mB03+

Slim edition

User Manual

version 1.0



Powerful smart interface for any
ZX Spectrum 48K, 128K, 128+2/+2A/+2B/+3 and compatibles.

Welcome!

Before turning on the computer with the MB03+ Slim interface attached, please read the first chapter of this manual, **Quick start**.

The MB03+ Slim has a built-in **divSD interface** with two SD card slots, available in all its hardware models, from the 48K, through the +2 and +2A, to the latest Pentagon. If you have never used a similar device, read the ***esxDOS*** chapter on the page 20.

I need to find information on how to…

load & run games online	go to	page 9
set RTC		page 9
prepare SD card		page 21
solve an issue (not listed in the SetUp)		page 19
change a BASIC ROM		page 16, 21
look at PC keyboard layout		page 12
use the Extra button		page 4, 14
upgrade the system		page 17

MB03+ Slim – User Manual, version 1.0
written by SCjoe/SamC

2026 (C) Jan Kučera / LMN128, www.128land.com
city Zlín / Czech Republic

Dear user,

Thank you for purchasing the MB03+ Slim interface.

Following the MB03+ Ultimate and Ultimate2 interfaces and the eLeMeNt ZX computer, I am introducing a new device in the **eLeMeNt hardware** family.

The **MB03+ Slim** interface provides:

- digital audio and video output for any modern home TVs and computer displays
- full-featured USB interface with an option to connect USB hubs
- perfect synchronization with all classic Spectrum models and most modern clones
- I2C interface (with Qwiic connector from SparkFun)
- K-Mouse, PC keyboard, Atari joystick and Sega gamepad connection
- traditional expansions like real-time clock (RTC), SD (SPI) interface or Z80-DMA
- more than twenty advanced memory, graphics, sound and other expansions
- future-proof design, including upgrades of the RetroCoreX FPGA module

With the new MB03+ Slim you can **connect any modern USB** keyboard or mouse (you no longer have to rely on old USB devices with PS/2 protocol support). In addition to Wi-Fi and USB-C connectivity, the MB03+ Slim offers **I2C for data communication**, making the good old ZX Spectrum a tool for modern technical enthusiasts.

With the MB03+ Slim (2026), I'm glad to offer you a great modern interface, an enhanced gadget for your ZX Spectrum and the best interface compatible with divIDE/MMC devices.

Jan Kučera

Quick start with the MB03+ Slim

The MB03+ Slim can be connected to the standard edge connector of the computer in the usual way. Always keep the edge connector clean! A dirty connector can cause malfunctions or data corruption. Use isopropyl alcohol to clean the connector. If the edge connector is damaged you should solder another one!

Don't plug anything into (or unplug from) the edge connector while the ZX Spectrum is powered on! Don't insert or remove SD cards from the MB03+ slots while the ZX Spectrum is powered on!

Only use a Kempston/Sega/Atari type joystick with your MB03+ Slim. Do not use the MB03+ Slim with unsupported machines or interfaces.

Please take good care of your MB03+ Slim. Avoid shocks, dust, moisture etc.

Turning on

1. Put the interface onto the edge connector of your ZX Spectrum.

2. Insert the FAT32 formatted (esxDOS) SD card into the SD1 slot. The MB03+ Slim has two SD slots: one closer to the computer is SD2 and one further away is SD1.

3. Connect the MB03+ with digital AV cable to the TV/computer monitor. The digital AV connection port is located on the back side on the left. **The use of a digital cable is essential.** The MB03+ cannot use old TV, video or RGB connectors from a computer to function properly.

4. Finally, turn the computer on. The MB03+ indicates its activity on the side strip, with LED diodes on the left side. Active power supply and running MB03+ Slim is indicated by a white diode.

5. Now you see the StartUp screen. For loading any software, press 1 to start the esxDOS, then press the NMI button and select a file to load&run. Otherwise go to the section ***SetUp***.

Buttons

There are three buttons on the MB03+ Slim. All buttons are mapped to keys on the PC keyboard, see map in the section ***External keyboard layout***.



The **NMI button** on the left is used to interrupt any running program and to start a special NMI Menu or an esxDOS File Browser. It is mostly used to find and run software from SD cards quickly.

Pressing the (red) **Reset button** on the right results in full, fast or esx-NMI start**,** according to your preferences in the SetUp.

The **extra (ext) button** in the middle helps to switch some hardware options quickly. The button can be linked to warm

boot or to GigaScreen modes. The **warm boot** performs a fast reboot of the computer while preserving the state of the machine and the divSD.

Optional connections

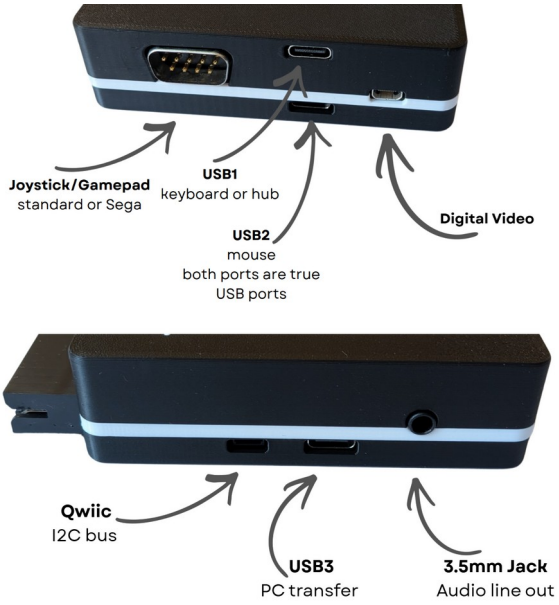
Joystick DE-9 connector is located on the back side, on the right. Switch between Atari or Sega type in the SetUp. Please note: old Sinclair and Amstrad joysticks do not work.

USB-C connectors for a keyboard and mouse are positioned centrally on the rear side (**USB1** lower, **USB2** upper).

I2C support for the **Qwiic** connector is prepared for a future use with Sparkfun and Adafruit devices.

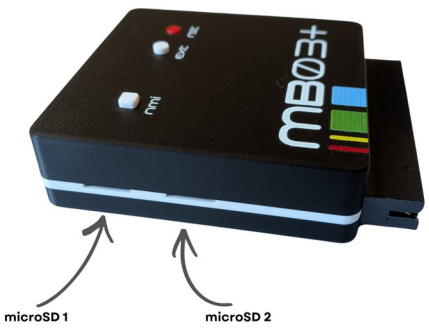
USB-C on the left side serves as PC-link.

MicroSD slots are on the right, **SD1** and **SD2.** Please note the SD cards **are not** hot-swappable in the esxDOS system.



