

H0420

Programmable MP3 Audio Player for Exhibitions and Kiosk Applications

Firmware Update: Version 1.3 Build 3637

[For upgrading to the new firmware, please see page 4 for the procedure.](#)

This document describes the changes since version 1.2 of the firmware (build 3508). If you want to review the changes between versions 1.0 and 1.2, please see the documents “h0420_3444.pdf” and “h0420_3508.pdf”.

New functionality

1. MP3Loop: a utility for creating gapless loops

The PAWN toolkit now comes with the new utility “MP3Loop” and the associated documentation. This utility post-processes MP3 files so that they can loop without “gap” or click at the looping point.

2. MP3Crypt: a utility to create encrypted MP3 tracks

The new utility MP3Crypt encrypts MP3 files with a strong encryption algorithm and a 128-bit key. The associated documentation gives the details on the encryption method. Customers that require encryption should request a unique device key with their order.

Also new is the script function `mp3password()` for setting the password that was optionally used in the encryption.

3. Ready-made scripts

This release of the firmware contains several more complete scripts, compiled and ready for use. The scripts are configurable with an “INI” file, and they are separately documented.

4. Chain to other scripts with the `exec()` function

The new function `exec()` allows a script to run another script. The launched script replaces the running script in memory. Using multiple scripts and chaining from one script to the other may be used to implement processes that are too big to fit in memory as a single script.

5. A watchdog timer for script functions

The new function `watchdog()` sets a maximum time that a public function may use to handle an event. If the script takes longer than the specified amount of time (for example, due to an infinite loop), the watchdog timer causes the entire device to be reset.

6. Low-power mode

The new function `standby()` switches the H0420 to a low-power mode, which may be useful for battery-operated devices. During low-power operation, the H0420 is not operational: it does not play audio and the script execution is halted. The H0420 monitors its switch inputs and its I/O pins, and resumes from stand-by as soon as it detects activity on the pins.

7. PAWN scripting language & tools

The compiler and toolkit have been improved in various areas, especially in the area of code generation. The new compiler creates more compact and quicker code.

When uploading scripts to the H0420 via the Quincy IDE or via the PAWN debugger (over a serial cable), the date and time of the H0420 are synchronized with those of the PC.

Quincy now provides the function reference of the H0420 scripting environment as a Windows “help file”, which allows easy look-up of scripting functions. The help file is generated from the same sources as the PDF file and the printed manual (however, the help file lacks the introductory material and the examples).

8. Other tools

The FileLink utility (for file transfer) is much improved: it now supports high Baud rates (115200 and 230400 Baud) for quicker transfer and sub-directories on the CompactFlash card. It also allows you to copy files to the CompactFlash card by dragging the files from the Windows Explorer and dropping them on the FileLink utility.

The Termite serial monitor is improved to include a command history, logging to file, clipboard copy and a few minor fixes.

Corrections and behavioural changes

1. Correction for an issue that could cause a hang-up on start of playback

Under rare circumstances, it could occur that the H0420 did not initialize the MP3 decoder correctly (timing condition). This could happen at the start of playing a new track. The effect was that the H0420 failed to play the audio file. Sometimes, a hard reset was required to make the H0420 leave this status.

2. Correction for a conflict between the timing circuit and the wave generator

When using the wave generator (on the analogue output pin), the timing circuitry (for millisecond resolution events) was re-initialized. This could cause, under rare circumstances, to an apparent hang of the H0420 after hours of correct operation.

3. Improved reliability of MP3 decoding

The firmware of the MP3 decoder now takes into account rare occurrences of hardware glitches, which may be observed in some environments. The so-called “spurious interrupts” provoked by such glitches are now handled in a more reliable way, improving the product stability.

4. Correction for ID3 tags which might cause failure to play an MP3 track

An ID3 tag could cause the MP3 track to be non-playable, due to a parsing bug in the H0420 firmware. This only occurred for ID3 tags that were larger than 512 bytes, and only when a chunk header spanned a 512-byte sector boundary. In the new firmware, the ID3 parsing bug has been fixed.

5. Improved support for version 2.2 of the ID3 tag

Previously, the H0420 supported versions 2.3 and 2.4 of the ID3 tag, and a subset of version 2.2. Although version 2.2 is classified as “obsolete”, it still appears to be widely used. Support for the version 2.2 of the ID3 tag has been improved to the same level as that of later versions.

