

# **Ultimate 1MB, Incognito and 1088XEL|U1MB Firmware**

## **for Atari 8-bit Computers User's Manual 11th Edition**

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*Revised to cover main BIOS v.2.0, PBI BIOS v.2.0, and XEX Loader v.2.0.*

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## Introduction

This document covers use of the 'alt' firmware (including BIOS setup utility and XEX loader) for Ultimate 1MB and Incognito upgrades. A version of the XEX loader is also provided for the SIDE/SIDE2 cartridge. The new firmware is supplied as three separate files (Main BIOS, PBI BIOS, and XEX loader), and in the case of U1MB, a single 64KB firmware ROM which may optionally be used to update all three components at once.

The new Main BIOS was created from scratch, initially to address certain limitations of the original firmware, to facilitate further development of the PBI BIOS, and allow more flexible use of the flash ROM space. A new XEX loader was subsequently developed and the PBI BIOS significantly reworked, resulting in an almost complete ground-up rewrite of all firmware components.

Enhancements provided by the new firmware include:

- The ability to set the date and time from the setup menu
- Three configuration profiles
- Modular menus covering system settings, hard disk, device setup, etc
- Super-fast XEX loader with speed-search facility and multiple FAT partition support
- ATR disk images, XEX files, APT partitions, 8KB ROMs and BASIC programs all handled by the loader
- Scripting facility to automatically handle mounting of multi-disk titles
- Turbo-Freezer compatibility
- Customisable BIOS entry, reboot and partition table rescan shortcut keys
- OS-independent high speed SIO for serial disk drives (US Doubler, Happy, XF551, etc)
- OS-independent SIO2BT operation (with optional high-speed support)
- 'Z:' RTC driver
- Optional BIOS logo screen and boot device selection menu
- Optional flash write protection (Ultimate 1MB only)
- System information page displaying CPU type, audio/video hardware, etc
- BIOS Plugin API for diverse hardware control (Ultimate 1MB only)
- Plugin modules supporting Stereo Pokey, Covox, Soundboard, Rapidus, and the 1088XEL
- Variable SpartaDOS X ROM sizes (192, 256 and 320KB), and the ability to boot the WIP Graphical OS (when 192KB SDX is used)

## Acknowledgements

Writing replacement firmware for Ultimate 1MB from the ground up turned out to be an even bigger task than I expected it to be, and when the scope of the project broadened to encompass the 1088XEL Mini-ATX motherboard project in late 2017, the undertaking at times threatened to become completely overwhelming. Fortunately, I received plenty of expert help, advice and encouragement from the most knowledgeable figures in the Atari community. Sincerest thanks to:

- Hias for testing (with Turbo-Freezer and a scope), suggestions, technical assistance, and especially for his fantastic high-speed SIO code which he kindly allowed me to incorporate into the PBI BIOS
- Phaeron for his encyclopaedic knowledge, technical insights, the fabulous Altirra Hardware Manual, and most of all for the incredible Altirra Atari 8-bit emulator
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- Michael St. Pierre (mytek) for his support, donations, and for placing the alt-BIOS powered U1MB at the heart of his 1088XEL motherboard project

Special thanks also to all the members of the Atari 8-bit community who take the time to report bugs, lodge feature requests, and make donations in recognition of the enormous amount of time invested into the development and maintenance of this firmware.

## Installation

The procedures for updating from the original (Candle) firmware and for applying updates to equipment already running the new firmware are broadly the same, since the flashing software (UFLASH) is capable of handling the transition from old to new.

### Updating with SIO2SD or SIO2PC and a Peripheral Emulator

#### Ultimate 1MB

1. Remove any cartridges (including SIDE/SIDE2) or PBI peripherals.
2. Mount the supplied update ATR (FIRMWARE.ATR) on drive 1.
3. Enable SpartaDOS X in the U1MB BIOS.
4. Disable 'SIDE Hardware' (original BIOS) or 'PBI BIOS' (new firmware).
5. Ensure extended memory is set at '1088KB RAMBO'.
6. Save the setting and press 'C' to reboot the machine.
7. You should see the SpartaDOS X prompt 'D1:.'. Type UFLASH.XEX and press Return.
8. If your hardware is not automatically detected, do not proceed.
9. Assuming the hardware is detected, navigate to the 'Firmware' entry and press Return.
10. From the resulting file list, select 'FIRMWARE.ROM' and press Return.
11. Press Return again to confirm the flash.
12. Reboot the machine.
13. If updating from the original Candle firmware, you will immediately be sent to the configuration menu (with the message 'Profile 1 reset'), where you should set the system clock and make any other adjustments as you wish, before saving the new configuration and rebooting the machine by pressing 'B'.

Advanced users may wish to flash individual components (Main BIOS, PBI BIOS, and Loader) separately, but since it's critical that components from different releases should not be 'mixed and matched', it's recommended that the complete firmware ROM be applied.

#### Incognito

Since the Incognito firmware is spread around the flash ROM, it's currently not possible to flash all components at once, so one must flash them individually.

1. Remove any cartridges.
2. Mount the supplied update ATR (FIRMWARE.ATR) on drive 1.
3. Enable XL/XE mode and SpartaDOS X in the Incognito BIOS.
4. Disable 'SIDE Hardware' (original BIOS) or 'PBI BIOS' (new firmware).
5. Ensure extended memory is set at '1088KB RAMBO'.
6. Save the setting and press 'C' to reboot the machine.
7. You should see the SpartaDOS X prompt 'D1:.'. Type UFLASH.XEX and press Return.
8. If your hardware is not automatically detected, do not proceed.

9. Assuming the hardware is detected, navigate to the 'Main BIOS' entry and press Return.
10. From the resulting file list, select 'BIOSxxx.ROM' and press Return.
11. Press Return again to confirm the flash.
12. Repeat the above process for the 'Loader' entry (selecting 'ILOADxxx.ROM') and the 'PBI BIOS' entry (choosing 'IPBIxxx.ROM'), in that order.
13. Reboot the machine.
14. If updating from the original Candle firmware, you will immediately be sent to the configuration menu (with the message 'Profile 1 reset'), where you should set the system clock and make any other adjustments as you wish, before saving the new configuration and rebooting the machine by pressing 'B'.

## Updating with the SIDE XEX Loader

You can update the firmware using the SIDE loader by placing UFLASH and the ROM files in a FAT partition on your Compact Flash card.

### Ultimate 1MB

1. Place UFLASH.XEX and FIRMWARE.ROM in the FAT partition of your CF card, plug the card into your SIDE cartridge and attach SIDE to the Atari.
2. Turn on the Atari while holding down the 'L' key to run the SIDE XEX Loader.
3. If already using the new SIDE loader, make sure that 'FMS Handler' is set to 'Enabled' in the Options menu.
4. In the FAT directory listing, navigate to 'UFLASH.XEX' and press Return to run it.
5. If your hardware is not automatically detected by UFLASH, do not proceed.
6. Assuming the hardware is detected, navigate to the 'Firmware' entry and press Return.
7. From the resulting file list, select 'FIRMWARE.ROM' and press Return.
8. Press Return again to confirm the flash.
9. Reboot the machine.
10. If updating from the original Candle firmware, you will immediately be sent to the configuration menu (with the message 'Profile 1 reset'), where you should set the system clock and make any other adjustments as you wish, before saving the new configuration and rebooting the machine by pressing 'B'.

Advanced users may wish to flash individual components (Main BIOS, PBI BIOS, and Loader) separately, but since it's critical that components from different releases should not be 'mixed and matched', it's recommended that the complete firmware ROM be applied.

### Incognito

1. Place UFLASH.XEX and FIRMWARE.ROM in the FAT partition of your CF card, and plug the card into your Incognito's card slot.
2. Turn on the Atari while holding down the 'L' key to run the SIDE XEX Loader.
3. If already using the new SIDE loader, make sure that 'FMS Handler' is set to 'Enabled' in the Options menu.
4. In the FAT directory listing, navigate to 'UFLASH.XEX' and press Return to run it.



5. If your hardware is not automatically detected by UFLASH, do not proceed.
6. Assuming the hardware is detected, navigate to the 'Main BIOS' entry and press Return.
7. From the resulting file list, select 'IBIOSxxx.ROM' and press Return.
8. Press Return again to confirm the flash.
9. Repeat the above process for the 'Loader' entry (selecting 'ILOADxxx.ROM') and the 'PBI BIOS' entry (choosing 'IPBIxxx.ROM'), in that order.
10. Reboot the machine.
11. If updating from the original Candle firmware, you will immediately be sent to the configuration menu (with the message 'Profile 1 reset'), where you should set the system clock and make any other adjustments as you wish, before saving the new configuration and rebooting the machine by pressing 'B'.

## Re-flashing the Entire ROM

Using either the SIO2xx method or the SIDE XEX loader method, you may flash the entire 512KB ROM with the provided binary ('FULLROM.ROM'), which includes a SpartaDOS X, a selection of Operating Systems, BASIC interpreters and programming tools, as well as the complete firmware package. Unlike other upgrade methods, this approach will replace the contents of your ROM including any customisations you have already made.

## Other Upgrade Methods

The supplied ATR containing the flashing tool and ROMs may also be mounted using the XEX loader (providing the PBI hard disk is enabled). The process is then basically identical to the SIO2xx method, with the advantage that ROMs will be loaded much more quickly.

**Note: When updating the PBI BIOS from a PBI-mounted ATR, be aware that you are actually erasing and flashing the ATR handler itself. Because of this, a reboot immediately after a PBI BIOS update is recommended, and if you're flashing all three firmware components, you should update the PBI BIOS last and reboot immediately afterwards.**

Finally, UFlash and ROM files may be copied to APT hard disk partitions. The same precautions apply, however, regarding the PBI BIOS as apply to ATR-based updates.

## Troubleshooting and Recovering from Flash Problems

While UFLASH is a very reliable means of updating the U1MB/Incognito flash ROM, when updating the main BIOS, there is always a very slim chance that a bad flash could render the machine unbootable. A bad flash could occur for the following reasons:

A power failure or system reset half-way through the programming process

System instability or poor connectivity

Flashing a corrupt or incorrect BIOS image

UFLASH only allows files with valid headers to be flashed to firmware slots, so it's almost impossible to flash the wrong file to the BIOS slot. System instability, meanwhile, has proved to be the biggest obstacle when upgrading to the new firmware. One specific issue especially common on U1MB-equipped 1200XLs is noise on the reset line. This can manifest issues even with the original firmware, but issues tend to be worse with the new firmware because of the new firmware's heightened dependency on properly working hardware.

