README.md

Flashing the 218e with Firmware

We will be updating and improving the firmware for the 218ev3 over time. You will, at some point, need to update your device with new firmware. We've tried to make the process as easy as possible. This document describes how to do this painlessly and successfully.

Requirements

- Windows 7 and up **or**
- macOS Snow Leopard and up.
- USB-C connection to the LEM218 **or**
- USB and h-power connection for 218e module
- Downloads described below.

Download

The firmware update package has files for macOS and Windows

The firmware package includes:

- Script to flash firmware
- Firmware hex file
- sendmidi command line executable
- dfu-programmer executable
- msvcp140.dll for VC++ runtime
- For Windows,
    - zadig-2.8.exe USB DFU driver installer

Connecting the LEM218v3

If you have the standalone LEM218, your connections are simple. Just connect the USB-C to your Mac or Windows computer, connect to power, and turn it on.

Connecting to the 218ev3 Module

If you are using the module version of the 218e, and it's installed with the rest of your Buchla Modular system, we are assuming you have a 5xIO module that provides USB and MIDI access to the LEM218. In this case, simply connect the USB-B connector to your Mac or Windows computer.

Flash the Firmware

Now that you have downloaded and connected everything, you are ready to flash firmware.

- Unzip the **218 firmware flashing.zip** file.
- Open the resulting folder "218 firmware flashing"
- Windows:
  - Double click the **windows/ProgramLEM218.bat** file. You may get a warning from System Defender. Do not worry, this is not dangerous software!
- Mac:

- Double click the **mac/ProgramLEM218.command** file. You may need to open the System Preferences/Security panel and allow the script to open by clicking "open anyway":
- Follow the prompts in the Command Prompt/Terminal until done
- Once the flashing is complete, the 218 will reboot, flash lights, and be ready to use

This is likely all you will need. What follows below is a lot of detail for troubleshooting and general understanding of the process.

Alternative Firmwares

There is an alternative version of the firmware in the "otherfirmware" folder. This firmware changes the behavior of the Arpeggiation Rate CV input. Standard behavior for the input is to use pulses to advance the arpegiattor's pattern. With the alternative "...Porta_CV_to_Arp_Rate.hex", the input will use CV to modulate the Arpeggiation rate. Fun!

If you want to flash that version, simply move it up a directory from "otherfirmware" into the "mac" or "windows" directory, into the same directory as the ".command" or ".bat" flashing script. When you launch the flashing script, you will be prompted to choose a firmware, using the number keys.