6. Correction for a file directory corruption issue

When using the script functions to create a new file on a freshly formatted CompactFlash disk, where this new file has a long filename, this new file could replace another existing on the CompactFlash card. In other words, when creating a new file, an existing file was deleted (under specific circumstances).

7. The date/time of the device is no longer reset on a “warm reset”

In the old behaviour, the date and time of the H0420 was set to midnight on 1 January 1970, on every power-up, hardware reset or software reset. In the new behaviour, only a power-up will reset the time and date; a hard reset or soft reset keep the current date in the real-time clock of the H0420.

8. Improved pseudo-random number generator and random seed

The pseudo-random number generator (PRNG) in the H0420 is based on a cryptographic hash. As such, it is a cryptographically-secure PRNG with a very long cycle. It was discovered, however, that the PRNG did not score well on a few other qualities for random numbers, such as low bias and low correlation. In the new firmware, the pseudo-random number generator has been amended to give low bias and low correlation, while still being cryptographically-secure.

At the same time, the start value of the pseudo-random number generator (the “seed”) now depends in part on “noise” bits captured on an analogue input. Every reset of the H0420 is now highly likely to start with a different range of random numbers.

9. `strformat()` function did not accept `%s` specifier

The script function `strformat()` did not accept the `%s` specifier to build strings from sub-strings. Instead, it stripped the “`%s`” character pair from the source string and ignored the replacement.

10. “sleep” instruction and `delay()` function would “stack” timer events

When a script had a timer event to fire every second and another script function called either instruction `sleep` or function `delay()` to wait for, for example, 5 seconds, the timer event function would receive five timer events in rapid succession immediately after the delay expired. In the new behaviour, only a single timer event is sent immediately after the delay.

Since delays suspend event handling (not just of timer events), they should be used sparingly, and only for short delay intervals.

11. `delay()` function was not implemented

Although the `delay()` function was documented in the manual, the function was not available to script programmers. A work-around was to use the `sleep` instruction. In the new firmware, both the `delay()` function and the `sleep` instruction are available and they have the same semantics.

12. `@reset()` event function, equivalent to `main()`

For purposes of symmetry, the new event function `@reset()` may replace function `main()`. These two functions are equivalent: both are called after a hard or soft reset, and after power-up. In a single script, you may use either `@reset()` or `main()`, but not both at the same time.

Upgrading the Firmware

When upgrading firmware, the scripts in the PAWN language should also be recompiled with the latest release of the PAWN compiler. Any “**amx**” file built for earlier versions of the firmware may not function accurately with the new firmware. The new release of the PAWN toolkit is included in each firmware update.

The procedure below describes how to upgrade the firmware using a PC running Microsoft Windows. When you do not run Microsoft Windows, please contact us for an alternative upgrade procedure.

We advise you to read through this procedure before starting the upgrade, so that you have a mental picture of the steps that are involved in the procedure.

1. Install the software

If you have not done so already, download the firmware update and then “open” or “run” the file. The firmware update file is a *setup* program that installs the required components. If you received the firmware update on CD-ROM, you can install it directly from the CD-ROM.

2. Connect the H0420 to a PC & remove the Compact Flash card

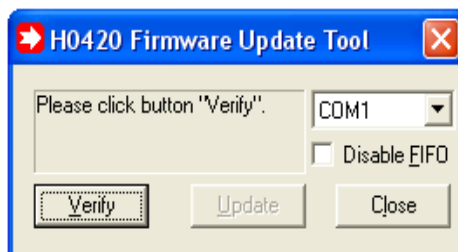
First unplug the H0420 MP3 player from the 5V power. Then remove the Compact Flash card from the H0420, and connect a standard RS232 cable (not a null-modem cable) between a PC and the H0420. Plug the power connector back into the H0420 once the serial cable is connected. Do not re-insert the Compact Flash card (this is done in step 5).

If you are using a simulated RS232 port (for example, through an USB-to-RS232 adapter), it is best to wait a few seconds between inserting the RS232 plug and the power plug —10 seconds should always be sufficient.

If the device was already connected to the PC through the RS232 cable and the Compact Flash card had already been removed, it is still advised to remove the power plug for a few seconds, so that the device does a full restart.

3. Run the “Firmware Update Tool”

Locate the “Firmware Update Tool” in the *Start Menu* (under *Programs / H0420 MP3 Controller*), and run it —this tool was installed in step 1. See the screen shot below for the appearance of the Firmware Update Tool.



Make sure that the correct COM port (RS232) is selected in the update tool.

