MOD-SIX
Nixie Clock System
Updating Instructions

June 2013

This manual provides instructions for updating the firmware of the MOD-SIX Nixie Clock System firmware as well as a brief firmware revision summary.

Revision/Update Information:	This is a new manual
Clock Firmware:	V07-53
GPS Repeater Firmware:	V27

http://www.badnixie.com

16 June 2013

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CAUTION: This clock makes use of high voltages within the case. Use extreme care when operating the clock with the cover removed.

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Preface

This manual provides instructions for performing firmware updates as well as a brief firmware revision summary for the MOD-SIX Nixie Clock System.

Intended Audience

This manual is intended for all MOD-SIX Nixie Clock System owners.

Important Cautions

Hazardous voltages are present at some locations on the circuit boards when the clock is operating. Avoid touching any components other than the updating dongle while power is applied.

Never install or remove the updating dongle or the RF-Link mezzanine board while power is applied.

Like all electronic devices, the clock system components can be damaged by static electricity. When updating the firmware, always touch the aluminum base plate first to discharge any static.

The tubes are extremely fragile and expensive. Take care to avoid damaging them when removing and reinstalling the acrylic cover and when updating the clock firmware.

1 Identifying the installed firmware

In order to determine if there is a newer version of firmware available for any of your clock components, you will need to first determine the current versions. This chapter provides instructions for identifying the firmware version of each clock system component.

1.1 Identifying clock firmware

Unplug the power cable from the left rear of the clock. Wait a moment and then plug it back in. As part of the clock's startup messages, it will display the firmware version as "Vxx-xx" where xx-xx is the current firmware version.

1.2 Identifying GPS repeater firmware

Disconnect the power from the GPS repeater, either by unplugging the AC adapter from the wall outlet or by unplugging the other end of the power cord from the GPS repeater, whichever will give you a better view of the clock. Wait a few moments and reconnect the GPS repeater's power. The clock display will show a message of the form "RPTRxx" where xx indicates the GPS repeater's current firmware version.

Note: **The clock must be running firmware V07-31 or newer *AND* the GPS repeater must be running firmware V11 or newer in order to perform this function. Failure to display the version message (normally displaying a "PING" message instead) does not identify which of the clock, GPS repeater, or both is out of date.**

Note: **Recent versions of the repeater firmware also display the revision on the repeater LEDs at power-on. For example, two green blinks followed by six yellow blinks would indicate firmware V26.**
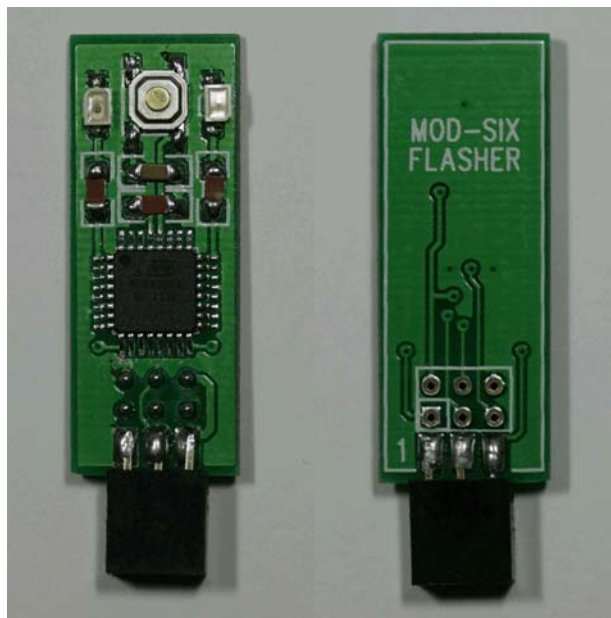
2 The firmware updating procedure

Firmware updates are performed with a small updating dongle. There are separate dongles containing the clock firmware and the GPS repeater firmware. The only difference is the firmware provided in the dongle and a sticker indicating the firmware version and which component the dongle is for. The dongle installs the new firmware onto the clock or GPS repeater CPU and is removed once the update is completed.