The solution to the noisy reset issue is simple, however. Solder a 1nF ceramic capacitor between the RST pin of the U1MB (on the reverse side of the board, under the P4 header) and GND (a nearby GND pin of the PLCC flash ROM socket is ideal). The fix prevents noise from the reset line causing the U1MB itself to spuriously reset after the BIOS menu has already been activated, and applies equally well to other Atari models experiencing U1MB BIOS menu screen corruption.

Another simple fix which sometimes works is replacing the 74LS08 IC with one from a different machine. If this doesn't help, sometimes changing the CPU can correct problems.

Other stability issues can be caused by marginal connections on ribbon cables and sockets. On properly installed and stable equipment, however, UFLASH is a safe and reliable means of applying firmware updates.

If you do find yourself with a 'bricked' machine, the only solution is to remove the PLCC Flash ROM and re-flash it in another device. The most common means of doing this is with a USB EPROM programmer. Such devices are now inexpensive and widely available, the MiniPro TL866CS being a good example.

## The Splash Screen

By default, the new BIOS displays a 'splash screen' whenever the machine is rebooted (although this can be turned off). The splash screen has a progress bar which fills up while the BIOS waits for a keystroke from the user.



At the bottom of the screen, the selected BIOS menu entry hotkey is displayed, along with the XEX loader shortcut key ('L'). Note that if the system is configured to boot directly to the loader, the loader shortcut will not be displayed. Finally, if the PBI BIOS is enabled, pressing 'D' will invoke the boot drive screen, where the boot drive may be chosen on a 'one-off' basis, temporarily overriding whatever is selected in the hard disk setup menu (see the 'Boot Drive' section).

Note you may press the space bar while the splash screen is displayed to immediately clear it and get on with booting the operating system.

When the splash screen is disabled, one may still make use of any of the available shortcut keys by simply powering on the machine with the selected key held down.

***Note: To immediately clear the splash screen and proceed with booting the operating system, press the space bar or Escape key. You can also temporarily disable SpartaDOS X or the GOS (or the XEX loader if the system is to boot directly to the loader) by pressing 'X' while the splash screen is displayed. The ROMs will remain disabled until the next forced cold boot.***

## The New BIOS Setup Utility

The opening menu of the new BIOS setup menu looks like this:



The eight icons represent categorized menus, which you may move between by using the left and right cursor keys or a joystick connected to port 1. To select an option in a menu, use the joystick or the up and down cursor keys to move the highlight bar.

Initially, the menu will display 'Profile 1 reset!', and all options will be set to default values.

To cycle through a list of highlighted options, press Return or press and release the joystick button with the stick in the neutral (central) position (you may also nudge the joystick into the DOWN position while holding the button, before releasing the button with the stick in the neutral position). To cycle backwards through the list, press the joystick button and nudge the stick into the UP position before releasing the button with the stick centred, or press Control and Return.

Settings do not become permanent until saved and are otherwise discarded from the menu upon Reset or when the menu is left by other means (see later). You will be reminded of any unsaved settings when leaving the menu via the reset key or via the selections in the 'Save and Exit' menu at the extreme right. Save settings by navigating to the 'Save and Exit' menu, and selecting one of the available choices with the Return key or joystick button, or by pressing one of the shortcut keys listed at the right-hand side. For example: press 'S' to save settings without leaving the setup menu.

You will notice that some settings are mutually exclusive: for example, Graphical OS (if it is available), is automatically disabled when SpartaDOS X is enabled, and vice versa. Notice also that some menu items are 'dimmed' or 'greyed out', and as a consequence not selectable. Sometimes

this depends on the state of other settings (for example, no hard disk menu items can be changed when the PBI BIOS is disabled), and sometimes it depends on the underlying hardware (for instance, the 'XEGS Slot' options are only available when the machine is an Atari XEGS, or at least when the Ultimate 1MB is configured for that machine type).

We shall now take a brief look at each menu in turn.

## Memory and System ROMs

The *Memory and System ROMs* menu (previously pictured) permits the selection of extended RAM size (Disabled, 320KB RAMBO, 576KB CompyShop, or 1088KB RAMBO), one of four operating systems, one of four BASIC ROMs (which may be any 8KB ROM, but occupying the internal BASIC space), one of four XEGS 8KB ROMs (occupying the *Missile Command* slot and only available when Ultimate is configured for an XEGS machine), and the status of *SpartaDOS X*, the WIP Graphical Operating System, and the SIDE XEX Loader. Note that the GOS (Graphical Operating System) will only be available if the Ultimate 1MB has previously been configured for a 192KB build of SDX (SpartaDOS X). Details on how to do this are provided in the 'ROM Configuration' section.

By using UFlash or a compatible ROM editor, it is possible to populate the Operating system, BASIC and XEGS ROM slots with any content desired. In the *OS ROM* slot, the stock Ultimate ROM includes, for example, a Stock XL/XE OS, Atari OS B (PAL), Q-Meg OS, and the XEGS OS.

Note that saved changes to the RAM, OS ROM or SDX/GOS configuration will trigger a mandatory cold restart when exiting the menu by any means, including the Reset key.

*Tip: To temporarily disable SpartaDOS X or the GOS when booting, press the 'X' key on cold powerup or prior to an OS reboot. This is somewhat easier when the splash screen is enabled (otherwise you must press – for instance – 'C' and 'X' in very quick succession).*

As of BIOS version 2.0, it's also possible to suppress the internal BASIC ROM during the OS boot via the 'BASIC default' option, which may be Enabled or Disabled. However, this functionality (which merely affects the default state of BASIC; it remains accessible via the usual writes to bit 1 of PORTB) depends on the PBI BIOS being enabled. When the PBI BIOS is disabled, 'BASIC default' will be dimmed and set to 'Enabled'. Since disabling of BASIC in this manner is (like the PBI BIOS notice) achieved by on-the-fly patching of the OS display handler, it is not guaranteed to work with custom operating system ROMs. If problems are observed, leave internal BASIC enabled.

**Note: the XEX loader had its own BASIC enable/disable option which will override the main BIOS's setting. Therefore, if you wish to boot via the loader an ATR or load an XEX which requires BASIC, there's no need to first go back into the main BIOS setup menu and enable BASIC should you have it set to 'Disabled'. The main BIOS setting takes precedence again on subsequent normal system reboots.**

## System Clock and Features

The System Clock and Features menu allows setting of the system clock, selection of the VBXE hardware base address (if present), and control of Soundboard, Stereo Pokey (if present), and Covox.

To set the system clock, simply cursor to the desired field (date, month, or year, for example) with the Tab key or by nudging the joystick right with the button down, and then scrolling up or down through the available values with return or the joystick button. Notice that when changing the date, the day of the week is automatically updated, and now corresponds correctly with the day of the week shown by the SpartaDOS X TD line.

Unlike other settings, changes to the system clock become permanent immediately.

Regarding the other settings, it should be noted that – with the exception of Covox – the BIOS already knows which audio and video hardware is present and controllable by the Ultimate 1MB. If a device is greyed out, it means it cannot be enabled or disabled via the menu settings, although it may still be present. For example, if Stereo Pokey is greyed out but set to 'Enabled', the machine contains a Stereo Pokey board which is either permanently enabled, or controlled by other means (by a toggle switch on the back of the computer, for instance). Likewise, if Stereo Pokey is greyed out and set to 'Disabled', not only does Ultimate 1MB have no control over the stereo hardware, but no such hardware was detected; therefore, it is either not installed, or is currently disabled by other, external means.

An exception to this rule is Covox, since that hardware cannot be silently detected by the BIOS. However, both the Stereo Pokey and Covox options are actually part of the default BIOS plugin (see the 'Plugins' section) and may be removed if the ability to control such hardware is not required.

## **PBI BIOS and Hard Disk**

The PBI BIOS and Hard Disk menu is the largest menu of all and provides numerous settings which apply to the integral hard disk (when used with the SIDE/SIDE2 cartridge). We shall discuss the individual options in some detail. Note that because the PBI BIOS is now able to (optionally) provide OS-agnostic high-speed SIO drivers (configured using the next menu: HSIO Settings), the presence of a SIDE2 cartridge is no longer a pre-requisite for PBI functionality.

### **PBI BIOS**

Unlike the original Ultimate Setup which described the PBI BIOS as 'SIDE Hardware', enabling the PBI BIOS does not now automatically imply that the SIDE hard disk has become active. A separate setting ('Hard Disk') must be set to 'Enabled' before the PBI hard disk will become active. When 'PBI BIOS' is disabled, all other items are greyed out and unavailable, but they will revert to their prior settings when the PBI BIOS is enabled again.

### **PBI Device ID**

Once the PBI BIOS is enabled, the next available setting is 'PBI Device ID'. This allows the PBI device number (0-7) to be changed (the Atari can manage up to eight PBI devices, each with a unique ID). Only the even ID numbers (0, 2, 4, 6) can be assigned to the Ultimate PBI device.

### **Hard Disk**

The 'Hard Disk' setting simply switches the hard disk on and off. If the hard disk is off, 'ATR swap button', 'Boot Drive', 'D1: Redirect', 'CONFIG.SYS', 'HDD write lock' and 'HDD rescan key' will be unavailable and deactivated.

Note: the U1MB PBI BIOS makes the SIDE driver (a SpartaDOS X SIO driver allowing access to the SIDE cartridge's hard disk) completely unnecessary. To use the PBI hard disk, place the SIDE's switch in the upper (loader) position. This – together with the PBI BIOS – disables all ROMs on the SIDE cartridge, since none are required (SDX and the XEX loader on the U1MB ROM should be used instead).

### **ATR Swap Button**

Next is the 'ATR swap button'. The ATR swap button – when pressed – rotates the drive numbers of multiple mounted SIDE/SIDE2 disk images (see the section on the *SIDE Loader*). When no ATRs are mounted, or when the button is disabled, it has no effect. A side-effect of the ATR Swap Button being enabled is that the external cartridge is suppressed. This is normally desired behaviour when using SIDE PBI hard disk emulation (since SIDE's cartridge ROM is not usable when the PBI HDD is enabled), but if you wish to use the High-Speed SIO feature of the PBI BIOS with some other external cartridge, the ATR Swap Button must be disabled.