SD card

A quick way to run a game, demo or utility is to use an NMI/File Browser in the esxDOS. Many legacy emulation formats such as tape-images (TAP) files, snapshot files (Z80 and SNA) and floppy-images (SCL, TRD) of the old Betadisk TR-DOS system are supported.



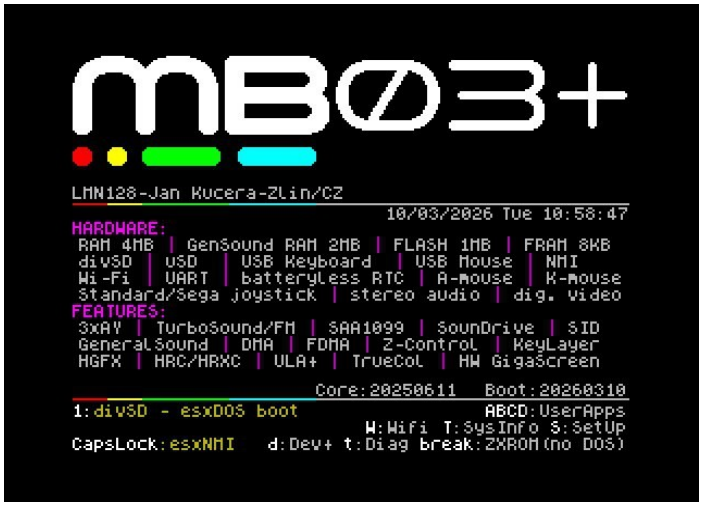
Please read the ***esxDOS section***. This system operates with a PC-like filesystem and FAT-formatted SD cards, so all files are directly readable and writeable on both the PC and the ZX Spectrum.

You get a microSD card with pre-installed software, or you can use any SDHC or SDXC FAT32-formatted card and copy the content of the card from www.elementhw.com (*Download section*).

Can I use another interface with the MB03 Slim?

The MB03+ has a wide range of interfaces already built-in, so you do not have to use older interfaces that have similar functionalities. Instead of attaching Kempston, mouse or sound interface, simply go to the SetUp and make a switch in the menu. For safe and proven interfaces, see the list of tested eLeMeNt ZX/MB Peripherals.

StartUp options



- date and time (if RTC is on)
- interfaces & enhancements available
  beware: this is only a list of what is present, items must be activated in the SetUp
- FPGA Core and Boot ROM version
- StartUp options

If you press this key, it will…

A, **B**, **C** or **D**	**run** one of installed UserApps or GameROMs
1	switch into the **divSD** mode and **boot esxDOS**
Caps Lock *CAPSSHIFT+2*	triggers **NMI start** to NMI/LFN Browser (esxDOS must be booted first)
R *CAPSSHIFT+r*	**restart** (use it if you have modified the SetUp)
S *CAPSSHIFT+s*	**SetUp** - allows you to modify initial startup parameters
T *CAPSSHIFT+t*	**show** "user experience" and usage statistics, incl. internal HW counters: power on, reset and NMI
t	run ZX Spectrum **hardware test** and diagnostic ROM
W *CAPSSHIFT+w*	run **Wi-Fi** connection setup and set the RTC online

Note: There are also other options (eg. ***d*** for DevastACE+) on the start screen that are for development purposes only.

Press BREAK to skip options and run the standard ZX ROM (without esxDOS and SDs attached).

When booting esxDOS, after pressing key 1, you can re-read (re-initiate) the SD card by holding the SPACE key. This **esxDOS reboot** also works after reset**:** push **reset** while **holding the Space** key (on the external PC keyboard: press and release **Symbol shift + Alt** keys while **holding the Space** key).

MB03+ enhancements

Your MB03+ Slim is a **smart multi-interface** that allows you to jointly and easily operate a number of extensions that before the MB03+ only existed as separate interfaces for ZX Spectrum computers.

The MB03+ **combines features** that are only available on some ZX Spectrum models. All of them can be applied even to oldest and most basic ZX Spectrum models and thus increase their performance.

The MB03+ requires only one add-on, the digital AV connection, to operate. As for the other peripherals, it **is up to you how and whether you use them**, or whether you enable them in SetUp.

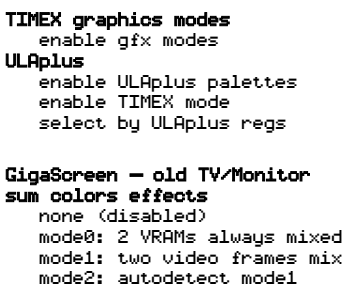
The MB03 Slim architecture follows these approaches:

- make the most of and combine existing features of the ZX Spectrum computers
- enable connection of modern peripherals (dig. video, SD cards, USB HID, Wi-Fi, etc.)
- **all-in-one** operation mode, i.e. ensuring seamless operation of all extensions without compromises

Legacy graphics modes

The performance and design of the MB03+ Slim allows you to use various graphics modes through a **high-quality digital video** output. This ensures perfect display of all modes and timings on any compatible machine and eliminates imperfections such as GigaScreen flickering.

Timex: switch on/off HiColor (8*1 attributes) and HiRes (512*192 pixels, monochrome). **ULAplus** provides new colour palettes, from total 256 colours.



GigaScreen provides a mix of colours based on a quick change of two (current and shadow) videoRAM screens. For most software, set this option to "**auto**". Mode0 joins data from both videorams. Mode1 reads two video frames, if the program quickly alternates screens with a speed of 50Hz. Mode2 detects frame switching (or video buffer switching) and if so, it turns Mode1 on. Screens are mixed in advance and then a digital output is generated, which results into a perfect stable display.

New graphics capabilities

The MB03+ Slim provides **several graphic modes**. They follow the original ZX and Timex resolutions (256 pixels vertically and 512 pixels per line) and are able to use a memory space of two ZX videoRAM pages.

The **KeyLayer** graphic mode allows you to display image data from the second video RAM at a place of one selected color in the video RAM no. 1.

512*192 pixels of **HiResColour** (HRC) and **HiResindeXedColour** (HRXC) modes use colour attributes and an extended, true-colour palette (better than ULAplus).

ZX-Uno's **Radastan** is a neat 128*96 graphics mode without attributes limitations, with 16 colours per pixel from ULAplus palette and with a hardware scroll.

HGFX adds a powerful "planar" and "chunky" graphics, which enables to colour each individual point (pixel) with a unique indexed colour. The screen memory is relocatable (not only limited to the zx-screen area), can manage up to 8 bitplanes and consists of several modes. **LowRes** and **HiRes** modes provide resolutions of 256*192 and 512*192 pixels. **Fill mode** makes it easier to render 2D and solid 3D graphics. Up to 256 colours can be selected at once from a large true-colour palette. **HAM8 mode** presents images close to photographic quality with up to 98304 colours. **SuperHiRes** (SHR) provides a planar 512*384 graphics with 16 colours and **PAL546** does chunky 720*546 pixels (4 colours).