Flashing Details

Details: Flashing with macOS

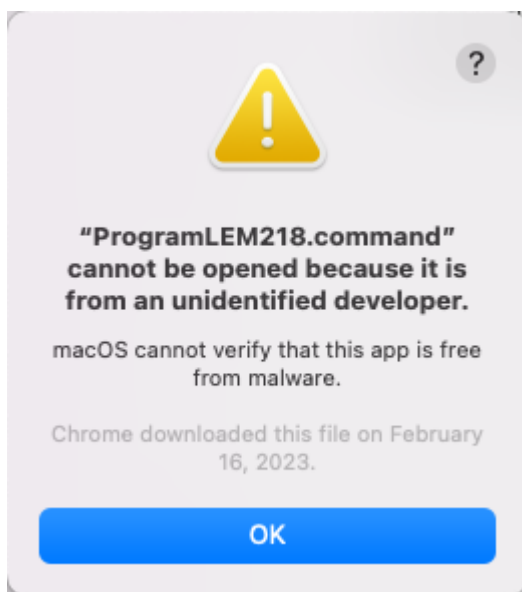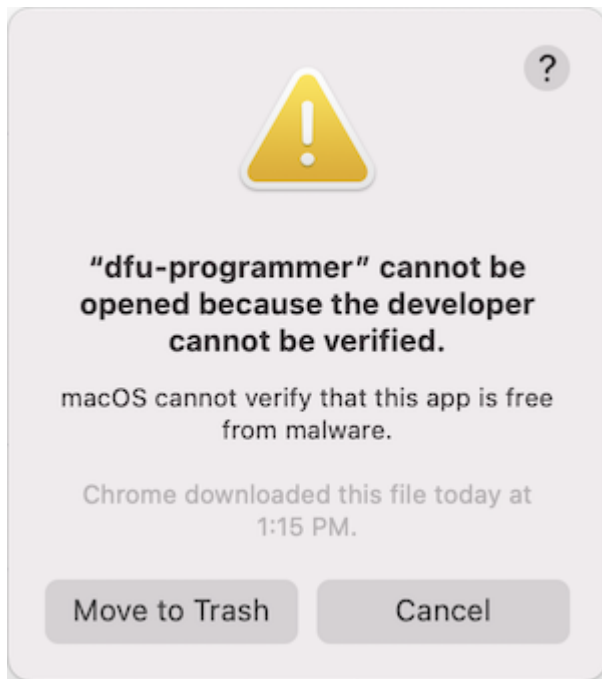Here is what a successful flash looks like on Mac, after double clicking the .command file:

```
Change to /Users/nyboer/Downloads/LEM Firmware flashing
<<<<====...BUCHLA LEM218 PROGRAMMER....=====>>>
The current working directory /Users/nyboer/Downloads/LEM Firmware flashing.
count: 1
There's just one firmware file and it's 218e_v34.1_Porta_CV_to_Arp_Rate.hex
Preparing to flash 218e_v34.1_Porta_CV_to_Arp_Rate.hex...
====.......=====
Sending Sysex using https://github.com/gbevin/SendMIDI
Press any key to continue.

MIDI ports now:
IAC Driver Bus 1
MicroBrute
MicroBrute MIDI Interface
iProgramCard
U86 XT Output
U86 XT Output
U86 XT Output
U86 XT Output
U86 XT Output
U86 XT Output
U86 XT Output
...
Erasing chip...
Programming firmware for 218e-V3...
59549 bytes used (23.45%)
Press any key to restart the 218e.
```
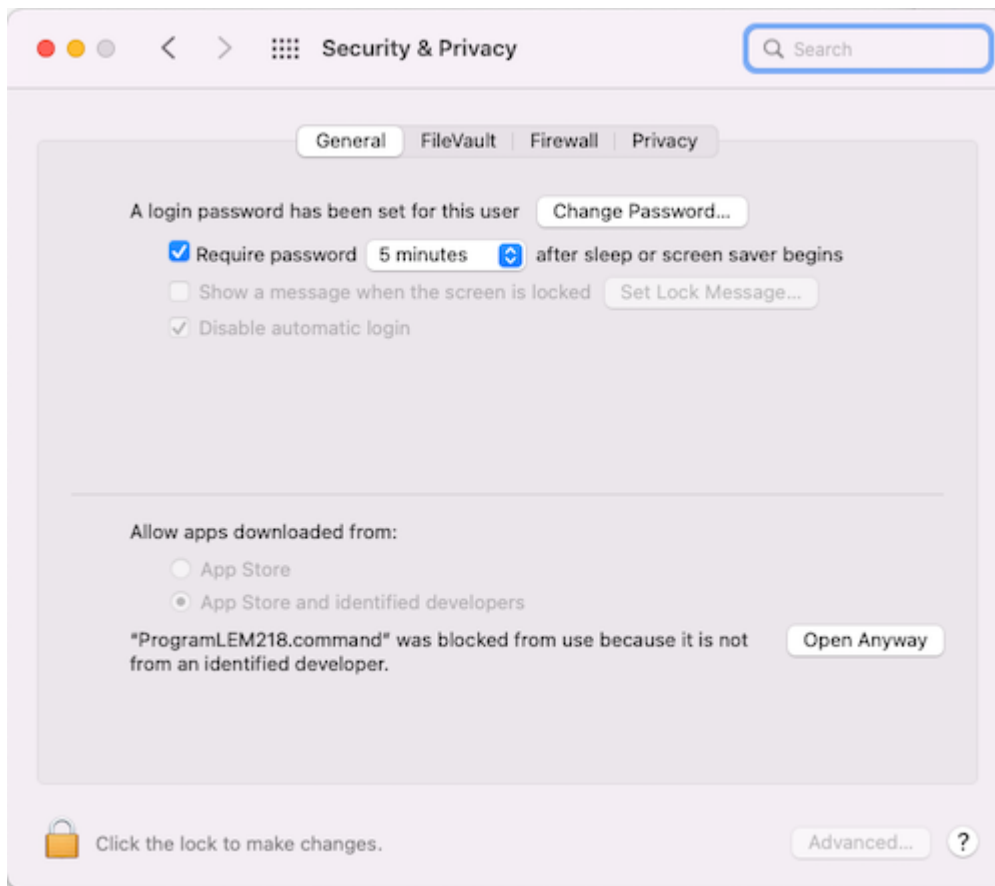
Flashing on a Mac is very straightforward. Double-click the ProgramLEM218.command file, hit enter when prompted, then enjoy. You may need to give your system permission to run the .command file. You might get these errors when you double click:

“ProgramLEM218.command” cannot be opened because it is from an unidentified developer.

macOS cannot verify that this app is free from malware.

Chrome downloaded this file on February 16, 2023.

OK

"dfu-programmer" cannot be opened because the developer cannot be verified.

macOS cannot verify that this app is free from malware.

Chrome downloaded this file today at 1:15 PM.

Move to Trash   Cancel

Just open the System preferences and allow the script to open by clicking "open anyway":

Security & Privacy

General   FileVault   Firewall   Privacy

A login password has been set for this user   Change Password...

☑ Require password 5 minutes ⬦ after sleep or screen saver begins

☐ Show a message when the screen is locked   Set Lock Message...

✓ Disable automatic login

Allow apps downloaded from:

○ App Store

● App Store and identified developers

"ProgramLEM218.command" was blocked from use because it is not from an identified developer.

