit 4).
`1`	Switch off 1FFD port (+2A/3 paging).
`7`	Switch off 7FFD port (128K paging).
`2`	Switch off TurboSound (secondary AY chip).
`a`	Switch off AY chip.
`r`	Switch off Radastanian mode.
`x`	Switch off Timex mode.
`u`	Switch off ULAplus.

Install a core to an image

To install a core in slot three from a file called `SPECNEXT.ZXD` with the name `SpecNext`:

```
...zx123_tool.py -i FLASH.ZXD -a 'CORE,3,SpecNext,SPECNEXT.ZXD'
```

To also set the core as the default:

```
...zx123_tool.py -i FLASH.ZXD -a 'CORE,3,SpecNext,SPECNEXT.ZXD' -c 3
```

Change esxDOS ROM from an image

As with the BIOS firmware you can install an esxDOS ROM file:

```
...zx123_tool.py -i FLASH.ZXD -a esxdos,ESXMMC.BIN
```

Combine several actions in one line

You can combine several actions in one command line. For example to "clean" an image file called `FLASH.ZXD` creating a new one called `FLASHnew.ZXD` installing the BIOS from the file `FIRMWARE.ZXD` set up video mode to VGA the keyboard in Spectrum mode add a Spectrum ROM file called `48.rom` with the name `Spec48` while using slot five install a core at slot three from a file called `SPECNEXT.ZXD` with the name `SpecNext` as default core:

```
... zx123_tool.py -i FLASH.ZXD -w -o FLASHnew.ZXD -a BIOS,FIRMWARE.ZXD -m 2 -k 3 -a
ROM,5,xdnlh17,Spec48,48.rom -a CORE,3,SpecNext,SPECNEXT.ZXD -c 3
```

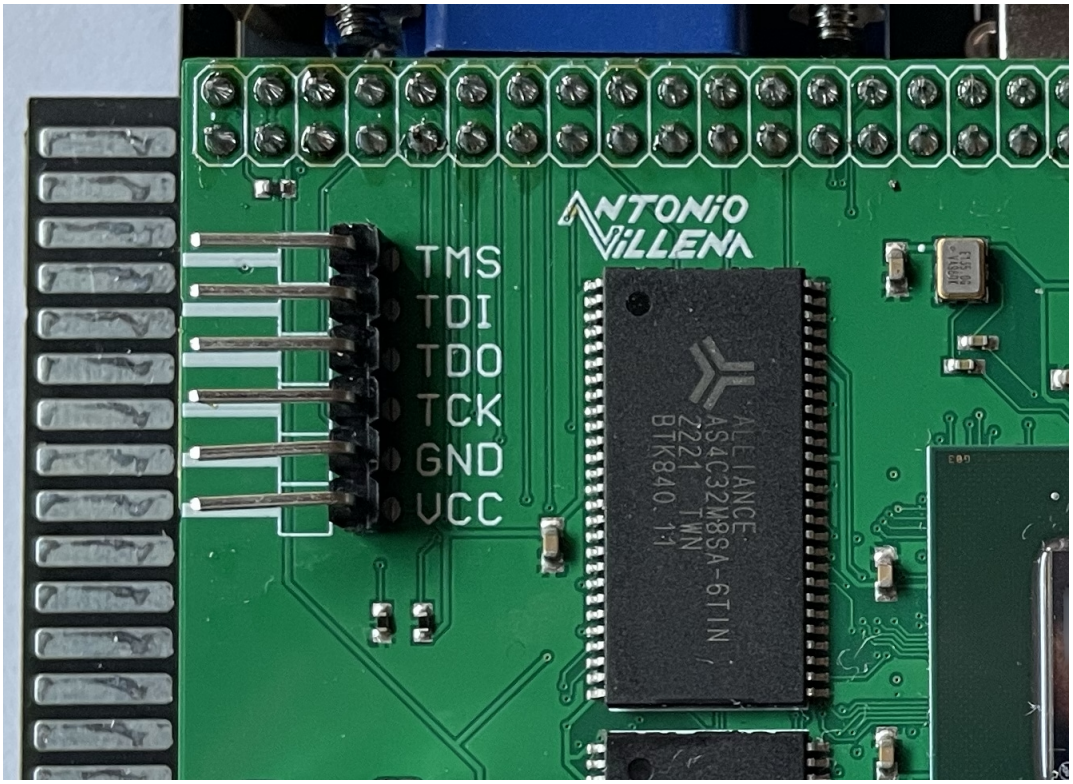
Firmware recovery

Sometimes it may happen that the ZXTRES stops booting, for example when installing an experimental core or when upgrading the ZX Spectrum Core or the BIOS. The ZXTRES board LEDs are on but there's no display and it doesn't do anything when trying the different key combinations to access BIOS setup and so on.