## Boot Drive

Setting 'Boot drive' forces the system to boot from a particular hard disk partition when SDX is not active, or when SDX is active but the 'CONFIG.SYS' option (see later) has not been set. In older firmware versions, the boot partition was always specified in the partition table on disk, and no provision was made to override this. Now, however, one may override the boot setting in the partition table. Settings are as follows:

Disabled. The OS will boot from the default boot drive, which is usually drive 1.

D1:-DO:. Drives 1 through 15. When SDX is disabled, the OS will boot from the specified drive (i.e. HDD partition). If no partition exists on the specified drive number, the OS will boot from the default boot drive (usually drive 1).

Disk: The boot drive number will be taken from the partition table, as with older firmware versions. If no boot partition is specified in the partition table, the OS will boot from the default boot device (usually drive 1).

Note that boot drives should refer to hard disk partitions, not serial disk drives or other devices not managed by the PBI BIOS. If no HDD partition is mounted on the specified drive number, the setting will be ignored and the system will boot from the OS default (usually drive 1).

## D1: Redirect

The next item on the menu is 'D1: Redirect', which is another feature suggested by ProWizard. When the PBI BIOS is enabled, this allows the redirection of all 'D1:' IO requests to whichever partition is selected as the Boot drive, and references to the Boot drive to be redirected to 'D1:'. There are some conditions:

'Boot Partition' must refer to a working hard disk partition, NOT a serial disk drive. If the boot partition doesn't exist, redirection will not occur.

The boot partition must be on some drive other than D1: (indeed, the option will be greyed out when the boot drive is D1:).

The envisaged purpose of boot drive redirection is to allow rapid switching between two bootable disk operating systems – for example, MyDOS on partition 1 and SpartaDOS 3.x on partition 2. If partition 1 is assigned the drive ID 'D1:' and partition 2 assigned 'D2:', then engaging and deactivating 'D1: Redirect' between cold boots will effectively swap those first two partitions around, allowing the machine to boot from one or the other without the need to persuade the operating system that the boot device is anything else than the usual 'D1:'. Aside from that, the setting should be used with caution, since if enabled unintentionally it will likely cause significant confusion.

## CONFIG.SYS

The new 'CONFIG.SYS' setting causes SDX to read 'CONFIG.SYS' from the specified drive, which also becomes the default logged drive once SDX has booted. When SDX is disabled (either in the BIOS settings or via 'COLD /N') the CONFIG.SYS setting is ignored and the OS boots from the 'Boot drive' partition instead. If the 'CONFIG.SYS' setting is disabled, SDX will fall back to the 'Boot drive' setting



and attempt to load CONFIG.SYS from that drive instead. If both settings are disabled, D1: will be used.

The idea of having separate 'CONFIG.SYS' and 'Boot drive' settings – as with the IDE Plus 2.0 BIOS, from which the idea was taken – is to allow convenient switching between SDX and another DOS (e.g. MyDOS) without having to change the boot drive setting each time.

### **HDD Write Lock**

'HDD write lock' is a system-wide hard disk write lock, and has three settings: Disabled, Physical Disk, and Global. 'Disabled' allows writes to all areas of the hard disk. 'Physical Disk' allows writes to partitions (logical drives), but disables low-level, physical disk writes to the MBR, APT records and other areas of the hard disk. 'Global' prevents writes to all areas of the disk, including ATRs. 'Physical Disk' is a useful way of safeguarding the partition table during normal operation, and need only be disabled again when changes are made to the logical disk geometry. Note that one may also disable writes on a per-partition basis by setting a logical drive's lock flag in FDISK.

### **HDD Rescan Key**

This setting toggles use of the 'Shift' key (pressed with the Reset key) as a means of re-reading the partition table from the hard disk, obliterating any ATR mounts and reinstating the partition mapping table as defined on the hard disk. This is useful if you want to revert the partition table to its power-up state after having mounted disk images or unmounted partitions.

### **PBI Logo**

When 'PBI Logo' is enabled, a boot message will be displayed showing the PBI BIOS version number and the HDD controller's PBI device ID. The logo only appears when SDX is present, although it now appears more predictably than in the past (SDX's base ROM bank need no longer be the one present when the OS boots).

## SIO and CIO Drivers

The SIO and CIO Drivers menu allows configuration of the high-speed SIO driver written by Matthias Reichl (adapted to work with SIO2BT and PCLink devices as well as high speed serial disk drives and other peripherals) and an RTC handler accessible from BASIC and other languages. The PBI BIOS must be enabled to gain access to the SIO/CIO settings, so if all items in this menu are greyed out, enable the PBI BIOS first via the PBI BIOS and HDD menu.

### SIO Driver

'SIO Driver' activates a serial IO handler in the PBI BIOS which can drive high-speed SIO devices (Happy 1050, US Doubler, XF551, Ultraspeed, etc) or be used with the SIO2BT device at any of three different baud rates to access a number of devices emulated by the *RespeQt* peripheral emulator software and the SIO2BT app for Android devices. It also allows high-speed operation with the PCLink device, and even use of PCLink across an SIO2BT connection.

The four possible SIO driver settings are:

*Disabled*: No serial IO is handled by the PBI BIOS.

*HSIO*: Devices selected by the 'SIO devices' setting (excluding tape drives and the 'New Poll' devices) will operate at up to 126Kb/s.

*SIO2BT*: Devices selected by the 'SIO devices' setting (excluding tape drives and the 'New Poll' device) will operate at standard speed (19.2Kb/s) with an extended SIO2BT command timeout.

*HSIO+SIO2BT*: A combination of the *HSIO* and *SIO2BT* modes, which is to say: high speed operation and an extended command timeout. Furthermore, in this hybrid mode, SIO2BT is also subject to a high-speed poll, allowing the device to operate at 19.2Kb/s, 38.4Kb/s, or 57.6Kb/s.

In HSIO+SIO2BT mode, any device which responds only at 19200 baud is then subject to the standard high-speed poll, allowing a mixture of high-speed devices and SIO2BT connected devices. Devices which fail to respond at 19200 baud are assumed to be offline and remain 'pending' in the speed table and will be re-pollled each time they are accessed until such time as their operating speed can be established.

**Note: SIO2BT requires peripheral emulator software (such as RespeQt) to employ use of a software handshake. Because the software handshake analyses the SIO data stream for valid command frames, it's possible that data sent to one device may be misidentified as a valid command frame for another device, causing a bogus write or other unintended operation and therefore risking data corruption. Care should be exercised when using software handshake with other devices on the SIO bus, whether those other devices operate at high speed (where the chance of failure is smaller) or standard baud rates. A safe method of copying data from SIO2BT to another disk is to use a RAMdisk or hard drive as temporary storage and to disconnect Bluetooth before finally copying files to their destination.**

## SIO Devices

Once the SIO driver has been activated using one of the four available modes (HSIO, SIO2BT, or HSIO+SIO2BT), you may use the 'SIO Devices' setting to define the *range* of drives and other devices handled by the SIO driver. There are three settings:

*D1-D4*

*Disks+PCLink*

*All*

The *D1-D4* setting applies the chosen SIO driver mode to disk devices 1-4 (SIO device ID 0x31-34).

The exact behaviour of the *D1-D4* setting depends on the SIO driver mode:

In *HSIO* mode, drives 1-4 will be handled using the high-speed SIO code.

In *SIO2BT* mode, drives 1-4 will run at standard speed but with a long SIO2BT timeout

In *HSIO+SIO2BT* mode, drives 1-4 will have the long SIO2BT timeout applied, be subject to the SIO2BT speed-poll, and will operate at high speed (if supported by the hardware), enabling a mixture of HSIO and SIO2BT drives (subject to the prior caveat regarding data loss).

The *Disks+PCLink* setting applies the chosen SIO driver mode to all disk devices (units 1 to 15 on device 0x3x), *and* to PCLink IO requests:

In *HSIO* mode, drives 1-15 and PCLink are handled using high speed SIO code.

In *SIO2BT* mode, a long timeout is applied to all disk drives and to the PCLink device.

In *HSIO+SIO2BT* mode, a long timeout and SIO2BT speed polling are applied to all disk drives and to the PCLink device, and those devices are also allowed to run at high speed.

The *All* setting applies the chosen SIO driver mode to all devices aside from cassette decks and the OS 'New Poll' device:

In *HSIO* mode, all devices are handled using high speed SIO code.

In *SIO2BT* mode, all devices are handled at standard speed (19.2k) using the long timeout.

In *HSIO+SIO2BT* mode, all devices have a long timeout and BT speed-poll, and will operate up to the maximum possible speeds.

Whichever 'SIO devices' range you choose, you may toggle the handling of disk drives 1-4 using the four settings at the foot of the menu, allowing very flexible control of just how the SIO code is employed. Be sure to enable at least one of these four drive toggles when SIO is restricted to 'D1-D4', however, otherwise HSIO will not be applied to any devices at all.

Although the settings may appear complex, in the most common scenario one may simply set 'SIO driver' to *HSIO* and 'SIO devices' to *Disks+PCLink* to obtain accelerated IO with any high speed devices connected to the machine. Conversely, SIO2BT users should set 'SIO driver' to *HSIO+SIO2BT* and 'SIO devices' to *Disks+PCLink* in the most common circumstances. Advanced configuration is intended to allow for situations where SIO2BT is mixed with other devices, or where there are specific reasons to exclude certain drive numbers from being handled by the custom SIO driver. For instance, if drives 5-15 are commonly polled but are never online, lengthy device polling can be

avoided by confining 'SIO devices' to *D1-D4* when SIO2BT is used, and one can further exclude drives 1-4 on an individual basis if further filtering is required.

Below are some examples. If you just wanted high speed operation on drives 1 and 2, without SIO2BT or PCLink, you would use the following settings:

```
SIO driver:      HSIO
SIO devices:    D1-D4
SIO driver D1:  Enabled
SIO driver D2:  Enabled
SIO driver D3:  Disabled
SIO driver D4:  Disabled
```

Note that it doesn't matter if you happen to mount an ATR (on the SIDE's CF card) on D1 or D2 at some point, or if you already have a hard disk partition attached to either of these drive numbers. The ATR or hard disk partition will always work regardless of the SIO settings.