Note: Unlike old graphics enhancements, **the new graphics modes** (Radastan, Keylayer, HR(X)C and HGFX) are **not listed in the SetUp.** They are implemented in such a way that do not collide with other hardware enhancements and, if needed, they can easily be disabled by software.

Audio expansions

The MB03+ is not only a ZX "graphics card", but also a **powerful sound interface** that provides most of the sound devices that have previously been created for the ZX Spectrum.

In addition to specialized sound/music chips (**AY, YM, TS/FM, SAA, SID**), the MB03+ Slim also features stereo audio DACs (**Covox** and **Sound DMA**) and more: a complex interface (with its own Z80 CPU and 2MB of memory) for playing music modules from an Amiga computer (**General Sound**).

As with the graphics extensions, sound devices can be enabled in the SetUp (and even run several of them together). And you will probably appreciate the possibility to turn on the device also by software, including with OUT commands from BASIC (see the examples on the back cover of this manual).

Memory expansions

MB03+ provides several types of memory expansion. It can **replace the original ROM** in the computer with its **own 16KB, 32KB or 64KB ROM**.

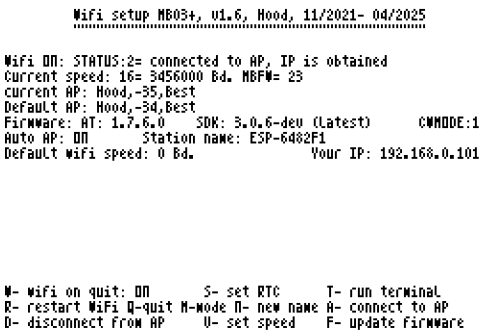
It also offers **all-ram** mode, while providing its own memory ranging up to several megabytes, paged in 8KB increments.

Note: The hardware of the ZX Spectrum computer does not allow external devices to access the upper part of the memory. No ZX interface will make a full 128K+ model from the old ZX Spectrum 48K. However, the MB03+ Slim can at least add a sound chip from the ZX128 model, a second videoRAM or a serial port to the good old ZX48.

Wi-Fi

The MB03+ uses the ESP-01 module for wireless transmissions. You can enable/disable the Wi-Fi module in the MB03+ SetUp.

There is a complex **Wifi setup** utility that is also available as part of the MB03's firmware. Press A to connect with the AP (Access Point). Press V to set a speed, the default transfer rate is 115200 baud.



A simple yet powerful tool is the **UART Terminal** command. This terminal helps to control the Wi-Fi module with AT commands. For a complete list of AT commands, please see the "ESP8266 AT Instruction Set" manual in https://mb03.elementhw.com/docs.

You can update the ESP module's firmware with the command `AT+CIUPDATE`

The command `AT+UART_CUR` changes the speed temporarily (valid only till the computer/module is turned off).

Another handy tool is the **Online Speccy Library** (ZXDB Downloader), which allows you to download and run Speccy games from remote (online) public storage. Please see more utilities and read instructions on https://hood.speccy.cz.

Real Time Clock

The MB03+ Slim has the RTC72421 chip implemented, compatible with modern divIDE/divMMC and interfaces. The RTC is **automatically set during the MB03+ boot** and shown on the StartUp screen.

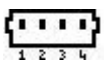
You can set the RTC by entering values manually using special applications (by Velesoft, Busy) or within the **Wifi setup** utility (press S for Set RTC).

Once set, resetting the computer will not affect it. However, the RTC is batteryless; it holds values until the computer is turned off and must re-initialize after turning on.

Pinouts

View of the connectors coming out from the computer:

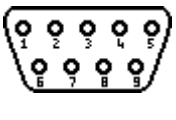
I2C port (Sparkfun Qwiic)



1	2	3	4
GND	VCC	SDA	SCL
ground	3.3 V	I2C Data	I2C Clock

This I2C port has a pinout compatible with Adafruit devices.

Joystick port (Atari and Sega)

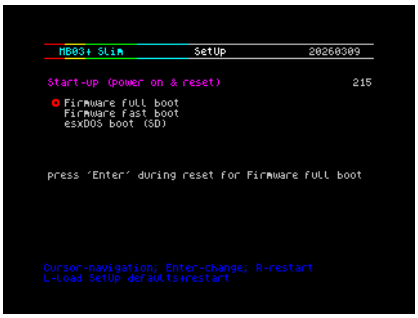


1	2	3	4	5
UP	DOWN	LEFT	RIGHT	+5V

6	7	8	9
FIRE1	+5V or Sega select	GND	FIRE2

Pin 7: depends on Joystick type in the SetUp

SetUp



The SetUp menu lets you modify the MB03+ startup parameters. These apply when the unit powers on or is reset. You can also change parameters anytime, as SetUp also exists as a separate program.

Use the cursor keys and Enter to navigate. Confirm changes by restarting with CapsShift+R. To restore defaults (and restart), press CapsShift+L.

Here are all options of the MB03+ Slim SetUp menu:

StartUp (power on & reset)
- full boot
- fast boot
- run esxDOS (SD)

Video timing (ZX Machine)
- ZX Spectrum 48
- ZX Spectrum 128/+2 grey case
- Harlequin 128 (model D)
- ZX Spectrum 128+2A/+2B/+3
- 48K clones on 3.5000 MHz: Humble48, etc.
- Pentagon on 3.5000 MHz
- Karabas 128

Audio output
- enable ULA audio
- enable TurboSound (FM)
- enable SAA1099
- enable MonsterBlaster DA (Soundrive, Covox)
- enable General Sound
- enable SID
- enable TAPE input

TurboSound FM
- chip model: 0-AY, 1-YM
- stereo: 0-ACB, 1-ABC
- type: 0-3xAY or 1-TSFM (2xYM2203)

SID
- chip model: 0-6581, 1-8580
- frequency: 0-PAL, 1-NTSC

Joystick interface
- none (disabled)
- Kempston

Joystick/DE9 connector
- standard joystick (8bits era)
- Sega controller (3-8 buttons)

External Keyboard/Mouse
- none (disabled)
- Keyboard (USB1) & K-Mouse Master (USB2)
- Keyboard (USB1) & K-Mouse Slave (USB2)
- Keyboard only (USB2)

EXTRA button
- none (disabled)
- Warm reset
- GigaScreen

TIMEX graphics modes
- enable gfx modes

ULAplus
- enable ULAplus palettes
- enable TIMEX mode select by ULAplus regs

GigaScreen – old TV/Monitor sum colors effects
- none (disabled)
- mode0: 2 VRAMs always mixed
- mode1: two video frames mix
- mode2: autodetect mode1