Open Anyway

🔒 Click the lock to make changes.   Advanced...   ?

Details: Flashing with Windows

On Windows, a successful flashing looks like this at the end:

```
C:\Windows\system32\cmd.exe

"==Begin Buchla 218 Firmware Flashing=="
Erasing flash...  Success
Checking memory from 0x2000 to 0x3FFFF...  Empty.
Checking memory from 0x2000 to 0x3F1FF...  Empty.
0%                            100%  Programming 0x3D200 bytes...
[>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>]  Success
0%                            100%  Reading 0x3E000 bytes...
[>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>]  Success
Validating...  Success
0x3D200 bytes written into 0x3E000 bytes memory (98.59%).
Press Y to Restart the 218e (Y/N)
```

When you first double click on the .bat file to run the script, Windows defender may warn you. Allow the script to run. It is not dangerous! During the script, Windows will likely require installing some software and drivers that take care of some dependencies. The batch script will guide you through firmware updating and installation and the Zadig USB driver installation.

Zadig: USB Driver Install

Zadig is used to install a driver to allow Windows to access the 218 in firmware update mode. We have found it may require af few steps of input from you. The firmware update script will launch it when needed. Below is a step by step guide to installation success!
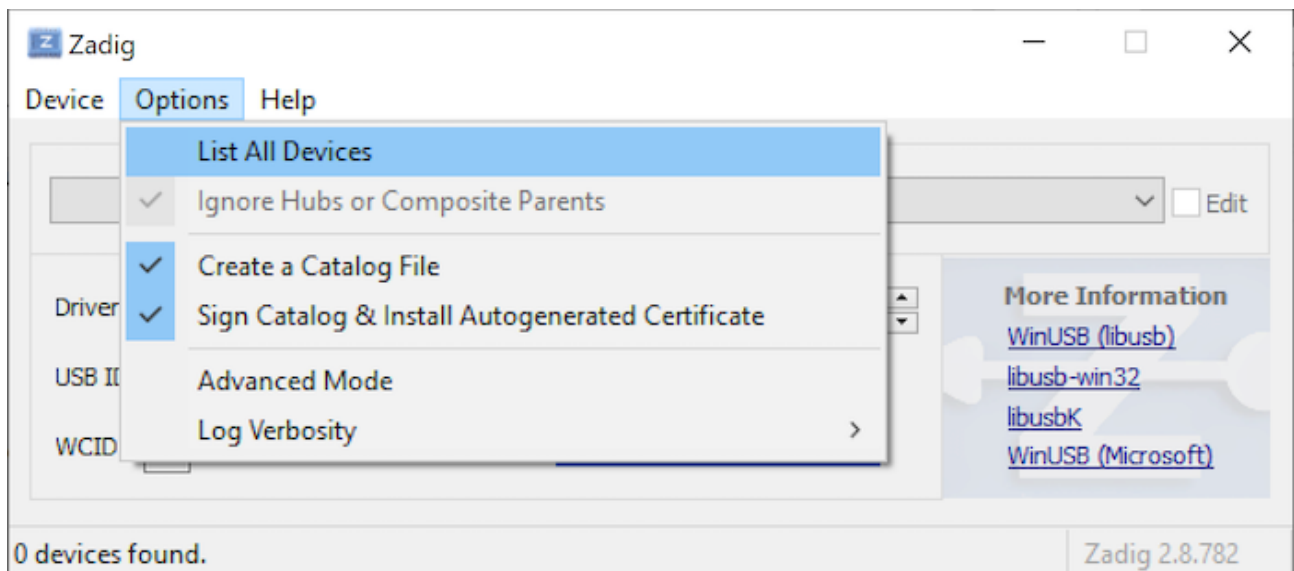
1 - When the script opens the Zadig USB driver installer, it may not automatically find "AT32UC3B" (which is the microcontroller model on the LEM218). When that happens, it looks like this:
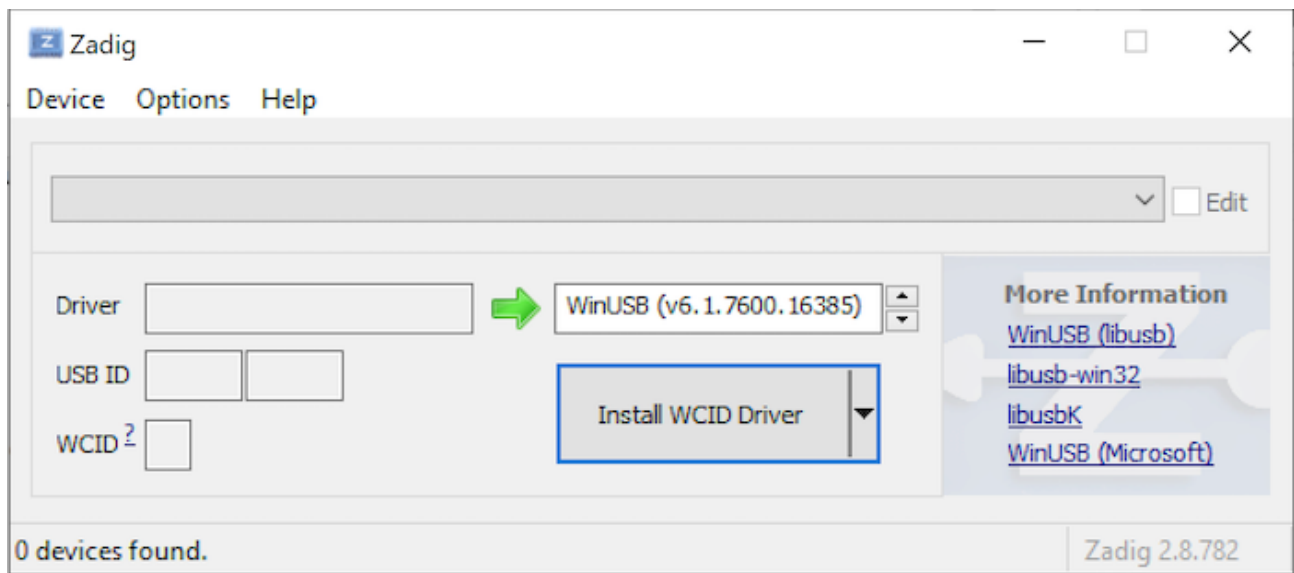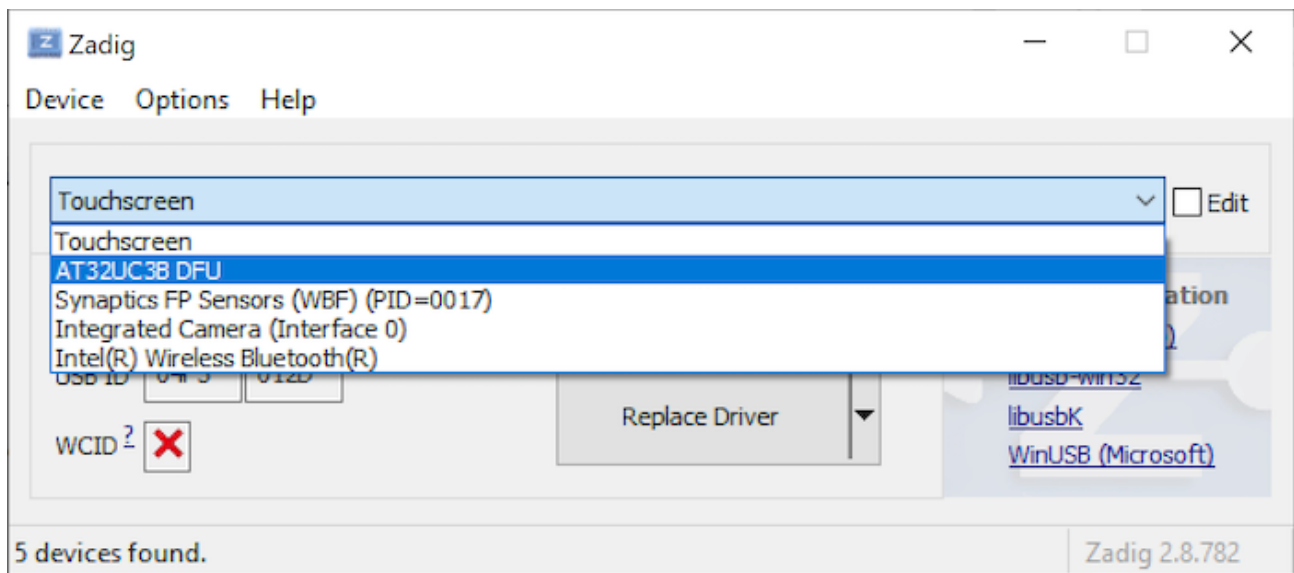
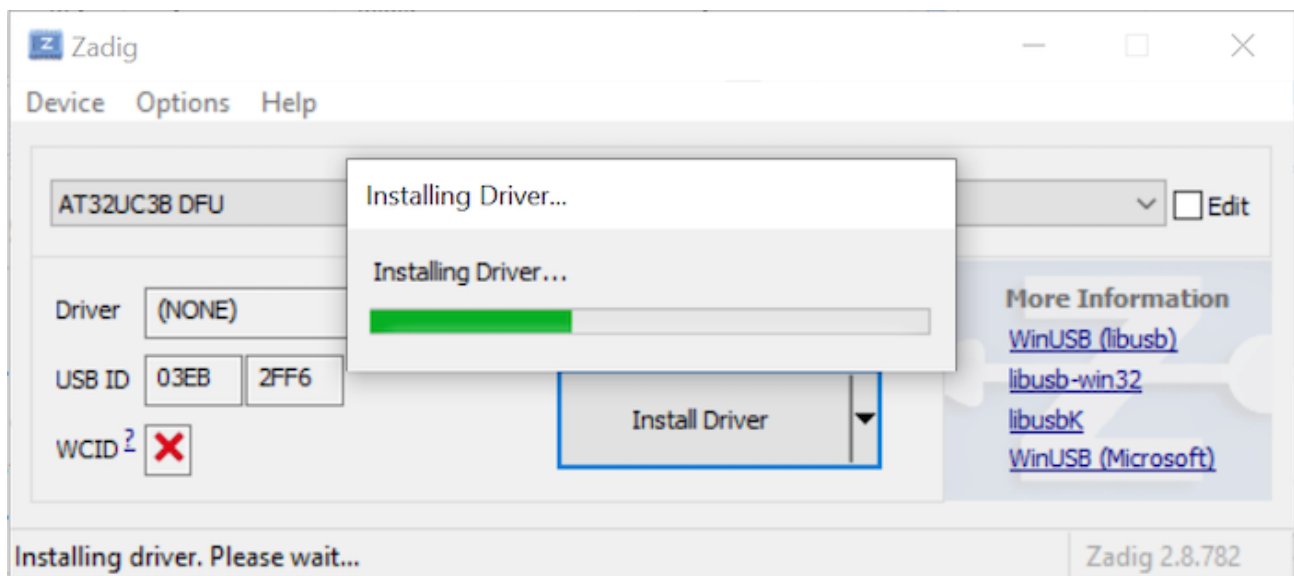If the AT32UC3B does show up in the devices, you can continue to #4.