As a second example: imagine you use SIO2BT at 19.2k and you have a large number of emulated drives on a PC or Android device (served by RespeQt or similar peripheral emulation software), but you like to keep the first three drive numbers for hard disk partitions and ATRs mounted using the SIDE XEX loader. You might set things up as follows:

```
SIO driver:      SIO2BT
SIO devices:    All
SIO driver D1:  Disabled
SIO driver D2:  Disabled
SIO driver D3:  Disabled
SIO driver D4:  Enabled
```

Here, the SIO driver is in SIO2BT mode, and will handle serial drives 4-15, PCLink, and all other devices aside from the cassette and the 'New Poll' device at the standard IO baud rate of 19.2Kb/s. Drives 1-3 will be handled by the OS SIO code, or by the DOS SIO driver (in the case of SpartaDOS), or may be devoted to hard disk partitions or PBI mounted ATRs.

A final example: supposing you have SIO2BT set up with mounted ATRs on drives 2 and 3, a Mega-Speedy 1050 on drive 1, a PCLink volume on drive 15, but wanted the OS to handle IO requests on D4:, a suitable configuration would be:

```
SIO driver:      HSIO+SIO2BT
SIO devices:    Disks+PCLink
SIO driver D1:  Enabled
SIO driver D2:  Enabled
SIO driver D3:  Enabled
SIO driver D4:  Disabled
```

Of course, this is subject to the previously mentioned caveat regarding software handshaking.

## **Z: CIO Driver**

This setting toggles the presence of a 'New Device' CIO real-time clock driver. The driver is compatible with the ICD handler described in *SpartaDOS Construction Set: R-Time & Owner's Manual and Supplement to SDCS Owner's Manual by ICD*. All functions except TD Line On and TD Line Off (XIO 38 and 39) are implemented.

## System Information

The System Information menu simply provides a summary of the hardware installed in the machine.



As well as Main BIOS and PBI BIOS versions, the machine type and CPU are reported, along with information about the video and audio. Note that VBXE and SoundBoard will still be detected even if deactivated in the BIOS settings. 'Stereo' will only be displayed if the default plugin or any other plugin which detects and controls Stereo Pokey is present.

As of BIOS v.1.36, both the GTIA video standard (PAL/SECAM or NTSC) and the ANTIC frames per second count are reported in order to accurately represent 'hybrid' systems (those with a mix of PAL and NTSC chips).

In addition, the GTIA core for VBXE is now properly detected (in prior BIOS versions, only the FX cores could be detected).

## BIOS Settings

The BIOS Settings menu allows the customisation of various elements of the BIOS. 'BIOS Menu Key' and 'Cold Boot Key' permit the activation of different system-wide 'hot keys' which cause setup menu entry and a system cold boot respectively when pressed with 'Reset'. By default, the BIOS menu hotkey is 'Help' (or the Atari Logo key on the Incognito), and cold boot and HDD refresh are deactivated. Changing these hotkeys may cause or resolve problems with other devices (for example, the IDE Plus 2.0 uses the Start key with Reset for setup menu entry, requiring use of 'Help' for U1MB BIOS entry).



'Boot Logo' controls the presence of the BIOS splash screen (displayed on power-up and cold reset), which offers a few seconds in which to select the boot device and launch the SIDE loader on an ad-hoc basis.

'ROM Flashing' is enabled by default, but you may use this setting to prevent flashing of the 512KB ROM in the Ultimate 1MB. Flashing must be enabled prior to any BIOS or other ROM update, however.

'Joystick' allows joystick control of the BIOS setup tool. Port1 or Port2 may be used, or joystick input disabled entirely. Disabling joystick input corrects issues when returning to BIOS setup from the Turbo Freezer menu.

'Colour' permits the selection of any of the sixteen Atari hues as the base colour for the BIOS Setup menu. 'Sound' toggles the key click sound in the BIOS menus.

'Screensaver' toggles a five-minute screen timeout (at which point a banner-type screensaver becomes active).

## Device Control

The Device Control menu is really a place-holder for BIOS plugin functionality, although the two items ('Device 3' and 'Device 4') do work and will toggle binary 0 and 1 on P4 header pins S0 and S1 respectively (corresponding to bits 2 and 3 of the Ultimate 1MB auxiliary register). Devices 0 and 1 control Stereo Pokey/Simple Stereo and Covox respectively in the default BIOS plugin, but these may also be reassigned or removed if not required, or if the M0 and M1 signals are to be reassigned. You may connect any device which responds to a binary logic signal to pins S0 and S1 and control the device using the 'Device 2' and 'Device 3' settings. Lotharek's 'u-Switch' is a useful aid here, as it converts binary logic to analogue switch logic and even allows logic inversion (which may otherwise be accomplished in software via a BIOS plugin). The author's 1200XL has an internal IDEa HDD interface, various aspects of which (including activation and deactivation via the S0 signal) are controlled by the Ultimate BIOS, using a customised plugin. See the 'BIOS Plugins' section.



## Save and Exit

The 'Save and Exit' menu displays all the available options for saving current settings, switching profiles, rebooting the machine, and returning to the underlying operating system or application. Note that the listed shortcut keys work in *any* menu, so – for instance – you can press 'S' while in the 'Memory and System' menu and settings will be saved to the current profile.

Note: the SIDE Loader option (which previously had a menu all to itself) now lives in the 'Save and Exit' menu. This was done to free up an extra menu panel for the SIO settings (it being rather wasteful to have an entire menu comprising only a single item). Of course, the loader may still be launched by pressing 'L' anywhere in the menu system, as before.

Certain changes to settings will automatically cause a cold reboot even when a warm reset was desired (i.e. when a reboot is not explicitly requested). Changing and saving the memory configuration, operating system, SpartaDOS X status, or Graphical OS status will always cause a cold reboot, since DOS and/or the OS must then reconfigure itself in fairly dramatic ways. If you leave the menu by pressing *Reset*, no warning will be given of the pending cold reboot. However, if you leave the menu via the *Escape* key, another shortcut key, or menu item, you will be warned of the forthcoming restart.

'Diagnostic Boot' is an advanced feature suggested by Phaeron, and runs a diagnostic cartridge (if present) with the Ultimate configuration unlocked and the BIOS Setup menu still present in ROM (instead of the Atari's operating system). This is envisaged as a useful tool for flash recovery and diagnostics. Note you can also trigger the diagnostic feature by booting the machine with Shift, Control and Help pressed.

The final option in the menu is 'Config Profile', and is described next.

## Configuration Profiles

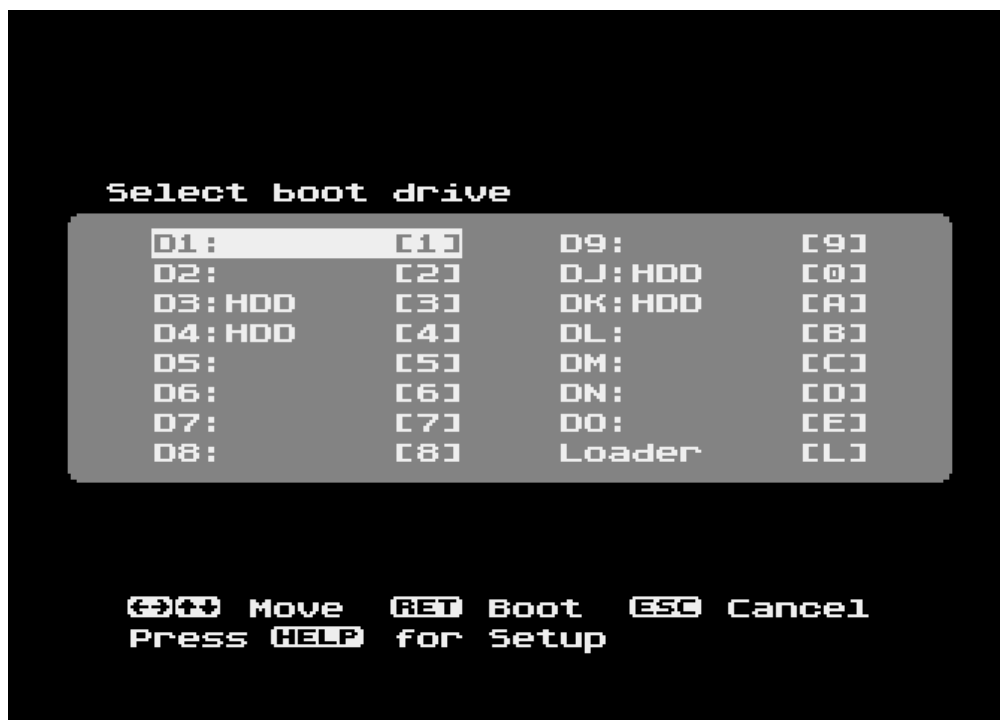
In the 'Save and Exit' menu, selecting 'Config Profile' (or pressing 'P' anywhere in the BIOS setup tool) will switch between three configuration profiles (numbered and named '1', '2' and '3', and increased from the two profiles available with earlier BIOS revisions). Unsaved settings in the current profile are not saved first, but you will be reminded to save any edits. The profiles allow the storage of completely different machine configurations which can be swapped with a single keystroke. This might prove useful if, for example, you like to use both MyDOS and SpartaDOS X with the hard disk feature. You can have different HDD boot partitions in each profile, with SDX disabled in one but enabled in the other. Likewise, you might use one profile for gaming (perhaps with the HDD disabled) and another for productivity.

As well as cycling through profiles with the 'P' key, you can (as of BIOS v.1.36) immediately jump to the desired profile by pressing '1', '2', or '3'.

## Boot Drive Selection

While earlier versions of the alt BIOS provided a simple method for one-off selection of the boot drive during a cold start, latterly this facility has been extended to provide a special boot drive selection menu which is – as before – accessed by pressing 'D' during a cold power-up or force reboot. You'll see the boot drive shortcut displayed on the splash screen (if enabled) when the PBI hard disk is active.

The boot drive menu displays a map of all fifteen available drive numbers, each with an associated shortcut key.



To boot the operating system from the desired drive, you may either move the cursor to it (using the keyboard or joystick) and press enter, or press the corresponding shortcut key.