Scan line (old CRT/TV) effect
- none (disabled)
- 1/2 1/4 1/8 1/16
- 1/32 1/64 1/128

Digital Video interface
- enable legacy DVI
- enable ULTIMATE sync. – only for some TVs

SD storage
- enable

divSD
- select esxDOS ROM: 0-FPGA (rescue),1-FLASH
- swap order first/second SD

Z-Controller SD
- none (disabled)
- on first SD slot
- on second SD slot

UART (Wi-Fi) parameters
- enable
- set lower RF power

UART (Wi-Fi) type
- UART on the USB3
- Wi-Fi via ESP01 module

DMA
- enable Z80-DMA
- enable detection of other DMA (eLeMeNt ZX)

SafeNMI (don't enable it with eLeMeNt ZX)
- enable

Interrupt
- enable SaveINT (don't use it with eLeMeNt ZX)
- enable HGFX Interrupt generation

RTC time zone
- GMT -8 … +5

CustomROM
- cROM0 … cROM7 (16KB mode)
- cROM0-3 … cROM4-7 (64KB mode)

Diagnostic
- none
- Video sync.
- Audio level
- Status info
- Video test text pattern
- Video test color moving patt.

If you use **any external interface** with the MB03+,
please check and turn off duplicate internal devices in this SetUp .

StartUp mode

Choose between standard and fast boot to your favourite operating system. You can always return to the MB03+ initial screen by pressing and holding the Enter key at start-up (and after reset).

```
StartUp (power on & reset)
   full boot
   fast boot
   run esxDOS (SD)
```

Video timing/machine selection

Select the model your MB03+ Slim is connected to. This option will ensure 100% synchronised digital audio and video output, meaning that software that requires specific model-specific timing will be displayed and run correctly.

```
Video timing (ZX Machine)
   ZX Spectrum 48
   ZX Spectrum 128/+2 grey case
   Harlequin 128 (model D)
   ZX Spectrum 128+2A/+2B/+3
   48K clones on 3.5000 MHz: Humble48, etc.
   Pentagon on 3.5000 MHz
   Karabas 128
```

Note: Setting up a 128K model on a computer with only 48KB of memory will cause the MB03+ to maintain a second video RAM at address 49152 and do some 128K double screen tricks in games and demos.

Audio expansions

The MB03+ brings together most of the audio interfaces available for the ZX Spectrum and combines their audio output into one stereo or HDMI output.

```
Audio output
   enable ULA audio
   enable TurboSound (FM)
   enable SAA1099
   enable MonsterBlaster DA (Soundrive,Covox)
   enable General Sound
   enable SID
   enable TAPE input

TurboSound FM
   chip model: 0-AY, 1-YM
   stereo: 0-ACB, 1-ABC
   type: 0-3xAY or 1-TSFM (2xYM2203)

SID
   chip model: 0-6581, 1-8580
   frequency: 0-PAL, 1-NTSC
```

Audio allows you to link all outputs from various audio devices together, incl. traditional **beeper** (ULA) and the Spectrum 128K **AY chip**. Two AY compatible sound chips joined together are known as the **TurboSound.** AY or YM types in ABC or ACB stereo modes are available, incl. the **FM synthesis**.

Philips SAA 1099 is a 6-voice sound chip used in the SAM Coupé computer, available for the ZX Spectrum also on the ZXM-Soundcard interface. The popular **SID** (Sound Interface Device) is presented in all versions 6581/8580/PAL/NTSC and prepared for future stereo (triple, quadruple) combinations.

And finally the **MonsterBlaster**, the D/A sound converter with four 8bit stereo channels, for a sample-based music. This hardware is compatible with the **Soundrive**. When a program asks for a port number, enter #3F (63 decimal).

Joysticks (interfaces, Sega)

Use a standard Atari joystick with up to 3 buttons. Switch off the Kempston if using computer with this joystick built-in. Various Sega gamepads are also supported, with up to 8 buttons, SEGA Master and Mega Drive (Genesis) compatible.

```
Joystick interface
   none (disabled)
   Kempston

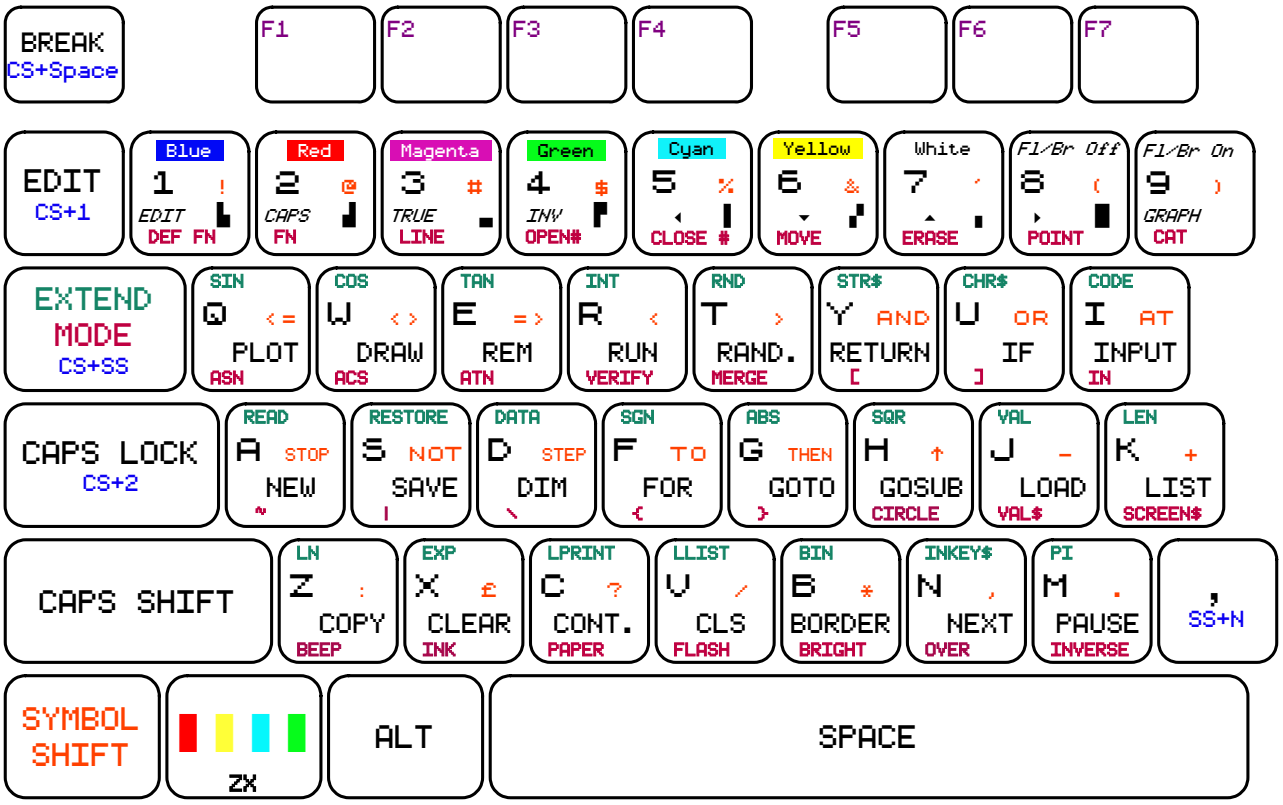
Joystick/DE9 connector
   standard joystick (8bits era)
   Sega controller (3-8 buttons)
```

External keyboard layout

PC	MB03+ Slim
Win	**ZX** (COLOUR or Meta)
Ctrl	**Symbol shift**
Shift	**Caps shift**
Esc	**Break**
Tab	**Extend Mode**

The **ZX Spectrum Delete** key is the **PC Backspace**, not the PC Delete key!