Note: **Depending on your current software versions, you may receive a clock updating dongle, a GPS repeater updating dongle, or both.**

Note: **The dongle checks to make sure it contains appropriate firmware for the device being updated and will not install the update if it is for the wrong device.**

Figure 2–1   Updating Dongle

2.1   Clock updating procedure

Note: **You may want to write down your clock configuration settings before proceeding, as the update process resets the clock to default values.**

To perform the update, disconnect the power cord from the clock. Remove the acrylic cover (you may want to use cotton gloves or some similar method to avoid getting fingerprints on the cover) and set it aside. Locate the programming connector on the CPU board, labeled "ISP J4". Note that if you have a GEN I CPU (labeled "CPU 1.0") with an RF-Link mezzanine board installed, you will need to remove the mezzanine board in order to access the connector.

**Figure 2–2   Location of ISP connector on CPU**
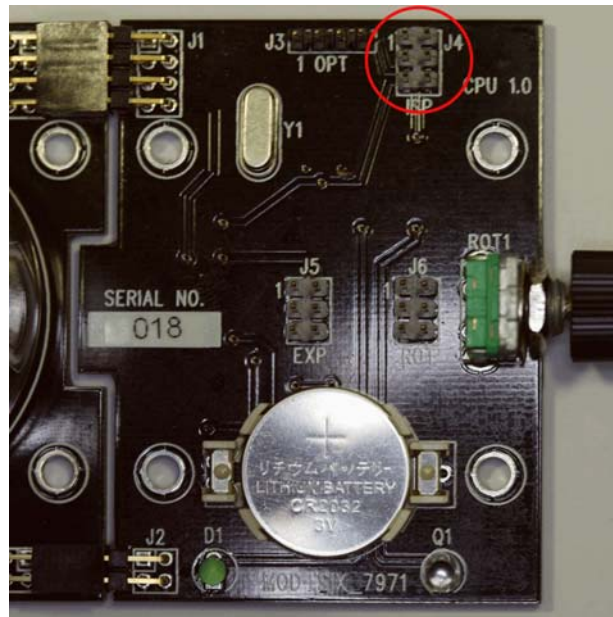
Note: **The above picture shows a GEN I CPU. While the layout of the GEN II CPU is somewhat different, the ISP connector is in the same location and orientation.**

Install the updating dongle on the CPU with the dongle components facing away from the tubes. Make sure that all 6 pins on the dongle are on the matching pins on the CPU, not offset by one pin.

Note: **The clock generates and uses high voltages to operate the tubes. Use caution to not touch any clock components other than the updating dongle when performing the update procedure.**

Figure 2–3   Dongle installed on CPU
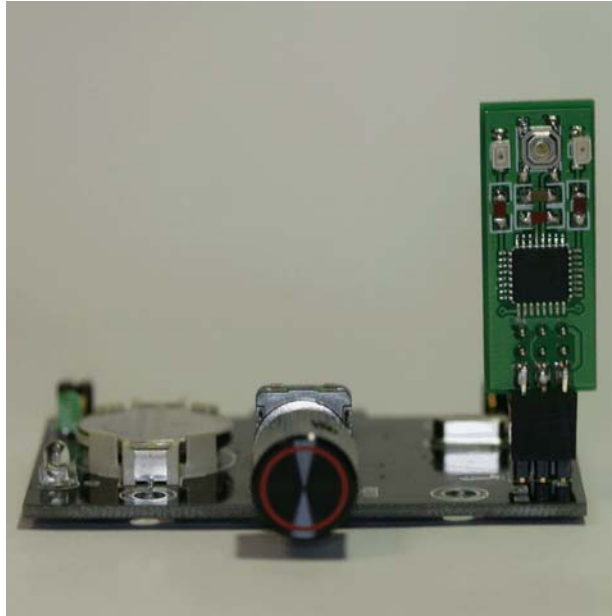
Apply power to the clock and wait for it to proceed through its normal startup. If the clock does not power on and display the normal startup messages, immediately disconnect the power and check your installation of the updating dongle.

Press the button on the top center of the updating dongle. It is rather small, and you may have trouble pressing it if you have large fingers. There should be an obvious tactile "pop" when it is successfully pressed.