Note that when the boot drive menu is invoked during a cold power-up, no partition information will be shown since at that stage the OS has not yet initialised the PBI hard disk firmware. On subsequent OS restarts, however, the boot drive menu will show 'HDD' or 'ATR' next to drive entries if they represent hard disk partitions or mounted disk images respectively. The final item in the menu, following the drive number list, is 'Loader'. Selecting this entry will launch the SIDE loader.

You may also boot as normal (without changing the boot drive) by pressing Escape, and to access the BIOS setup menu, simply press Help/Start (for U1MB) or the Atari Logo key/Start key (Incognito).

Note: the boot drive menu provides a means of booting from the specified drive on a 'one-off' basis. To persistently boot from a given drive, you should set the boot drive in the PBI BIOS menu.

When SpartaDOS X is active, setting the boot drive causes DOS to read CONFIG.SYS from the specified drive. This temporarily overrides the 'CONFIG.SYS' BIOS setting (until the next OS restart).

## ROM Configuration

Because the original SpartaDOS X build for Ultimate/Incognito did not leave sufficient space for a 128KB Graphical OS, the option now exists to use a 192KB SDX build (prepared with the SDX Imager). Moreover, users not interested in running the GOS may use the first 320KB of the flash ROM to house an enlarged build of SpartaDOS X. The latest version of UFlash allows configuration of the SDX slot sizes (192, 256 or 320KB), and the new BIOS automatically deactivates the GOS slot if anything larger than a 192KB SDX ROM is used.

## Editable Slot Descriptions

Since the 'OS ROM', 'BASIC ROM' and 'XEGS ROM' slots house user-defined content (four 8KB ROMs each for BASIC and XEGS, four 16KB ROMs for the OS; Incognito's editable slots are 'Colleen OS' and 'XL/XE OS'), it's possible to edit the titles of the slots to reflect their content.

Flash ROM editors such as UFlash allow editing of the slot names, which must then be re-flashed to the BIOS ROM. As well as merging any existing slot descriptions into a new BIOS ROM, UFlash will attempt to preserve slot descriptions from the original Ultimate or Incognito BIOS when upgrading to the new BIOS. If slot descriptions do not appear as expected following the BIOS upgrade, please let me know so that I can try to ascertain the cause.

There are a couple of important differences to consider regarding the new slot description encoding. Firstly, Ultimate slot descriptions may now be one byte longer than was permissible with the original BIOS (fifteen bytes instead of fourteen in the original U1MB BIOS). The U1MB description size was increased in order to properly accommodate the 'Missile Command' title of the default XEGS slot (which was previously named 'Missle Command'. Incognito slot descriptions, meanwhile, were always fifteen characters long, and have therefore not changed.

Secondly, slot descriptions are no longer encoded using internal character values. ATASCII is now used. Strings should be NUL terminated and of no more than fifteen characters long (sixteen bytes including the NUL terminator). Readers interested to know how slot descriptions and other metadata are encoded in the BIOS ROM may refer to the accompanying technical/developer documentation.

## Plugins

Plugins are a fairly important part of the new BIOS, in as much as they provide absolute flexibility regarding use four of the IO signals on the Ultimate 1MB. The default plugin (Stereo/Covox) mimics the behaviour of the original Ultimate BIOS and controls Simple Stereo and Covox via pins M0 and M1 of the P4 header. The default plugin also adds an 'Audio hardware' entry to the System Information menu and 'Device 2' and 'Device 3' toggles to the Device Control menu (Stereo and Covox being devices 0 and 1 respectively).

By swapping the default plugin for a different one, it's possible to control up to four user-defined hardware devices using the P4 logic signals. Plugins may also perform any hardware tests required on system initialisation, set up menu items in a contextual manner, and perform hardware writes on system reset. Sixteen bits of NVRAM configuration data are also reserved for plugins, so they may store data in the battery-backed RAM for retrieval by one of the target devices.

The plugin buffer resides at ROM offset 0x3B00 and is 1KB long. Plugins should be assembled at 0xFB00 and must carefully observe the guidelines described in the plugin developer guide, which is part of the technical documentation for the new firmware.

It is hoped that the plugin feature will attract the interest of third-party developers who wish to use the Ultimate BIOS setup menu to control a diverse range of internal hardware upgrades which lack their own configuration facilities.

**Note: the plugin header format has been revised as of v.1.36 of the BIOS. The breaking of backwards compatibility should not be an issue, since there was previously no means of flashing a plugin to an active BIOS ROM. UFLASH is now able to perform this operation, and will not allow flashing of incompatible plugins.**

**In addition, the BIOS now silently clears plugin configuration data every time a new plugin is used so that plugin options always have default, zeroed values prior to their initial use.**

## The SIDE Loader

Together with a new setup menu, the revised U1MB/Incognito firmware brings with it a new SIDE XEX loader. The loader has been further updated to more closely match the main BIOS setup tool, complete with scroll bars. You can launch the loader in a number of ways:

Selecting the 'XEX Loader' menu in the BIOS setup tool and pressing Enter

Pressing 'L' anywhere in the BIOS setup menus

Selecting 'Loader' from the BIOS boot drive menu

Pressing 'L' on the BIOS splash screen (if enabled) or starting the Atari with 'L' held down

Enabling the 'Boot to loader' option in the 'Memory and System ROMs' menu

Running the disk-based version of the loader from DOS

The 'Boot to loader' method will persistently start the loader on every cold start or reboot until the option is disabled. Note also that starting the computer with 'L' naturally only applies if the system is not already set to boot direct to the loader.

When you start the new XEX loader with a suitably formatted CF card in the SIDE cartridge (or on-board CF card slot if using Incognito), you'll be confronted by the launcher menu:



The loader contains eight menus, just like the main BIOS setup tool. By default, the loader opens the third menu (the launcher), which presents an alphabetised list of all the files handled by the loader contained in the root directory of the first (or last accessed) FAT16 or FAT32 partition on the hard disk. The loader displays files with the following extensions:

ATR: A disk image

BAS: A tokenised Atari BASIC or Altirra BASIC program

COM: An application program or game

EXE: An application program or game

MAP: A script which mounts multiple ATRs

ROM: An 8KB unbanked cartridge image

XEX: An application program or game

Note that 'ATR' files will not appear if the PBI BIOS and/or Hard Disk are disabled in the 'PBI BIOS Setup' menu of the main BIOS setup utility.

To launch a program or disk image, simply use the cursor keys or the joystick to highlight the desired filename and press the Enter key or the joystick button.

## Movement and Selection

You may control the loader using the keyboard or joystick (joystick control must be enabled in the Options menu for the latter to work). Methods of movement and control are as follows:

Action	Keyboard	Joystick	1200XL F Key
Previous Menu	Left Arrow	Left	F3
Next Menu	Right Arrow	Right	F4
Previous Item	Up Arrow	Up	F1
Next Item	Down Arrow	Down	F2
First Item	Ctrl+H (Home)	N/A	Shift-F3
Last Item	Ctrl+E (End)	N/A	Shift-F4
Page Up	Shift+Ctrl-Up Arrow	Up with button	Shift-F1
Page Down	Shift+Ctrl-Down Arrow	Down with	Shift-F2
Open/Edit	Enter	Button	Ctrl-F3
Regress Selection	Ctrl+Enter or Shift+Enter	N/A	Ctrl-F4
Set Drive Number	Tab	Left with button	Ctrl-F2
Tag with next drive number	Ctrl-Space	Right with button	Ctrl-F1
Tag with specified drive number	Ctrl-Number (1-9)	N/A	N/A
Cancel	Escape	N/A	N/A
Toggle BASIC	Ctrl-B	N/A	N/A
Undo Mounts	Ctrl+U	N/A	N/A
Refresh Disk	Ctrl+D	N/A	N/A
Restart	Ctrl+R	N/A	N/A

Since version 1.28 of the loader, joystick movement actions performed in conjunction with the button will auto-repeat just like those without the button. In addition, versions 1.28 and beyond have a built-in type-ahead keyboard buffer.

## Searching for Filenames

Rather than paging through a long list of filenames, the loader allows rapid searching for a partial filename match simply by typing characters, and in versions 1.28 and higher, this ability has been greatly enhanced to allow recursive searching through all levels of the folder structure. For example, to locate all files and folders whose names begin with the 't' (to search for characters anywhere in a name, see the note below), simply type the character and the search will be triggered automatically. To narrow the search the filenames beginning 'tur', type 'ur' while the initial search is underway, and the search will begin again.



To broaden the search, shorten the search string by pressing the Backspace key. While the list of search results is being created, you may move through the list and perform operations on filenames just as you would in a normal directory listing. It is therefore not necessary to wait for a search to complete before launching the file of interest as soon as it appears.

Pressing the Break key while a search is underway will terminate the search but leave the search results on the screen. Meanwhile, pressing Esc will exit search mode completely and return to the directory which was logged prior to search mode being invoked. You may also exit search mode by pressing the Backspace key on an empty search string.

Occasionally, one may wish to enter characters into the search string which are normally used as navigation keystrokes (for example, the '-' or '\_' characters). To enter such characters in the search string, simply press Ctrl+Esc first.

In the list of search results, as well as launching and mounting files, one may open a file's containing folder by highlighting the file and pressing Ctrl+F.

**Note:** The search operates in two modes: 'Starts with' and 'Contains'. You can choose which via the 'Search' item on the *Options* menu. 'Starts with' means matching filenames must begin with the search string. 'Contains' means files will be matched if the search string appears *anywhere* within their name. The default setting is 'Starts with'.

## Device Menu

Using the left cursor key, move the menu icon highlight to the leftmost icon to open the 'Device' menu. This menu displays the physical controllers attached to the system which are recognisable to the loader, i.e. 'SIDE' or 'SIDE2', followed by the manufacturer and/or model of currently inserted CF card. Pressing Enter on the chosen device name logs all partitions on the device and opens the partition menu (if there is more than one partition on the card) or the FAT/APT browser menu (if there is only one partition on the card).

## Partition Menu

The Partition Menu display a list of all recognized partitions on the hard disk. This will include FAT16 partitions, FAT32 partitions, and the APT partition (which contains any Atari partitions created using the FDISK partition editor).



As usual, you can move the highlight using the up and down cursor keys, and open a partition by pressing Enter. When you open a partition, the contents are immediately displayed in the launcher menu. If you open the APT partition, the Atari partitions contained therein will be displayed in the launcher menu, where you may mount partitions by selecting them.