ZX + F11	EXTRA button
ZX + F12	NMI button
ZX + G	GigaScreen (switch)
ZX + D	DVI mode (switch)
ZX + Alt + D	Status (diag) info
SymbolShift + Alt + Delete	Reset
SymbolShift + Alt + Space	Reset + esxDOS reboot



Shifts and extra keys of the ZX keyboard are mapped to a **PC keyboard** as follows:

Caps Shift		**Shift**
Symbol Shift		**Ctrl**
Extend mode	CS+SS	**Tab**
Edit	CS+1	**`** (accent)
Caps Lock	CS+2	**Caps Lock**
True Video	CS+3	**Page Up**
Inverse Video	CS+4	**Page Down**
<=	SS+Q	**Home**
>=	SS+E	**End**

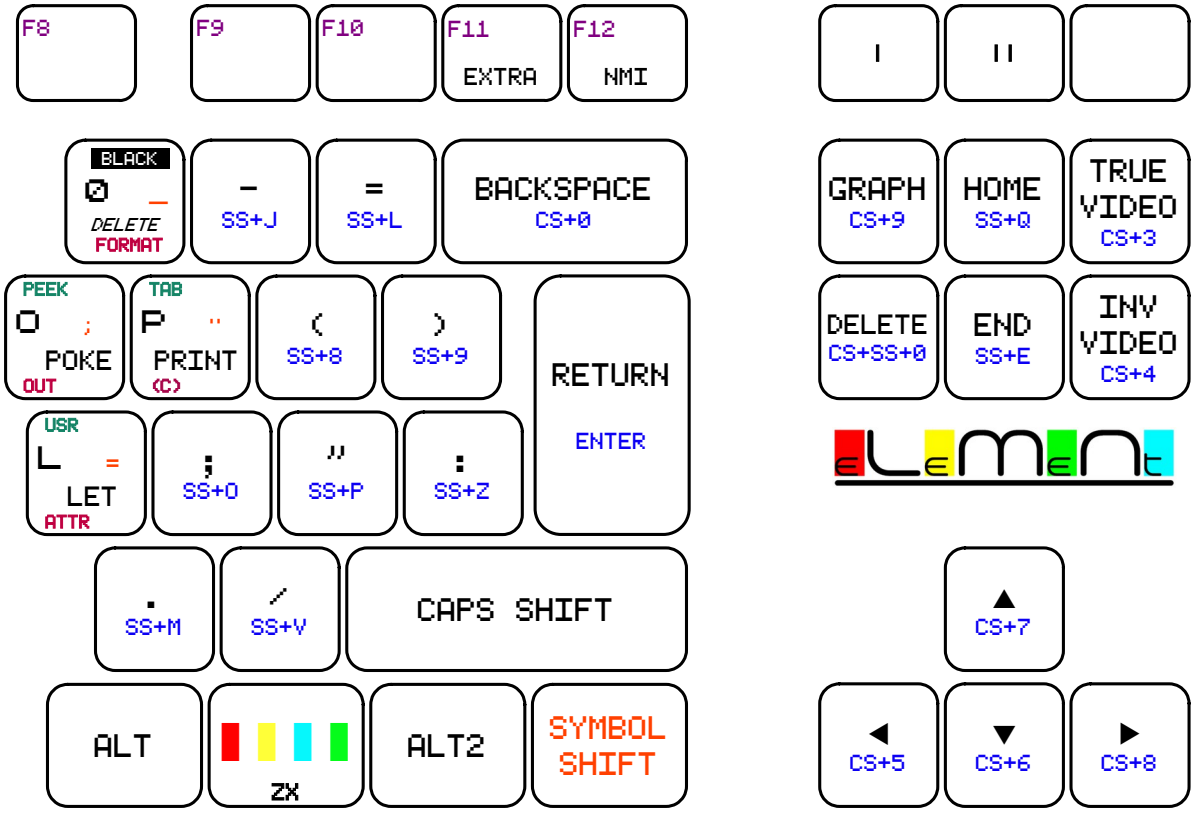
: (colon)	SS+Z	**** (backslash)
Left	CS+5	**Left**
Down	CS+6	**Down**
Up	CS+7	**Up**
Right	CS+8	**Right**
Graph	CS+9	**Insert**
Delete	CS+0	**Backspace**
	CS+SS+0	**Delete**
Break	CS+Space	**Escape**

ZX Basic **colours in extended mode**:

EXT +	keys 0 to 7	key 8	key 9
no caps	paper colours	no brightness	brightness
Caps shift pressed	ink colours	no flashing	flashing

On smaller keyboards **without a separate numeric block**, the numeric keys usually take up part of the main block. In this case, after turning the computer on, press the **NUM lock** key to switch the numeric block off.





esxDOS reboot: push **reset** while **holding the Space** key or
press and release **Symbol shift + Alt** keys while **holding the Space** key

Notes: Every key has a **unique (PC) scancode** and can be read in the same way as the ZX-Uno does. You will find more details in the Programmer´s Reference Manual.

Extended and shifted keys may have different meanings in various programs, especially in numerous Pentagon/Scorpion software.

This keyboard layout is available on the **original eLeMeNt ZX**, highly abrasion-resistant keyboard. Use keycap stickers with other PC keyboards.

Unfortunately, in models **+2A/+2B/+3** the ULA circuit **does not allow** the use of an external keyboard.

SetUp, part II

Mouse and keyboard (USB1 and USB2)

External Keyboard/Mouse
none (disabled)
Keyboard (USB1) & K-Mouse Master (USB2)
Keyboard (USB1) & K-Mouse Slave (USB2)
Keyboard only (USB2)

Mouse is the K-Mouse with up to two buttons and mouse-wheel, available on the USB2 connector. If an external K-Mouse interface is already plugged into the computer, you can set the USB2 to the "slave" option.