The red and green LEDs on the dongle will light while updating is in progress. This normally completes within a few seconds. After the update completes, the green LED will remain lit to show a successful update and the clock will reset and display the new firmware version. If the red LED is lit instead, the firmware update was unsuccessful and you should press the button again to repeat the update procedure.

Note: **During the updating process, the tubes may go blank or freeze while displaying a message. This display may be brighter or dimmer than normal operation and does not indicate a problem with the update process.**

Once updating is complete, disconnect power from the clock and remove the updating dongle. If you removed the RF-Link mezzanine board, reinstall it, being careful to align all the connectors properly. Place the dongle back into its antistatic bag and reinstall the acrylic cover on the clock.

Apply power to the clock and set your desired configuration options. You may wish to review the new features in the latest User's Guide to see if there are any new options you'd like to explore.

2.2 GPS repeater updating procedure

To perform the update, disconnect the power cord from the GPS repeater. Using a 3/32" Allen wrench, remove the four cap-head screws and black plastic spacers holding the clear acrylic cover to the top of the GPS repeater.

Note: **There may be additional spacers under the cover - be careful not to lose them if they are present.**

Lift the acrylic cover off of the GPS repeater and set it to one side, on a surface where it won't be scratched.

Locate the programming connector near the front right of the GPS repeater board. It may be labeled "ISP" or it may be unlabeled, depending on your hardware.

**Figure 2–4   Location of ISP connector on GPS repeater**
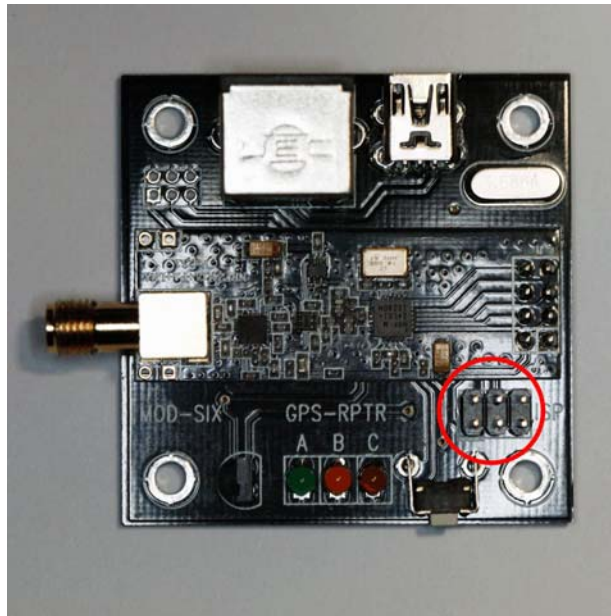
Note: **The above picture shows a high-power GPS repeater. While the layout of the standard GPS repeater is somewhat different, the ISP connector is in the same location and orientation.**

Install the updating dongle on the GPS repeater with the dongle components facing toward the rear of the GPS repeater (the side with the power and GPS connectors). Make sure that all 6 pins on the dongle are on the matching pins on the GPS repeater, not offset by one pin.

Note: **In some cases the front right hexagonal standoff may interfere with installation of the dongle. It can be rotated or completely unscrewed to make more room, if needed.**

Figure 2–5   Dongle installed on GPS repeater
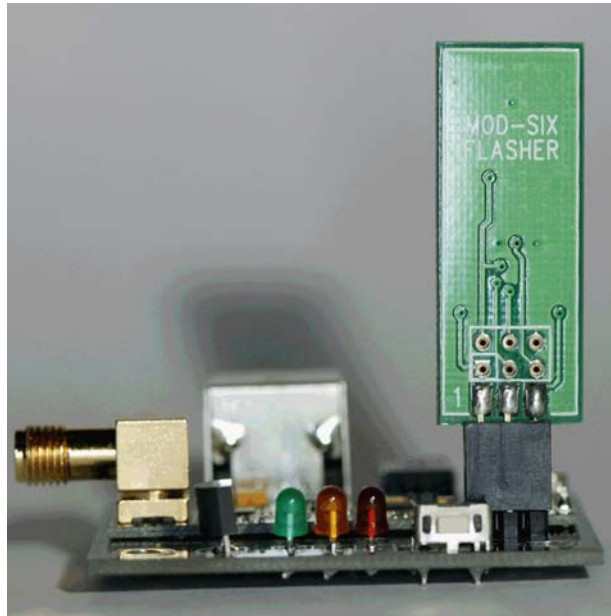
Apply power to the GPS repeater and wait for it to proceed through the normal startup. If the GPS repeater does not power on and display the normal LED startup sequence, immediately disconnect the power and check your installation of the updating dongle.