Some simulated RS232 ports (USB-to-RS232 adapters) do not properly simulate the RS232 FIFO buffers. For these devices, you may set a check-mark in the “Disable FIFO” option.

4. First click “Verify”, then click “Update”

Click on the button “Verify” and allow it to complete. This function checks the current firmware version and the device model and reports these to you. If all is well, it will tell you the version number of the firmware that is currently in the H0420, as well as the version number of the latest firmware. If the device already has the latest firmware, this tool will tell you so.

If the “Verify” button found no error, you can click on the button “Update”. Updating the firmware may take a minute. Do not abort the program while the firmware update is processing.

After the update has completed, the program will inform you that the device will automatically reset itself after a time-out of a few seconds. If you wish to check that the firmware has indeed been uploaded correctly, you will have to wait at least this number of seconds before clicking on the button “Verify”.

5. Recompile the PAWN script

Recompile the script and store the resulting file AUTORUN.AMX on the Compact Flash card.

Make sure that the script is compiled with the up-to-date PAWN compiler. You can now re-insert the Compact Flash card in the H0420 player.

Trouble shooting — when uploading fails

If the “Verify” button times out and responds with the error message:

Unable to synchronize with the device.

Please check the serial connection.

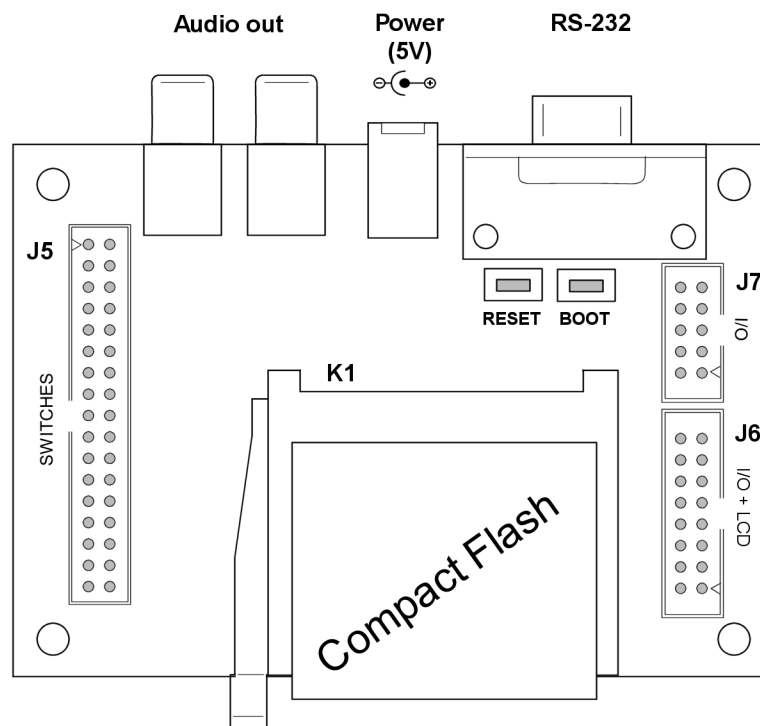
- check the RS232 cabling
- “power cycle” the H0420 MP3 player (remove the power plug from the device for a few seconds and then re-insert it)
- run the update procedure (on the previous page) again.

If this fails again, try to reset the H0420 while the Update Tool is busy verifying the device. That is: click on the button “Verify” and then press the “**RESET**” switch on the H0420. See below for the location of the reset button. You may also want to try to perform the procedure after rebooting the PC, or from a different PC.

If all fails, a last option that you can try is to set the H0420 in “Boot Loader mode” (see below), and run the procedure again. In this case, the “Verify” button will inform you that it cannot find the “current” version of the firmware in the H0420, but it still allows you to update to the latest revision. Resetting the H0420 to Boot Loader mode is typically necessary when an earlier upload has been aborted or interrupted.

Resetting the H0420 to “Boot Loader mode”

The H0420 has two switches, behind the connector of the RS232. In order to gain access to these switches, it may be necessary that you open the case in which the H0420 is mounted.



These switches must be pressed and released in the correct order:

- Press (and hold) “**RESET**”
- Press (and hold) “**BOOT**”
- Release “**RESET**”
- Release “**BOOT**”

It is advised to “power cycle” the device before resetting it to boot loader mode, and to remove the Compact Flash card. (Do *not* power-cycle the device *after* switching it to boot loader mode, because this would reset the device to normal mode.)