External keyboard (always on the **USB1**) means any modern PC keyboard with an USB plug. If you have an external keyboard and a mouse connected at the same time, the keyboard must be on USB1 and the mouse on USB2.

In case of accidental disconnection of the external keyboard, perform **a long reset** (1.5 sec) while holding down the NMI button. This action will re-initialize the keyboard.

Extra button settings

EXTRA button
none (disabled)
Warm reset
GigaScreen

Link the EXTRA button to a function you will use most often. The **warm boot** preserves the state of the divSD machine.

Legacy video modes

TIMEX graphics modes
enable gfx modes

ULAplus
enable ULAplus palettes
enable TIMEX mode
select by ULAplus regs

GigaScreen – old TV/Monitor sum colors effects
none (disabled)
mode0: 2 VRAMs always mixed
mode1: two video frames mix
mode2: autodetect mode1

Switch on Timex graphics, HiColor and HiRes modes and/or ULAplus palette (256 colours).

The graphic effects of GigaScreen are created by quick change of image screens in order to get a colour mix. Video RAMs (or video buffers) are processed in advance in the MB03+, then a digital output is generated, which provides a perfect display, without any flickering image.

Read about new graphic capabilites in the section ***Graphics enhancements***.

Digital Video and CRT effects

Scan line (old CRT/TV) effect
none (disabled)
1/2 1/4 1/8 1/16
1/32 1/64 1/128

Digital Video Interface
enable legacy DVI
enable ULTIMATE sync.

The digital image might be too perfect for a **true retro feeling.** Here you can choose 7 levels of a blurred quality, similar to old TVs/monitors.

Set **enable legacy DVI** when using an old LCD/TV. However, this option does not include a sound stream. You have to **disable** it if you want **to hear a sound** through a modern digital video output.

The ULTIMATE sync performs the best synchronization between DVI and ZX; however, this is still experimental and works only on some TVs.

SD and divSD

Disable SD slots if they interfere with another device.

```
SD storage
   Enable

divSD
   select esxDOS ROM: 0-FPGA (rescue),1-FLASH
   swap order first/second SD

Z-Controller SD
   none (disabled)
   on first SD slot
   on second SD slot
```

You can switch the esxDOS **boot** process from the Flash (ROM) memory to the unbrickable FPGA memory (Core). This is the safest way to test the start of the esxDOS, when something goes wrong.

Many programs support only one SD slot. To avoid having to shuffle SD cards, there is an option of **changing the logical order of SD slots** (switching SD cards no. 1 and no. 2). Also, you can swap the first and the second SD slots.

In addition to the divSD, it is possible to have the **Z-Controller** enabled. This is another SD interface and can be simultaneously attached to one of the SD slots. The Z-Controller is supported by programs for Pentagon, ZX-Evo, etc. Although there are only two physical SD slots in the MB03+, some programs can detect three drives (2xdivSD and one Z-Cntrl.).

UART and Wi-Fi

You can set the power of the Wi-Fi module. If the RF power option is set in the MB03+ SetUp, the signal power is reduced to 50%.

```
UART (Wi-Fi) parameters
   enable
   set lower RF power

UART (Wi-Fi) type
   UART on the USB3
   Wi-Fi via ESP01 module
```

The **UART on the USB3** option connects the computer to a PC and transfer files via the USB cable. A good transfer utility is the *.SERCP* dot-command.

Z80-DMA, Int. etc.

The Z80-DMA chip is necessary to support esxDOS system, as well as some software.

Do not enable SafeNMI and SaveINT if the MB03+ Slim is connected to the eLeMeNt ZX computer.

```
DMA
   enable Z80-DMA
   enable detection of other
        DMA (eLeMeNt ZX)

SafeNMI
   enable

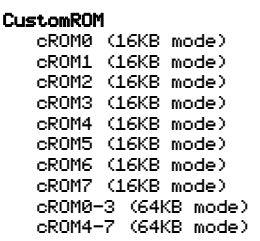
Interrupt
   enable SaveINT
   enable HGFX Interrupt generation
```

Diagnostic

The diagnostic menu serves for testing purposes, for visualising hardware settings and signals, showing them on the edge (in a wider area) of the border.

```
Diagnostic
   none (disabled)
   Video sync.
   Audio level
   CPU speed
   Status info
   Video test text pattern
   Video test color moving pattern
```

Custom ROMs



Here you can switch the ZX BASIC ROM and change your computer's original ROM with an alternative Custom ROM and even on 16KB ROM models use a larger 64KB ROM system, identical to the ZX Spectrum +3/+2A. This option also lets you set an alternative ZX BASIC ROM for the esxDOS.

There is a robust ROM mechanism in your MB03+ Slim, allowing for these combinations:

- eight 16KB ROMs,
- two 64KB ROM
- four 16KB ROM and one 64KB ROM.

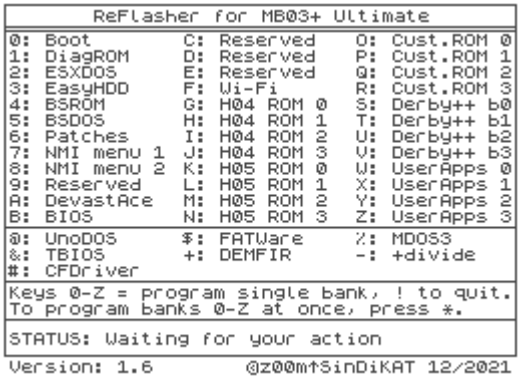
To set one of the 16KB ROMs, choose slots named cROM0 to cROM7 in the SetUp. For one of two 64KB ROM systems, choose cROM0-3 or cROM4-7. After selecting a custom ROM, press R (Shift+r). There are four 16KB ROMs already installed in cROM0 to cROM3, and one 64KB in cROM4-7.

You can flash other ROMs, to any slot, by the Reflasher utility. Remember that when you flash the 64KB ROM for +3/+2A models, you must always flash it continuously into the first half (O, P, Q, R) or the second half (S, T, U, V) of cROM slots. There are also W, X, Y and Z slots for user applications, accessible in the StartUp menu as UserApps A-D.

Core and Firmware Update

It is suggested to update the Firmware before the Core. Both Firmware and Core updates are done with the ZX Spectrum utilities. An old method of the Core update from a PC system, through a USB cable, is also available. The latest Firmware and Core you can find on the webpage https://mb03.elementhw.com/download

How to flash Firmware



For a Firmware update, use the **ReFlasher utility**. Update at least both Boot and SetUp files.

Download the *UPDATE20XXXXXX.zip* file. Extract this file to a folder on a CF card or an SD card. Insert the card into your MB03+ and connect the MB03+ to the ZX Spectrum, then boot the system.