2 - In this case, make sure you select "List all Devices" from Options:
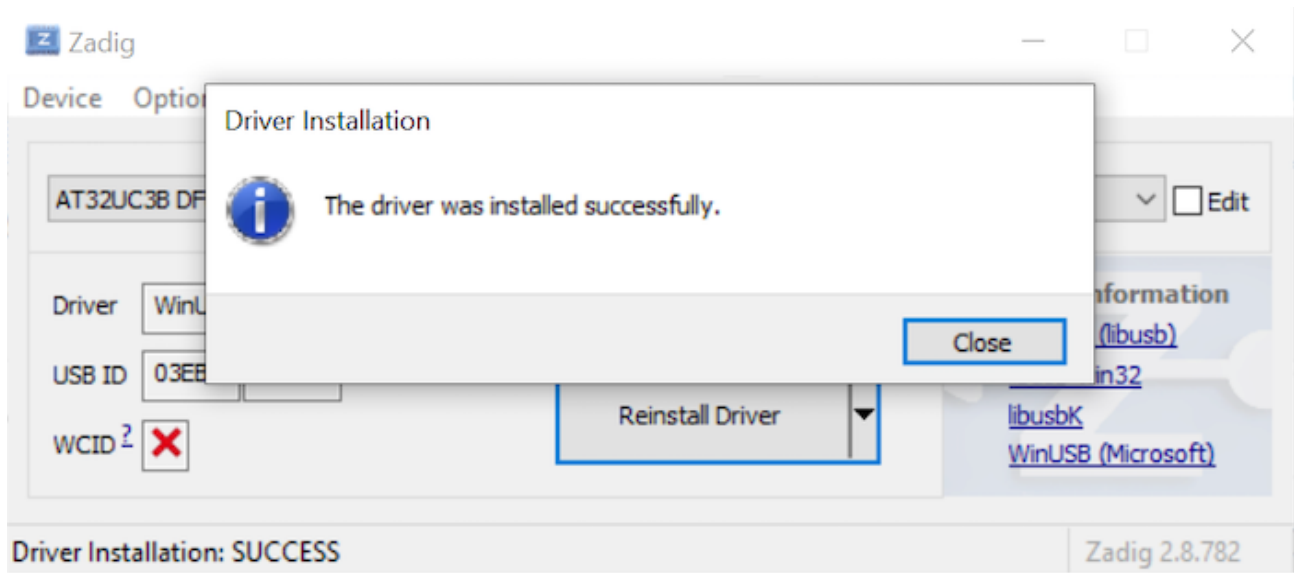

3 - Then Select the AT32UC3B from the devices menu

4 - Finally, press the "Install" (or Reinstall) button. There may be a bit of a pause (that seems like forever, but is only a few seconds) before it starts installation. Don't panic, it will start!