Press the button on the top center of the updating dongle. It is rather small, and you may have trouble pressing it if you have large fingers. There should be an obvious tactile "pop" when it is successfully pressed.

The red and green LEDs on the dongle will light while updating is in progress. This normally completes within a few seconds. After the update completes, the green LED will remain lit to show a successful update and the GPS repeater will reset and display the new firmware version on its LEDs. If the red LED on the dongle is lit instead, the firmware update was unsuccessful and you should press the button again to repeat the update procedure.

Once updating is complete, disconnect power from the GPS repeater and remove the updating dongle. Place the dongle back into its antistatic bag and reinstall the acrylic cover on the GPS repeater using the black plastic spacers and Allen cap-head screws. Do not overtighten the screws.

Note: **If you are not using the default radio options (RFCHAN / RFBAUD) on the clock, you will need to pair the GPS repeater with the clock after updating the GPS repeater firmware.**

2.3   Return of updating dongle(s)

Once you have confirmed that the firmware has been updated and all components are operating normally, please email badnixie@badnixie.com for the address to return the dongle(s) to.

Note: **A single dongle and its packaging can be mailed in a regular envelope and should be under 1 ounce. A pair of dongles may require 2 ounces of postage.**

Note: **Returning the dongles lets us send them to another clock owner and keep costs down.**

3 Version history

Note: **Gaps in version numbers indicate unreleased development versions.**

3.1 Clock version history

- V06-06 - Version shipped with original GEN I clocks
- V07-07 - Version shipped with GEN II clock kits
- V07-09 - Version shipped with assembled GEN II clocks
- V07-53 - Version shipped with GEN IIv7 clocks, latest version

3.2 GPS repeater version history

- V10 - Version shipped with GEN II clocks and GEN I upgrade kits
- V26 - Version shipped with GEN IIv7 clocks
- V27 - Latest version

A Advanced updating techniques

The above description presumes that you are using the supplied updating dongle(s) when updating the clock and GPS repeater firmware. Firmware updates are also available (upon request) as .hex files for those who have their own programming capability. In this case, the firmware is directly installed onto the device without using an updating dongle as an intermediary. As a minimum, you will need updating software such as AVRDUDE (http://www.nongnu.org/avrdude) or eXtreme Burner (http://extremeelectronics.co.in/software/BurnerAVR) as well as a compatible programmer such as the USBasp (http://www.fischl.de/usbasp). The choice of programming hardware and software is up to you. However, not all combinations (in fact, very few) have been tested by us so some experimentation may be needed. Here are some pointers which may be useful:

- The CPU on the clock is an ATMEGA168A and should be programmed at 5V.

- The CPU on the GPS repeater is an ATMEGA48 and should be programmed at 3.3V.

- Many USBasp devices come with an 8-pin programming connector. In that case, you will need an 8-pin to 6-pin adapter for programming the MOD-SIX components.

- On some programmers / adapters, the 6-pin connector has a large keying tab which may interfere with seating the adapter on the GPS repeater's ISP connector.

- The dongle's checks for appropriate firmware type do not apply when directly programming the MOD-SIX components. Therefore, it is definitely possible to flash something that doesn't work. As long as you do **NOT** reprogram the fuses, you should be able to recover by flashing a valid firmware image.

- If you are at all uncertain about the correct orientation / pinout of the ISP connectors on the clock or GPS repeater, refer to the schematic and board artwork package provided with the clock.