Run the *ReflashrSlim.tap* file. At the prompt of this utility, press the key corresponding to a number or a letter or *** (asterisks) for all slots** flashing. Be aware: upper and lower case letters are treated differently.

After every (even partial) update you have to **reset computer, go into the SetUp** and then **press CS+L** (for Load Defaults).

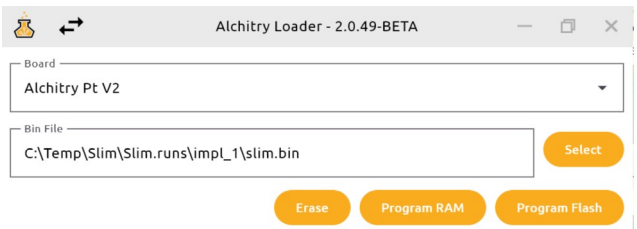
Core update

Use the **elCoreUp utility** to update FPGA core. Download the file *UPDATE20XXXXXX.zip*. Extract the content of the file to a folder on an SD card. Put the card into your MB03+ Slim and connect the MB03+ to the ZX Spectrum. Then boot the esxDOS system.

Run the *elCoreUp.tap* file and follow the instructions on the screen. The elCoreUp tool automatically detects the FPGA module type, looks for an appropriate binary on the SD card and flashes the FPGA core.

Core update - using a USB cable

For an upgrade made from a PC, make a link between a PC computer and the USB3 port and run the **Alchitry loader** for the Linux/Mac/Windows, from the webpage alchitry.com/alchitry-labs.



To flash a core, the **box „Program Flash"** must be always checked, otherwise the firmware will be stored temporarily, only until a reset of the computer.

Rescue Mode

The MB03+ Slim has a built-in RESCUE MODE that you can use if you overwrite or damage important parts of the firmware in the FLASH memory and your favourite system will not start. In this mode, the device always reliably runs the backup version of the esxDOS v0.8.9.

To activate RESCUE MODE, follow these steps:

- Open the interface case and find two small switches on the left side of the board.
- Turn the second DIP lever to the ON position.
- Connect the MB03+ board to your ZX Spectrum and turn it on.
- While resetting, hold the BREAK key. The MB03+ will then boot into rescue divSD mode.
- Re-flash any damaged or non-functional areas by following the ***How to update HW Core and Firmware*** section. If you're unsure about what needs fixing, flash all the basic firmware parts in slots 0 to B.

Finally, put the DIP switch back and close the MB03+ Slim case.

Troubleshooting

For each problem, a typical situation is described, followed by a hint. Please check the corresponding SetUp option (in the box).

App runs to a black screen

The app may use an enhanced graphics mode. An HDMI connection is needed.

Check the digital AV cable or test another one.

No sound in the digital audio

You have already checked a TV/monitor connection, the picture is brilliant, but no sound can be heard.

Turn **old DVI off**. `SetUp: Digital Video Interface / enable legacy DVI`

esxDOS does not start after reset

The esxDOS welcome screen does not appear. Holding the SPACE key when you reset the computer (or pressing Symbol shift + Alt + Space on the external PC keyboard) does not cause the esxDOS to detect an SD card.

Check if the **divSD is on**. `SetUp: SD storage`

Check the **order of SD slots**. `SetUp: divSD / swap order first/second SD`

Switch to the backup **ROM** (**FPGA**).

`SetUp: divSD / select esxDOS ROM: 0-FPGA (rescue), 1-FLASH`

Disconnect the TV/monitor cable. Even if the computer is switched off, some TVs may still supply low power to the computer via a digital video connection. The SD card is locked and needs to be totally powered off, cut off from any power.

PC keyboard does not work

The keyboard was not initiated by startup, LED indicators on the keyboard are off.

Check the USB1 setting. `SetUp: External Keyboard/Mouse / Keyboard (USB1)`

Start-up behaves strangely

The startup procedure is frozen. Some quirks or random colourful attributes have appeared on the screen instead of the standard welcome (ROM) message.

Flash the firmware again (see the previous page).

esxDOS

The esxDOS is an operating system for modern storage media, so it is an ideal system for **divSD** slots in your MB03+ Slim**.** The esxDOS has a built-in tape and betadisk (TR-DOS) layer and performs all load- and save- operation within TAP, TRD and SCL files. The built-in file browser helps to access and run files stored on SD cards easily.

To re-initialize the esxDOS, press the **reset button and hold the SPACE key** while resetting. If the SD card cannot be detected this way, power off/on the computer.

BASIC commands

The esxDOS provides a set of BASIC keywords with a customized syntax in order to support a file-handling to/from SD cards. Currently the following commands are implemented:

drive means: * (current drive), hd0 (main SD slot) or hd1 (second SD slot)
[LINE | CODE | BIN] are alternatives - choose one (LINE or CODE or BIN)

change directory	GOTO *drive* "*path*"	GOTO hd0"games"
	GOTO *var*	LET name$="games/gyron": GOTO name$
list directory	CAT *drive*	CAT hd0
	(or DIR in some ROMs)	
	fast dir:	CAT
	detailed list of current drive:	CAT *
load file	LOAD *drive* "*path/filename*" [CODE | SCREEN$]	
		LOAD *"/progs/editor.bas" LOAD *;name$
merge file	MERGE *drive* "*path/filename*"	
save file	SAVE *drive* "*path/filename*" [LINE | CODE | BIN | SCREEN$]	
	save screen picture:	SAVE *"filename" SCREEN$
	save „raw" file without +3DOS header:	SAVE *"/DAT/filename" BIN 40000,25000
delete file	ERASE *drive* "*path/filename*"	

To recognize ZX file types, the esxDOS adds ZX-headers (metadata compatible with +3DOS) to the beginning of each file. However many data files can be used, saved and loaded as "raw" files, without headers. For example, a **screen image** can be saved into a **standard SCR file** with the command SAVE *"name.SCR" BIN 16384, 6912

Dot-commands

Dot-commands are system commands located in the /BIN directory on the SD card. These are executed directly from BASIC by typing a command with or without parameters.

Many basic dot-commands are quite self-explanatory, typing them without any parameter will print a short instruction. Most of them may use a syntax known from modern PCs, e.g.