5 - The installer will notify you that the driver has been successfully installed:

Close the Zadig Application and return to the Command Prompt window to continue with the flashing script to its end.
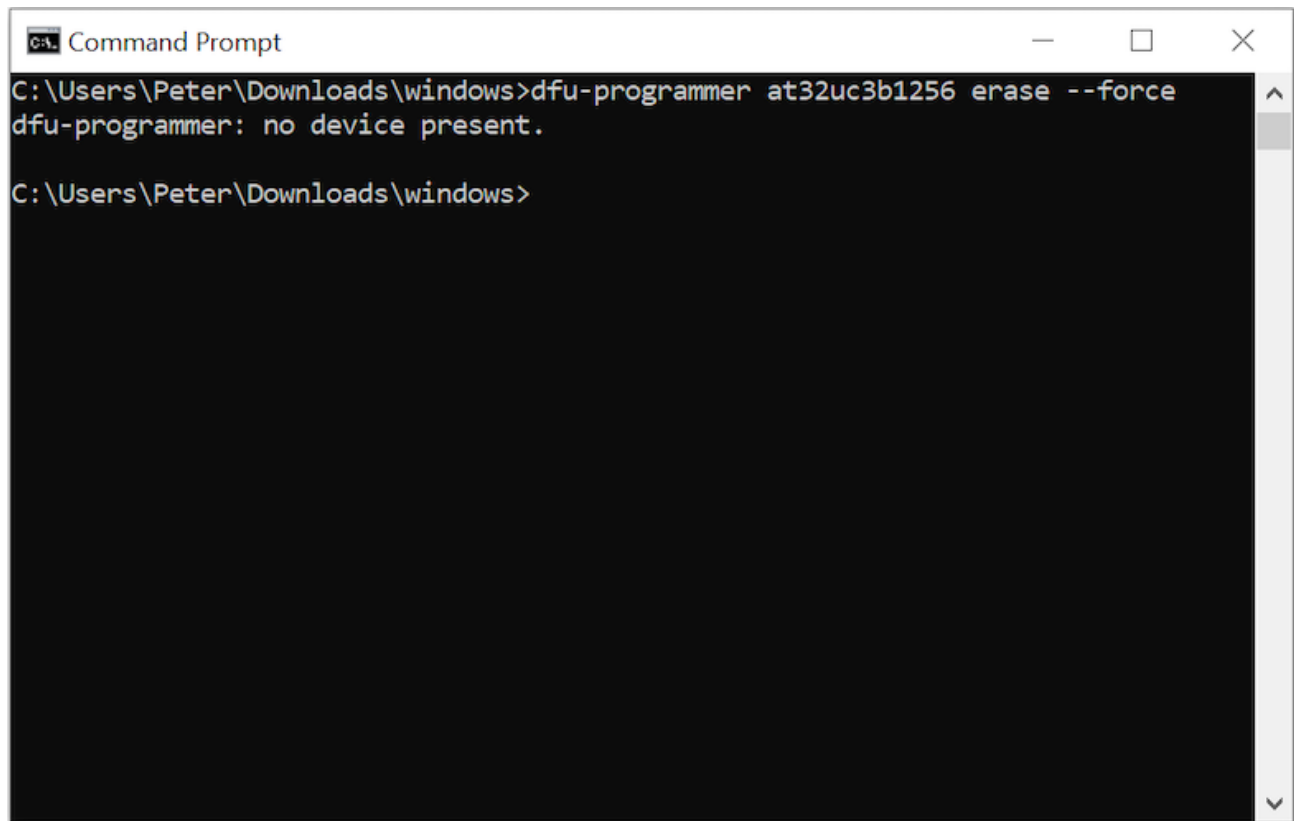
Troubleshooting

If things are failing, it's important to understand what's going on in the script.

1. `sendmidi` sends a MIDI sysex message that puts the 218 into "DFU" (Device Firmware Update) mode
2. With the 218 in DFU mode, `dfu-programmer` is now able to access the device, and sends a message to erase it
3. It then sends the new firmware to the device
4. Once finished, it starts the device, making it available as a MIDI device and ready to use.
5. You may need to power cycle the device

Problem: Device is unresponsive, but it does show up in the USB devices as a AT32UC3B device.

Solution: Run the flashing script again. It should be able to pick up the device while in DFU mode and completely flash the firmware.

Problem: You get an error in terminal that looks like `dfu-programmer: no device present`

```
Command Prompt                                    —    □    ☓

C:\Users\Peter\Downloads\windows>dfu-programmer at32uc3b1256 erase --force
dfu-programmer: no device present.

C:\Users\Peter\Downloads\windows>
```

Solution:

- The dfu-programmer is not in the same folder as the script.
- On Windows, this could mean the libusb driver was not properly installed. Make sure the driver is installed according to the instructions for Zadig above.