When this happens there are several recovery methods to enable you to restore the firmware.

JTAG cable connections

You can use these images as a reference in some recovery steps when using jump wires or USB-Blaster connections to the ZXTRES board.



Don't connect the 3V line.

Recovery using a Raspberry Pi

Hardware required:

- Raspberry Pi (with microSD card, keyboard, display, power supply and so on) and with internet connection.
- Five jump wires (if possible female on both sides) or instead a USB-Blaster cable.
- A hex key (Allen key) for the ZXTRES cover screws.
- A microSD card with the first partition formatted as FAT16 or FAT32 for the ZXTRES.
- Keyboard and display for the ZXTRES.

Software required:

Flash image and recovery file for ZXTRES from the main Github repository. Note, there are different files for each device:

- `recovery_a35.bit` for ZXTRES
- `recovery_a100.bit` for ZXTRES+
- `recovery_a200.bit` for ZXTRES++

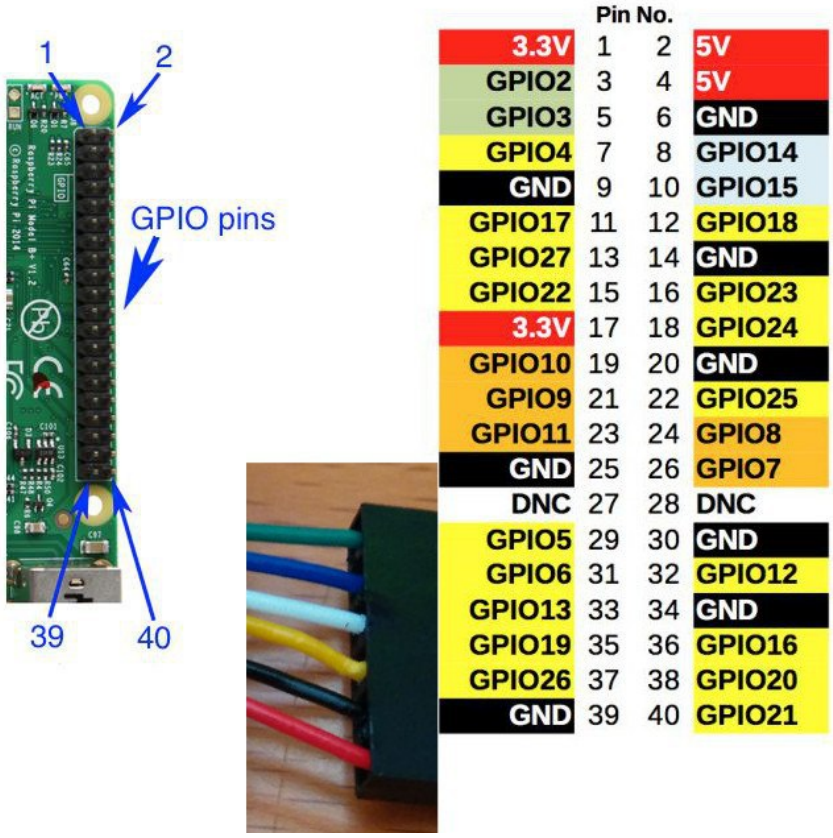
Instruction steps:

1. Install Raspberry Pi OS (formerly known as Raspbian) to the Raspberry Pi microSD card (using the official download NOOBS PINN and so on).
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 the USB-Blaster or jump wires if using GPIO. In this case open the ZXTRES case and as explained before connect the FPGA JTAG lines (`TMS TDI TDO TCK` and `GND`) using the wires to the Raspberry Pi GPIO pins.

If using a GPIO connection, take note of the chosen pins and ensure that `GND` is connected with `GND`.



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

ZXTRES 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 the file called recovery_axx.bit previously downloaded from the main Github repository to the Raspberry Pi. In this example it's at /home/pi/zxtres/unbrick/
5. If using GPIO, make a copy of the Open OCD configuration file to the folder where recovery.bit is located.