.LS .CD .RM .MV .MKDIR .CP .MORE .FILE .TAR .CAL .DATE

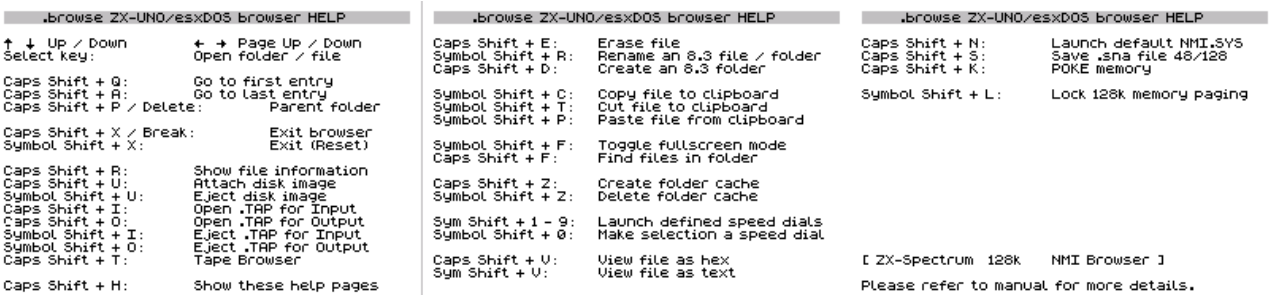
NMI Menu or File Browser

The esxDOS provides a simple **NMI Menu**, which serves as a filebrowser. It recognizes the most popular file formats and helps to run files. You can also make system snapshots (store all memory to an SD card).



An advanced **File Browser and Viewer** can display **long filenames** (LFN) in directory listings, perform a lot of useful file handling operations and play many audio and video file formats.

If needed, you can return to the original NMI menu with **CAPS SHIFT+N**.



Configuration files

There are two text files ESXDOS.CFG and TRDOS.CFG in the directory /SYS/CONFIG, for setting up the esxDOS itself and for the TR-DOS emulation. All options are already set so that software runs to the best user's satisfaction, here are some examples to check:

TRDOS.CFG	**AlwaysBoot**	if a boot-file is missing, TR-DOS Navigator starts with TRD/SCL files
ESXDOS.CFG	**AutoBoot**	a way the /SYS/AUTOBOOT.BAS file starts
ESXDOS.CFG	**AutoLoadColour**	depends on BORDER colour you like
ESXDOS.CFG	**DMA timings**	in the eLeMeNt make the best transfer speed ever available for ZXS

How to prepare a card for the divSD

SD cards must be formatted as FAT16 (for cards under 2 GB) or FAT32 (for larger cards). A suitable tool is the ***SD Formatter***, www.sdcard.org. An easy point-and-click tool for Linux is the ***Gparted***.

To get the best performance, copy the **SYS and BIN folders to a newly formatted card first**! Please also note that the system will give you quicker responses with bigger clusters of the SD card.

Compatible system ROM

These patched or improved ZX BASIC ROMs were tested and work with the esxDOS and its NMI system: **Pretty** (Colour) ROM, **64Char** ROM, **GAMA81** ROM, **GW03** ROM and **ZXDIR** ROM. Nowadays, new esxDOS commands can do the same job as many functions in older patched ROMs did.

Contents

Quick start with the MB03+ Slim.....4

- Turning on
- Buttons
- Optional connections
- SD card
- Can I use another interface?
- StartUp options

MB03+ enhancements.....7

- Legacy graphics modes
- New graphics capabilities
- Audio expansions
- Memory expansions

SetUp.....10

- StartUp mode
- Video timing / machine
- Audio expansions
- Joysticks (interfaces, Sega)

External keyboard layout.....12

SetUp, part II.....14

- Mouse and keyboards
- Extra button settings
- Legacy video modes
- Digital video and CRT effects
- SD and divSD
- UART and Wi-Fi setup
- Z80-DMA, Int. etc.
- Diagnostic
- Custom ROMs

Core and Firmware Update.....17

- How to flash Firmware
- Core update
- Core update - using a USB cable

Rescue Mode.....18

Troubleshooting.....19

- App runs to a black screen
- No sound in the digital audio
- esxDOS does not start after reset
- PC keyboard does not work
- Start-up behaves strangely
- Audio output is not clear

esxDOS.....20

- BASIC commands
- Dot-commands
- NMI Menu or File Browser
- Configuration files
- How to prepare a SD card
- Compatible system ROMs

Useful links

www.elementhw.com	news, manuals, FPGA core and firmware updates
t.me/eLeMeNt_forum	Telegram **info-channel** – user support, news
ilnx.cz/element-zx	**premium software** - copier, file (SD) manager, viewer, editor
esxdos.org	FAT-based **operating system** for DivSD
thefossilrecord.co.uk	LFN **file browser** and NMI menu for esxDOS
zxart.ee	great site with **zx-enhanced software collection** (and more)
vtrd.in	all **Betadisk** software collection
element.zxfiles.net	eLeMeNt hardware (eZX and MB03+) resources
vym.cz/sercp/	USB-**PC link** utility, serial copier
hood.speccy.cz	Wi-Fi tools for eLeMeNt ZX/MB03+
ilnx.cz/lnxsp	LnxSpectrum **emulator**
www.dadither.com	graphics PC **converter**

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Josef Prokeš . user manual / web

How to control MB03+ Slim hardware in ZX BASIC

Apart from the SetUp, you can change any hardware setting quickly by sending a value to system ZXi ports. Enable a device or switch to another timing temporarily. Use the OUT command of the ZX Spectrum BASIC and type:

The order of SD slots: `OUT 28731,29 : OUT 28987,3`

This assigns the SD slot No. 2 to the first SD position (used as HD0 in esxDOS).

The second zx128-like videoRAM on the ZX Spectrum 48KB (at address 49152):

```
OUT 28731,9 : OUT 28987,1
```

joystick:	`OUT 28731,7 : OUT 28987,0`	off
	`OUT 28731,7 : OUT 28987,1`	Kempston
Timex graphics:	`OUT 28731,12 : OUT 28987,1`	on
ULAplus colours:	`OUT 28731,13 : OUT 28987,1`	on
Z-Controller:	`OUT 28731,44 : OUT 28987,2`	use SD slot No. 2
extra button:	`OUT 28731,32 : OUT 28987,0`	this holds a CPU only
	`OUT 28731,32 : OUT 28987,1`	warm reset
	`OUT 28731,32 : OUT 28987,3`	Gigascreen switch

There are settings that not only switch a single option, but set multiple options at once. Before you turn a particular option on/off, inspect a state of the relevant ZXi port:

```
OUT 28731,1 : PRINT IN 28987
```

This example reads a value of the Audio output register. You can check now what audio chip is set on. From positions 0 to 4, single bits of the read number hold states of: ULA audio (beeper), AY/TurboSound FM, SAA1099 (Sam Coupe sound chip), Monsterblaster/Soundrive AD, General Sound IF and SID (C64 sound chip). Type your new settings; here is an example:

```
OUT 28987,65        ; turn beeper and SID on (bits 0 and 5 are set)
```

See other hardware ports in the MB03+ Programmer's Manual at www.elementhw.com.
When using OUT instructions, you have to know exactly what you are doing, otherwise you may freeze your system.