Problem: The Command Prompt has the error `sendmidi is not recognized`

```
Command Prompt                                              —   □   X
Microsoft Windows [Version 10.0.19044.1889]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Peter>cd "E:\LEM Firmware flashing\windows"

C:\Users\Peter>sendmidi list
'sendmidi' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Peter>sendmidi.exe list
'sendmidi.exe' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Peter>
```
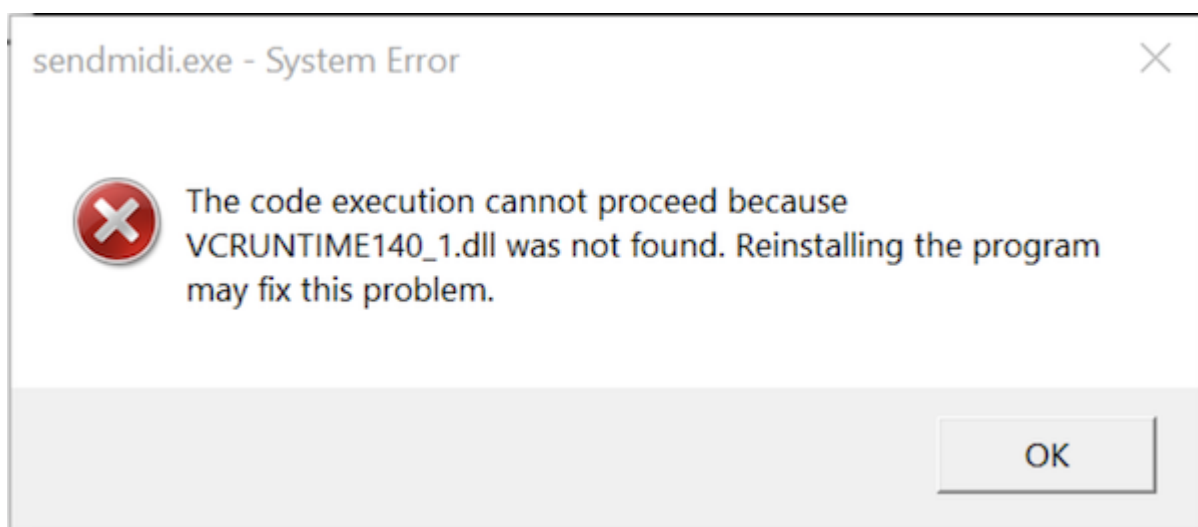
Solution: The Microsoft VC++ Library is not installed. Install the VC++ Runtime with the included VC++ installer.

Problem: You got a popup window that has an error like:

> sendmidi.exe–system error: The code execution cannot proceed because VCRUNTIM

sendmidi.exe - System Error   X

❌ The code execution cannot proceed because
VCRUNTIME140_1.dll was not found. Reinstalling the program
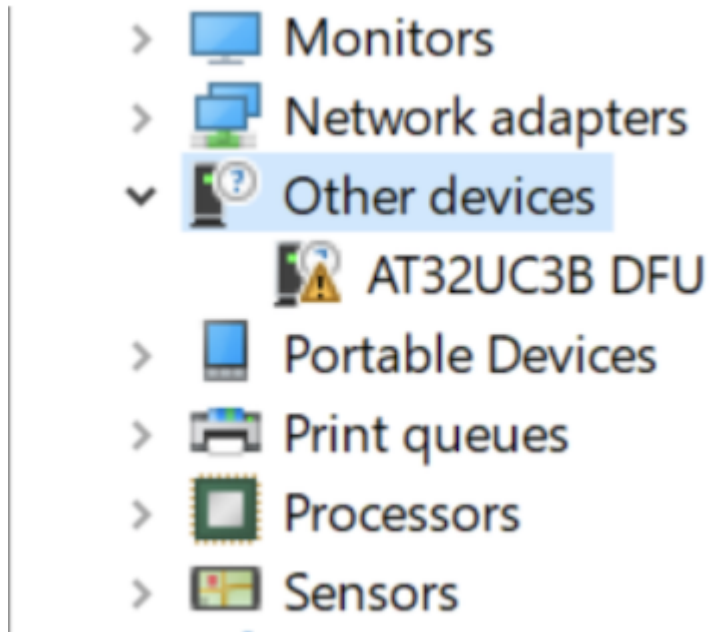may fix this problem.

OK

Solution:

- The Microsoft VC++ Runtime is not installed. You can use the installer supplied with the script package.

Problem: When the 218e is DFU mode, the Device Manager, it shows the AT32UC3B is in "Other"

Solution: This means the USB driver was not properly installed. Make sure the driver is installed according to the instructions for Zadig above.

If the driver is properly installed, when the device is in DFU mode, it looks like this in Device Manager
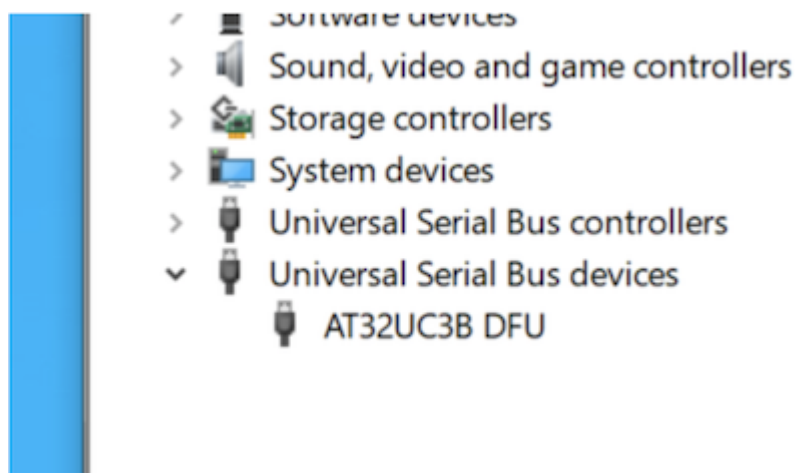
Problem: All the LEDs of the 218 are on, and it is unresponsive

Solution:

- This is a very unlikely outcome. Honestly, you just put the "trouble" in "troubleshooting." This indicates there is no firmware on the device. Try running the script again.