You may notice a number appearing next to partition names after ATR disk images have been mounted. The number denotes the host partition ID, which is to say the ID of the FAT to which the mounted image belongs. Up to four host partitions can be registered, and this is done automatically by the loader as disk images are mounted. If you have many partitions on the card, it's theoretically possible to exhaust the four host partition limit, but even in the unlikely event that this happened, refreshing the disk or unmounting all partitions (with "Refresh disk" or "Undo mounts" respectively) unregisters all the FAT partitions, enabling one to start afresh.

## Partition View

After opening the 'APT' entry in the partition menu, one is confronted by a list of all APT partitions complete with their current drive assignments, partition names (where present), partition IDs, partition types, and sizes.



Mounting, tagging and launching work just as they do when XEX and ATR files are being displayed.

In the partition type column, you'll see 'DOS' or 'Ext' since these are the only two APT partition types catalogued by the loader. 'DOS' denotes a standard partition, while 'Ext' denotes an 'Extended' APT partition: namely one which is mapped directly to an MBR FAT partition mapped outside of the APT area. External entries (which are described in the APT partitioning manual) may be created via the APT FDISK partitioning tool, and they provide an excellent method of sharing data between PC operating systems (such as Windows and Linux) which recognise and mount MBR partitions, and Atari disk operating systems (such as SpartaDOS X) which can read FAT partitions. External entries also provide an essential means of assigning drive numbers to MBR FAT partitions at the partitioning stage (since the Atari – unlike a PC – needs to store persistent drive assignments on the disk).

At the extreme right, the logical partition size is shown. Note that this size does not necessarily represent the physical size of the partition on disk. Rather, it is the addressable size of the partition. Although a 65,535 sector partition occupies 32MB on disk, if the logical sector size of the partition is 256 bytes, the size will be shown as 16MB.

## Launcher Menu

The launcher menu (actually untitled and headed by the volume name and absolute path of the current directory; it is symbolised by a 'rocket' icon) is displayed when the loader starts and is where you load XEX files and mount ATRs and APT partitions. Folders are denoted by a right-pointing wedge in the left margin. The different file types handled by the launcher will now be described in detail.

### **BASIC files (\*.BAS)**

Altirra BASIC or Atari BASIC files may be launched by the loader by means of the built-in FAT file system handler. If the file system is disabled, it will nevertheless be installed when running a BASIC program. Once the BASIC program is running, it has full read-only access to its containing directory on D1: via a DOS 2.5 compatible CIO file system handler. The CIO handler is reset-proof, and calling DOS from BASIC re-runs the loader (ROM version only; an exit to DOS does nothing at all in the disk-based version of the XEX loader).

### **Executable files (\*.COM, \*.EXE, \*.XEX)**

Executable files are loaded by code residing at 0x0700 which does not require the file system handler to be present. However, enabling the file system handler provides read-only CIO file access to launched programs. One application for this is launching UFLASH.XEX from the XEX loader, and then loading ROM files from the same directory on the hard disk. The Ultimate 1MB/Incognito flash ROM may thereby be updated without booting DOS and without copying large ROM files into Atari partitions (they need simply be copied into the same folder as UFLASH in the FAT partition).

When the file system handler is not present (i.e. disabled in the Options menu), MEMLO is roughly at 0x0A68 (the loader code being some 800 bytes long). When the file system handler is enabled, the MEMLO is around 0x104E, although XEX files may still overwrite anything beyond the end of the loader (ending at 0x0A68) without problems during the launching process. If an application is designed to work with DOS (i.e. loads beyond 0x1F00 and implements standard CIO calls), it should load and work with the read-only FAT FMS.

### **Disk images (\*.ATR)**

ATR disk images are mounted by the loader only if the PBI BIOS and Hard Disk are enabled in the main BIOS setup menu. After mounting an ATR, the loader will usually restart the operating system and boot the system from drive 1 (D1:). As well as mounting and launching ATRs with the Enter key, more precise control is possible. See the later section on Image and Partition Mounting for more information.

### **Map files (\*.MAP)**

Map files describe the mount points for ATRs. Map files are plain DOS/Windows/Unix text files containing lists of drive specifiers and FAT filenames. See the section on Image and Partition Mounting for more information.

### **Cartridge files (\*.ROM, \*.CAR)**

Although U1MB and Incognito do not emulate diverse cartridge mapping schemes, single-bank 8KB ROMs can be launched by the loader. Pressing Enter on a \*.ROM file will install it at 0xA000-0xBFFF and initialize and run the cartridge code. If the file system handler is enabled, the 8KB ROM will have read-only access to the containing folder via D1:.

As of version 2.0, the loader will also run 8KB (8,208 bytes including the 16 bit header) CAR files.

## The Logical Drives Menu

The *Logical Drives* menu displays a two-page list of logical drive assignments (for drives 1 through 15).



Drives may have one of three states: SIO, APT, or ATR. 'SIO' simply means the drive number refers to neither a hard disk partition nor a disk image (i.e. it may or may not be mapped to a serial device such as a floppy disk). 'APT' means the drive number refers to an APT HDD partition, and 'ATR' means the drive is mapped to a mounted disk image.

APT entries (partitions) have their partition ID and (optionally) partition name displayed next to them. The partition ID is the same one displayed alongside each partition entry in the launcher menu. ATR entries, meanwhile, have their host partition ID displayed alongside, followed (optionally) by the name of the mounted ATR. The host partition ID corresponds to the ID displayed on the Partition menu next to the FAT which contains the disk image file. Therefore, several ATRs may share the same host partition ID.

ATR and APT names are only displayed if they happen to have been logged on the launcher menu (either by logging the containing folder, or running a recursive search which happens to match the mounted ATR). This 'lazy' approach to populating names in the logical drives menu is preferred to recursively scanning every folder in every MBR partition every time the loader is launched with ATRs already mounted.

Pressing Enter on a drive number will unmount any hard disk partition or disk image to which it is mapped, reverting the drive to 'SIO' status. In addition, pressing Ctrl+S will rotate (swap) all

mounted disk images by one place (see the Mounts Menu section below). This shortcut is available from any of the loader's menus, but is especially relevant to the drives menu.

## The Disk Menu

The *Disk* menu has three items: 'Undo Mounts', 'Swap ATRs', and 'Refresh Disk'. 'Undo Mounts' simply re-reads the partition table from disk, unmounting all ATRs and restoring the partition map to the state it was in when the computer was first booted (or the last time changes were written to the partition table by the FDISK tool, or the last time the partition table was refreshed). You may access 'Undo Mounts' from any of the loader menus by pressing Ctrl+U. 'Undo Mounts' duplicates the functionality provided by Shift+Reset when the 'HDD refresh' option is enabled in the main BIOS setup menu.

The 'Swap ATRs' option rotates (swaps) all mounted disk images by one place. For example, if ATRs are mounted on drives 1, 2 and 3, rotating or swapping the ATRs will move drive 1's ATR to drive 3, drive 2's ATR to drive 1, and drive 3's ATR to drive 2). This is exactly equivalent to rotating ATRs by pressing the ATR swap button on the SIDE cartridge. You can rotate ATRs in this manner anywhere in the loader by pressing Ctrl+S.

The last item – 'Refresh Disk' – was introduced primarily to support the XEL-CF adapter designed by MytekControls for the MPBI interface of the 1088XEL motherboard. Since the XEL-CF lacks a card removal sense register, swapping a CF card requires a card reset to be explicitly issued following card reinsertion. Selecting 'Refresh Disk' (you can also press Ctrl+D anywhere in the loader) will issue a card reset, and refresh the partition table and FAT/APT catalogues. This facility should also allow card hot-swapping with the original SIDE cartridge (which lacked a card removal sensor), although this has not been tested.

## The Options Menu

The *Options* menu provides eight user-configurable settings.



Option	Purpose
BASIC	Toggle the presence of internal BASIC when launching XEX or ATR files
FMS handler	Toggle the presence of the FAT file system handler
File/drive size	Toggle display of XEX/ATR and logical volume sizes
Joystick	Change the port for joystick control or disable it entirely
Colour	Select one of sixteen colour schemes
Sound	Enable or disable the key click sound
Screensaver	Toggle the five-minute screen timeout (screen goes blank when idle)
Search	Toggle search string matching from the start of the filename or anywhere

Note that unlike in the main BIOS menu, settings are immediately 'remembered' in the loader.

## Info Menu

The *Info* menu displays the loader version number and copyright notice.

## Exit Menu

The *Exit* menu has only one selection: to restart the computer. You can also do this by pressing Ctrl+R anywhere in the loader. You would typically restart after manually mounting one or more disk images.

## Image and Partition Mounting

Several methods exist for mounting disk images and APT partitions. Pressing Ctrl+Space (or moving the joystick to the right with the trigger held down) assigns a partition or ATR then next logical drive number (or at least the drive number the loader thinks is the most logical suggestion), displays the drive number next to the filename, and moves the selection bar to the next entry. Pressing Ctrl+Space on a partition or ATR already mounted unmounts it, removing the drive number.

To manually specify the drive number, press the Tab key on a filename, or move the joystick left with the trigger held down. An editable drive number then appears next to the ATR or partition name. Increase or decrease the drive number using the cursor keys, and press Enter, Tab or the joystick trigger to accept the drive number and mount the volume. You can press Escape to abandon the process. Selecting the 'Off' entry in the drive number list unmounts the volume.

Volume mounts are immediately reflected in the 'Unmount volumes' menu, should you require a quick visual cue of which drive numbers are assigned and which are free.

## Map Files and Disk Flipping

Sometimes it's necessary to mount multi-disk ATR sets and this can be a tedious process. Map files make this easier by automating the mounting procedure. A map file is simply a plain DOS/Windows/Unix text file containing EOL terminated lines comprising a drive number and a filename. For example, you might create a file called *Ballyhoo.map* and add the following two lines:

```
D1:Ballyhoo (s1).atr  
D2:Ballyhoo (s2).atr
```

When you press enter on *Ballyhoo.map*, the loader will mount the two ATRs on the specified drives and – if successful – reboot the Atari, which will then boot *Ballyhoo (s1).atr*. When Ballyhoo requests its second disk, pressing the SIDE/ATR swap button prior to accepting acknowledging the disk swap request will move *Ballyhoo (s2).atr* from D2: to D1:, and *Ballyhoo (s1).atr* from D1: to D2: (assuming no other ATRs are already mounted on higher drive numbers). The SIDE/ATR swap button *rotates* the entire ATR set down by one place in the drive mappings, taking the lowest mount point (D1: in this case) and moving it the vacated highest mount point (D2: in this example).