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

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

```
# Header pin numbers: 37 31 33 35
```

```
bcm2835gpio_jtag_nums 26 6 13 19
```

7. Ensure the line `bcm2835gpio_swd_nums` is commented out (not necessary for USB-Blaster):

```
#bcm2835gpio_swd_nums 11 25
```

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

```
adapter speed 250
```

9. Power on the ZXTRES.
10. Ensure that on the Raspberry Pi you're in the folder where `recovery_axx.bit` is located and run 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/zxtres/unbrick
sudo openocd -f /home/pi/zxtres/unbrick/raspberrypi2-native.cfg -f
/home/pi/zxtres/unbrick/xilinx-xc7.cfg -c "init; pld load 0 recovery_axx.bit;
shutdown"
```

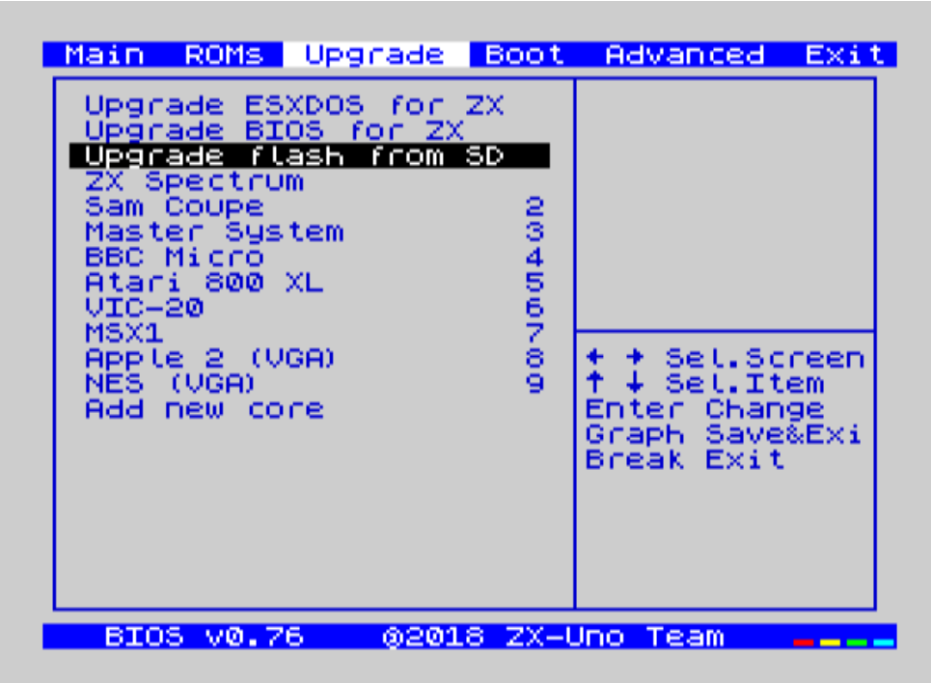
For USB-Blaster connection:

```
cd /home/pi/zxtres/unbrick
sudo openocd -f /usr/local/share/openocd/scripts/interface/altera-usb-blaster.cfg -f
/home/pi/zxtres/unbrick/xilinx-xc7.cfg -c "init; pld load 0 recovery_axx.bit;
shutdown"
```

Remember to enter the correct name replacing `recovery_axx.bit` in the previous commands.

11. If everything worked correctly, you'll see that the FPGA LED change their state and the BIOS is shown on the display.

If there's no image on the display and you're not using DisplaPort, press `Scroll Lock` to switch between RGB and VGA modes in case the recovery BIOS started in the wrong mode for your setup.



12. Insert the microSD card formatted as FAT16 o FAT32 and with the `FLASH.ZX3` file downloaded previously in the ZXTRES.
13. If using a USB-Blaster connection, disconnect the connector.
14. Select the `Upgrade Flash from SD` opiton. Press `Enter`, choose `Yes` and press `Enter` again to start the flash writing process.

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

15. After some minutes the process ends and on power cycling the ZXTRES it should start.

If no image is shown and you're not using DisplaPort, press `Scroll Lock` again to switch between RGB and VGA modes. In this case you must enter the BIOS and change [_advanced the right advanced setting] that matches your display.

References

Scan Codes

101-, 102-, and 104-key Scan Codes

KEY	MAKE	BREAK
A	1C	F0,1C
B	32	F0,32
C	21	F0,21
D	23	F0,23
E	24	F0,24
F	2B	F0,2B
G	34	F0,34
H	33	F0,33
I	43	F0,43
J	3B	F0,3B
K	42	F0,42
L	4B	F0,4B
M	3A	F0,3A
N	31	F0,31
O	44	F0,44
P	4D	F0,4D
Q	15	F0,15
R	2D	F0,2D
S	1B	F0,1B
T	2C	F0,2C
U	3C	F0,3C
V	2A	F0,2A
W	1D	F0,1D
X	22	F0,22
Y	35	F0,35
Z	1A	F0,1A
0	45	F0,45
1	16	F0,16
2	1E	F0,1E
3	26	F0,26
4	25	F0,25
5	2E	F0,2E
6	36	F0,36
7	3D	F0,3D
8	3E	F0,3E
9	46	F0,46
`	0E	F0,0E
-	4E	F0,4E
=	55	F0,55
\	5D	F0,5D
BKSP	66	F0,66
SPACE	29	F0,29
TAB	0D	F0,0D
CAPS	58	F0,58
L SHFT	12	F0,12
L CTRL	14	F0,14
L GUI	E0,1F	E0,F0,1F
L ALT	11	F0,11
R SHFT	59	F0,59
R CTRL	E0,14	E0,F0,14
R GUI	E0,27	E0,F0,27
R ALT	E0,11	E0,F0,11
APPS	E0,2F	E0,F0,2F
ENTER	5A	F0,5A
ESC	76	F0,76
F1	5	F0,05
F2	6	F0,06
F3	4	F0,04
F4	0C	F0,0C
F5	3	F0,03
F6	0B	F0,0B
F7	83	F0,83
F8	0A	F0,0A
F9	1	F0,01
F10	9	F0,09
F11	78	F0,78
F12	7	F0,07
PRNT SCRN	E0,12, E0,7C	E0,F0, 7C,E0, F0,12
SCROLL	7E	F0,7E
PAUSE	E1,14,77, E1,F0,14,F0,77	-NONE-

101-, 102-, and 104-key Scan Codes

KEY	MAKE	BREAK
[	54	FO,54
INSERT	E0,70	E0,F0,70
HOME	E0,6C	E0,F0,6C
PG UP	E0,7D	E0,F0,7D
DELETE	E0,71	E0,F0,71
END	E0,69	E0,F0,69
PG DN	E0,7A	E0,F0,7A
U ARROW	E0,75	E0,F0,75
L ARROW	E0,6B	E0,F0,6B
D ARROW	E0,72	E0,F0,72
R ARROW	E0,74	E0,F0,74
NUM	77	F0,77
KP /	E0,4A	E0,F0,4A
KP *	7C	F0,7C
KP -	7B	F0,7B
KP +	79	F0,79
KP EN	E0,5A	E0,F0,5A
KP .	71	F0,71
KP 0	70	F0,70
KP 1	69	F0,69
KP 2	72	F0,72
KP 3	7A	F0,7A
KP 4	6B	F0,6B
KP 5	73	F0,73
KP 6	74	F0,74
KP 7	6C	F0,6C
KP 8	75	F0,75
KP 9	7D	F0,7D
]	5B	F0,5B
;	4C	F0,4C
	52	F0,52
,	41	F0,41
.	49	F0,49
/	4A	F0,4A

Windows Multimedia Scan Codes

Key	Make Code	Break Code
Next Track	E0, 4D	E0, F0, 4D
Previous Track	E0, 15	E0, F0, 15
Stop	E0, 3B	E0, F0, 3B
Play/Pause	E0, 34	E0, F0, 34
Mute	E0, 23	E0, F0, 23
Volume Up	E0, 32	E0, F0, 32
Volume Down	E0, 21	E0, F0, 21
Media Select	E0, 50	E0, F0, 50
E-Mail	E0, 48	E0, F0, 48
Calculator	E0, 2B	E0, F0, 2B
My Computer	E0, 40	E0, F0, 40
WWW Search	E0, 10	E0, F0, 10
WWW Home	E0, 3A	E0, F0, 3A
WWW Back	E0, 38	E0, F0, 38
WWW Forward	E0, 30	E0, F0, 30
WWW Stop	E0, 28	E0, F0, 28
WWW Refresh	E0, 20	E0, F0, 20
WWW Favorites	E0, 18	E0, F0, 18

ACPI Scan Codes

Key	Make Code	Break Code
Power	E0, 37	E0, F0, 37
Sleep	E0, 3F	E0, F0, 3F
Wake	E0, 5E	E0, F0, 5E

Links

ZX-Uno

ZX-Uno FAQ

ZX-Uno Quick Guide

ZX Spectrum core

The ZX Spectrum +3e Homepage

Sharing a +3e disk with PC (FAT) partitions

Keyboard Layouts

Keyboard firmware for ZX Go+

zxunops2

Almost (In-) Complete List of esxDOS DOT-Commands

Cargando Leches 2.0

WiFi (RetroWiki)

WiFi on ZX-Uno

ZX-Uno Core Test UART (WiFi)

Network tools for ZX-Uno pack

ESP8266 AT Instruction Set

Radastanian Vídeos

New core zx48

Maxduino - user’s guide