The latest version of the loader allows you to perform the same ATR rotation via the 'Swap ATRs' option in the 'Mounts' menu.

Should you wish to execute a MAP file without an instant reboot, press Ctrl+Enter instead. The volumes will be mounted but no further action will be taken.



## Shortcuts

The following keyboard shortcuts are accessible at all times and from any menu except where stated:

Shortcut	Action
Ctrl+B	Toggle the status of the internal 8KB ROM (typically BASIC)
Ctrl+F	Select highlighted file in containing folder (search results only)
Ctrl+R	Reboot
Ctrl+S	Swap (rotate) ATRs
Ctrl+U	Undo mounts (re-read partition table)

## BASIC Enable Metatag

Executables and ATRs which require internal BASIC to be enabled on a 'one off' basis (assuming the loader is set to disable BASIC during normal use) may specify their dependency on BASIC by including the *[BASIC]* metadata tag anywhere in the FAT filename. For example, the following ATR will always enable internal BASIC upon booting (if launched via the Return key):

```
BASIC Games [BASIC].atr
```


Note that the BASIC metatag on an ATR file is not observed if the volume is mounted via tagging (using CTRL+Space) or via the TAB key.

## CF Card Hot-Swapping

If you use a SIDE2 cartridge (not Incognito or original SIDE), you can hot-swap CF cards while in the loader. All ATR mounts will be removed following a card swap.

## The Built-In CIO FAT File System Handler (Mini DOS)

As mentioned, when 'File system' is enabled in the Options menu, a small, read-only CIO file system handler is installed in low RAM when launching executables or BASIC programs. The file management system permits read-only access to the currently logged folder of the FAT partition from which the program was launched. Shown below is the DIR command of the FAT being executed in Altirra BASIC after a BASIC program was launched direct from the loader.



```

SPELUNKP.XEX 471
XCLOCK     .XEX 183
AB1088     .XEX 999
USC5       .EXE 022
SDX449ULROM 999
ELEKTR_1.XEX 365
48H        .XEX 054
* KORONI_1.ATR 721
C-DRUG     .XEX 813
NEAR       .XEX 791
OF          .XEX 281
RESCUE_1.XEX 337
ATARIB_1.XEX 999
F-155T_1.XEX 166
SOLOFL_1.XEX 149
REALSP_1.XEX 197
YOOMP_1.ATR 721
YOOMP_1.XEX 206
YOOMP      .ATR 721
YOOMP_PA.XEX 206
000 FREE SECTORS

Ready

```

Since no subdirectory facilities are provided (the file system handler provides a rudimentary facsimile of Atari DOS 2.5 operation), the folder logged by the loader appears to Atari programs as the root directory of drive 1. Files may be opened for read using the standard DOS 2.5 compatible API. Filenames must be prefixed by 'D:' or 'D1:' (any other unit number will return an error), and should comprise a 1-8 character name followed by an optional 1-3 character extension. Wildcards are fully supported. Long FAT filenames are not supported: only the aliases will be displayed (with the tilde character replaced by an underscore, as shown in the screenshot above). Such files may be opened for read, however, via the same filename expressed in the directory listing. The free sector count at the end of a directory listing is always displayed as '000'.

The CIO handler supports OPEN, CLOSE, GET and STATUS. PUT and XIO are not implemented and will return errors. Formatted directories may be opened and read, in which case the file size (normally expressed in DOS 2.5 as the number of sectors occupied by the file) is shown as the file length divided by 128 (to simulate the standard sector count on a single density DOS 2.5 volume). 720 sector ATR files, for instance, will appear with a file length of 721 sectors in the directory listing (the extra sector accommodating the 16-byte ATR header).

## **Limitations**

### **Maximum number of files and folders**

The launcher can display a maximum of 250 entries (files and folders) in a given folder. Similarly, search results may not exceed 250 entries. If many lengthy filenames are indexed, this limit may be reduced if the buffer is filled up (filenames may be up to 255 characters in length).

### **Lomem**

The XEX loader resides between 0x0700 and 0x09FF, and an executable file must not overwrite this memory area. If an XEX is to use the built-in FAT FMS, it should not load below 0x1000.

## Differences between the original and new firmware

Aside from what has already been discussed, there are some further key differences between the underlying behaviour of the new BIOS and loader and that of the original.

- ‘One-shot’ configuration changes are no longer possible. In the original BIOS, unsaved changes were written to the hardware registers and persisted through the next system restart until the next time the BIOS Setup Utility was invoked. This is no longer possible. Any unsaved setting is immediately lost when exiting setup.
- The POSIX standard (Monday = Day 1) is no longer used when calculating the system clock’s day of the week. A method compatible with SpartaDOS X is used instead (Sunday = Day 1).
- The new BIOS currently uses addresses 0x20-2E, 0x40-4D and 0x60-6D of the Ultimate 1MB’s SD1305’s NVRAM. SpartaDOS X uses bytes 0x30-31, so the entire 0x3x address range is deliberately avoided by the BIOS. The Incognito BIOS uses slightly fewer bytes, but 0x20-2F, 0x40-4F and 0x60-6F should now be considered reserved for Ultimate and Incognito. While it’s unlikely that NVRAM usage will significantly increase in future BIOS revisions, it would be unwise to make assumptions when designing your own drivers or any other software which makes use of the NVRAM. It would probably be wise, if in doubt, to use the 0x70-7F range, since 0x50-0x5F is used by the new XEX loader.
- The new BIOS knows whether the Ultimate 1MB is configured for XEGS mode or XL/XE mode, and dims the XEGS ROM slot menu item if the host machine is deemed not to be an XEGS.
- The main BIOS ROM signature and versioning information is somewhat enhanced compared to the original, and is completely incompatible with it.
- The new XEX loader does not clear the mount table on entry, so previously mounted ATRs will remain mounted and visible when re-entering the loader. To restore the partition table to its original state, select ‘Undo mounts’ on the loader’s ‘Disk’ menu.
- The new PBI BIOS fixes several bugs in the version designed to work with the original main BIOS, and it is not compatible with Candle’s original BIOS. Likewise, older versions of the PBI BIOS should not be used with the new main BIOS and XEX loader.
- The new PBI BIOS uses DUNUSE (0x0307) for bits 16-23 of the sector address when bit 7 of DDEVIC (0x0300) is clear. Use of DUNUSE was reinstated to ensure compatibility with the IDE Plus 2.0 BIOS, and to support versions of the SDX FATFS.SYS driver which relied on it (although as it happens, the newest version of FATFS.SYS dropped reliance on DUNUSE, using the XDCB instead).
- The new U1MB BIOS includes a copy of the OS character set at the usual address (0xE000). This enables the Turbo Freezer’s menus to display properly if the Freezer is invoked from

*inside* the BIOS setup menu. In addition, the BIOS setup menu's NMI handler vectors DLIs and VBIs through VDSLST (0x0200) and VVBLKI (0x222) respectively. The Incognito BIOS lacks the standard OS character set but uses the same interrupt vectors.

- The new BIOS – wherever possible – establishes via software the presence of attached hardware (VBXE, Stereo Pokey, Soundboard, etc) and disables software control of said devices if they are not present or not attached to the U1MB's IO signals (one exception is Covox, which cannot be detected in software). This methodology has already uncovered previously undiagnosed hardware issues on a few machines.
- The new BIOS has migrated all Stereo, Covox and Soundboard configuration functionality out to the default plugin module. As a result, support for these devices is entirely optional and may be completely removed and replaced by support for other hardware by means of a different plugin module. The only device for which support is hard-coded into the main BIOS is VBXE.
- The new PBI BIOS no longer automatically "registers" as a host partition the first FAT it finds on the disk. This was done in earlier versions as a convenience for the original loader (which did not register host partitions at all), but has been dropped since the new loader handles all host partition registration calls anyway.

## 1088XEL Features

The special build of the U1MB firmware for the 1088XEL includes some features unique to that platform. Although most differences are confined to the 1088XEL plugin module (which defines usage of the four IO signals on the U1MB), a few changes to the main BIOS, PBI BIOS and XEX loader were also necessary. Most notably, the 1088XEL version of the PBI BIOS is designed not to support the SIDE cartridge but the XEL-CF module. Since the XEL-CF can house up to two CF cards in a master/slave configuration, the PBI BIOS and XEX loader can access them both.

**Note: it's possible to drive a SIDE/SIDE2 cartridge via the internal U1MB firmware on a 1088XEL board. To do so, simply flash the standard U1MB/SIDE PBI BIOS and XEX Loader modules to the appropriate slots and replace the 1088XEL/XEL-CF main BIOS plugin with the 1088XEL/SIDE plugin. The SIDE plugin removes slave drive support and reinstates the SIDE cartridge's ATR swap button functionality.**

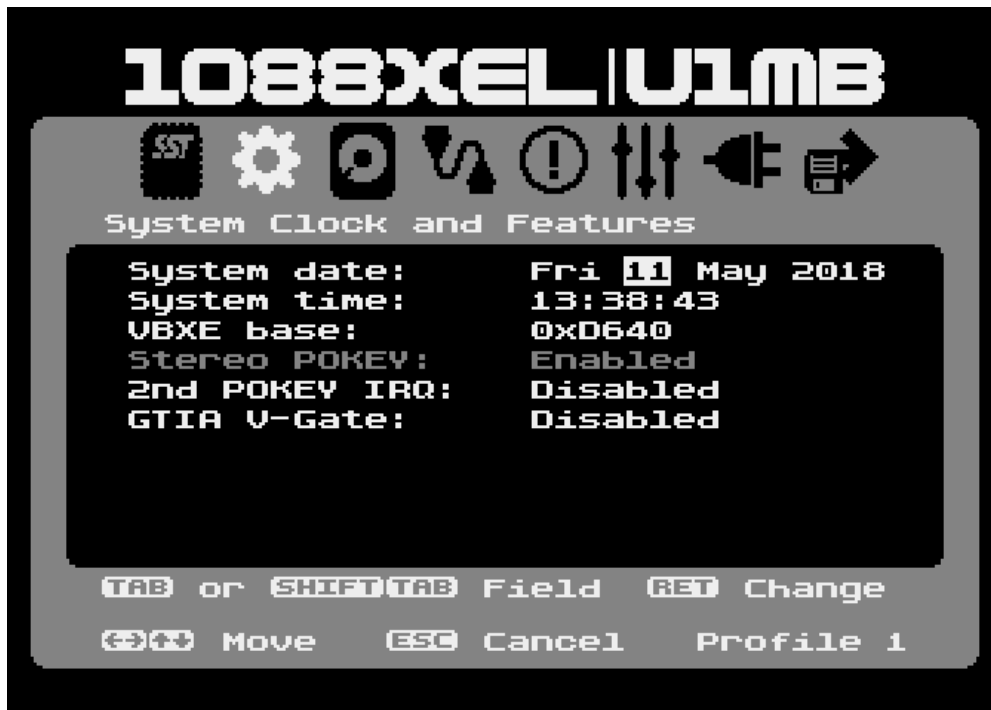
**In addition, users with third-generation XEL-CF (XEL-CF3) adapters have available to them the same ATR swap button feature present on the SIDE/SIDE2 cartridge while using the standard 1088XEL/XEL-CF BIOS plugin, PBI driver and loader.**

When turning on the 1088XEL for the first time, you'll see a special boot logo which stays visible for around three seconds. This logo appears irrespective of whether or not the "splash screen" is enabled, and it allows the TK-II keyboard interface to initialise so that the keyboard is responsive to hotkeys (for BIOS menu entry, disabling internal BASIC, etc) at the appropriate time.



Inside the BIOS setup menu, you'll see several items specific to the 1088XEL BIOS plugin, which we'll cover here.

## System Clock and Features



### Stereo POKEY

Turns the second POKEY on or off.

### 2nd POKEY IRQ

Turns the second POKEY IRQ on or off. Will be disabled and greyed out should there be no second POKEY present.

### GTIA V-Gate

Controls the V-Gate function (crops horizontal scan). V-Gate, when enabled, also crops the Sophia display (subject to Sophia firmware support).

**Note: Soundboard and Covox support are not present in the default 1088XEL plugin module, but functionality may be easily reinstated by flashing a suitable plugin.**

## PBI BIOS and Hard Disk



### Slave Drive

Turns XEL-CF slave drive polling on or off. If you're using a dual-card adapter with the XEL-CF interface and have both card slots populated, turn this option on. Otherwise (if you're only using the master card slot), turn it off to prevent delays caused by the system polling the second drive and timing out in the process. Note that the XEX loader has its own Slave drive option which will also need enabling to facilitate cataloguing of the second card. However, if you simply want to use two cards with standard HDD partitions, enabling Slave support in the PBI BIOS is sufficient.

### MPBI Device Control

Since U1MB's auxiliary IO header is no longer accessible in the 1088XEL, and since three of the signals are already allocated to internal devices, only one unassigned signal remains (M1), and since M1 appears on the 1088XEL's MPBI connector, the 'Device Control' menu is entitled 'MPBI Device Control' in the 1088XEL BIOS's default plugin. Of course, this may be changed – along with the naming and functionality of the M1 control option – via a custom BIOS plugin. One such plugin, designed to control the Rapidus core via the M1 signal – is included in the firmware distribution package.



## XEL Loader

### Slave Drive

The 1088XEL loader differs from the standard U1MB loader in one key respect: namely that it (optionally) supports two physical disks when a suitable dual Compact Flash adapter is used with the XEL-CF interface.



The second (slave) disk must be explicitly enabled in the loader via the 'Slave disk' option:

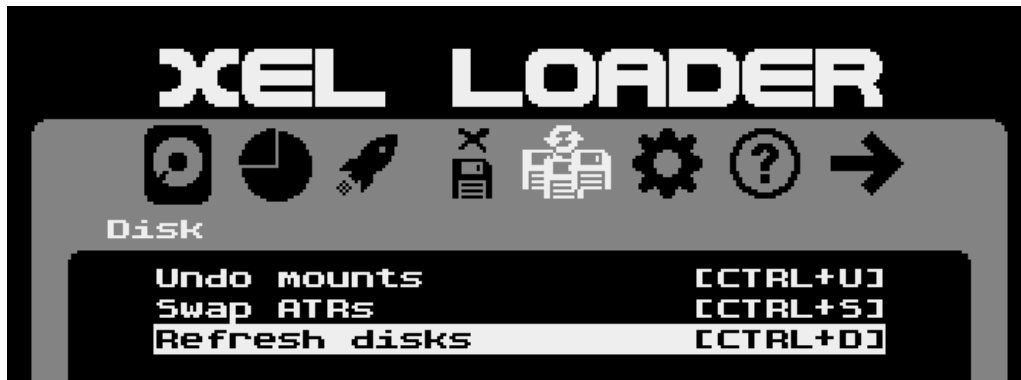


Once enabled, the second disk will be polled and the attached media displayed in the 'Device' menu, where one may switch between the two physical disks by pressing Return on the desired entry. If only one FAT partition is present on the chosen physical disk, it will immediately be opened in the Launcher menu. Otherwise – if more than one FAT partition exists – the partition list will appear, allowing selection of the desired FAT (or APT). If only a single FAT exists, one may cursor back from the launcher menu to the partition menu if one wishes to open the APT.

As with the standard loader, the last accessed partition is remembered, although in this instance it's the last accessed partition on the last accessed physical disk which will persistently be opened when the loader is first launched (until such time as the loader sees that the media has changed since a partition was last selected).

### Media Hot-Swapping

Although the XEL-CF has no card removal sensor, one may still swap physical disks (CF cards) by invoking the 'Refresh disk' function on the 'Disk' menu.



This will reset all controllers, re-poll the physical disk(s) and display the Launcher menu or the Device menu, depending on whether the same card was re-inserted.

## Frequently Asked Questions

Since the alt BIOS was released, I've compiled a list of the most common questions asked by users.

**Q: I've upgraded to the new Main BIOS and all my settings are gone. What happened?**

A: The new BIOS's configuration records in NVRAM are incompatible with those of the original BIOS, so your original configuration became invalid when you upgraded to the new BIOS. Please manage your new settings and set the system clock using the BIOS setup menu.

**Q: I've upgraded to the new Main BIOS and the PBI hard disk doesn't work anymore.**

A: Ensure you also upgraded the PBI BIOS: it's a required update when upgrading the Main BIOS. Also check that you have enabled the PBI BIOS and enabled the Hard Disk in the PBI BIOS Setup Menu.

**Q: There's a splash screen when my computer starts up.**

A: If you don't want to see the boot logo, disable it in Advanced Settings, or press Space or Escape to skip it.

**Q: When I press the left and right arrow keys, instead of scrolling through the available settings for the selected item, a different menu is displayed. How do I change an item?**

A: Simply press the Return key to scroll through the available settings for the selected item. In a list (e.g. months of the year or drive numbers), you can also press Shift or Control with the Enter key to scroll backwards through the available values. When returning to menu, the same item will still be highlighted.

**Q: I'm trying to set the date and time but I can't move the highlight out of the day/hour field.**

A: Press the Tab key to move to the next field, and Shift/Tab to move to the previous field.

**Q: How do I save my settings?**

A: In the BIOS setup menu, press the 'S' key. All available options for saving settings and restarting the computer can be found in the 'Save and Exit' menu. In the loader, settings changes are saved automatically as soon as you make them.

**Q: The XEX loader won't mount ATR disk images anymore.**

A: Ensure you have the PBI BIOS *and* Hard Disk enabled in the PBI BIOS Setup Menu.

**Q: XEX programs are crashing when run from the XEX loader.**

A: Ensure BASIC is not enabled for those programs which require it to be disabled.

**Q: My XEX programs fail to load or crash when I start them from the SIDE loader. They worked with the old SIDE Loader? Is the new loader buggy?**

A: The new SIDE loader loads executable files 2-3 times more quickly than the original SIDE Loader. It does this by burst-reading sectors into RAM without continually polling the IDE status register's data-ready bit after reading every single byte. As a result, systems which are already prone to bus instability may exhibit read errors with the new loader when they appeared to work well with the old one. The issue is squarely a hardware one, however, and the new loader is designed to work with stable systems. The solution is to a) Fix the instability issue, or b) replace your no-brand or Kingston 'Flower' CF card with something known to work with the hardware (preferably a SanDisk card).

**Q: Stereo Pokey is greyed out in the BIOS menu and I can't turn it on or off. I have it connected to U-Switch and it worked with the old BIOS. What's up with the new BIOS?**

A: There's nothing wrong with the new BIOS. Your U-Switch never worked in the first place since it's wired up wrongly or there's some other hardware problem. The original BIOS didn't care whether there was in fact a Stereo Pokey board present, let alone whether it could actually be toggled in software. The new BIOS ascertains whether the hardware is present and whether it can be deactivated in software.

**Q: The BIOS menu and/or XEX loader have corrupted displays. Everything was OK with the old BIOS. What's going on?**

A: The BIOS menu and loader employ numerous non maskable interrupts (NMIs) in order to generate the three-tone display and various other graphical effects. Corrupted graphics point to system instability which was simply not evidenced by the original firmware. Get your U1MB installation checked over for connectivity and noisy reset line issues.

**Q: I've attached a cartridge to my Atari but the machine is behaving as if the cartridge isn't there. What's wrong?**

A: If you have the PBI BIOS enabled, you must set the 'Hard Disk' to disabled, otherwise external cartridges may be suppressed. If high speed SIO is not required, one may also disable the PBI BIOS entirely, although HSIO is designed to work with external cartridges and may usually be left enabled. An exception is the 1088XEL when used with the XEL-CF HDD where – since the HDD is not cartridge based – external cartridges function perfectly well with the internal hard disk.

## Feedback

If you find any bugs, don't like the way something works, or have ideas for added functionality, please contact me by [email](#), or at AtariAge via PM (to user flashjazzcat) or in the [Alt BIOS discussion thread](#).

## References

Information consulted during development of the firmware under discussion and during the writing of this guide includes the following:

[Altirra Hardware Reference Manual by Avery Lee](#)

[High Speed SIO Patch by Matthias Reichl](#)

[SIO2BT by Marcin Sochacki](#)

[Atari 1088XEL Mini-ATX Motherboard by Michael St Pierre](#)

[The SpartaDOS X Upgrade Project](#)

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