Problem: You need to uninstall the driver that Zadig installed.

Solution: If for some reason, you are experiencing problems with USB devices, you may need to uninstall the libusb drivers from Zadig. This is unlikely, but it may be necessary. Here's how.

Run the Command Prompt. Type the command:

```
pnputil.exe /enum-drivers > drivers.txt
```

Then use a text editor to search the file "drivers.txt" for "at32uc3b" or "libusb". You'll find it is associated with a section headed by:

```
Published Name: oemXX.inf
```

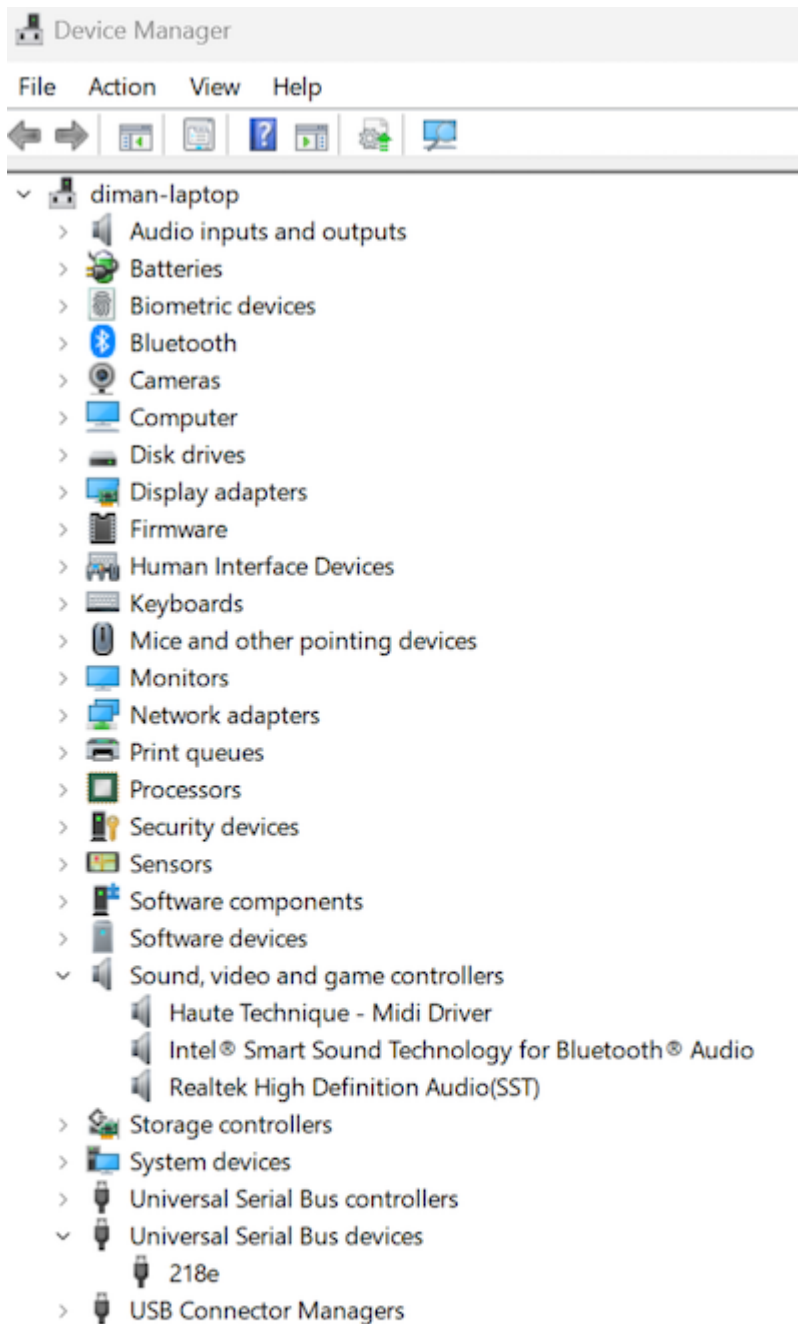such as "oem57.inf" for example.

Run Command Prompt as Administrator (right click on Command Prompt and select "Run as Admin"), use the command

```
pnptuil.exe -f -d oemXX.inf
```

Where XX is the number you found before. This will delete and uninstall the driver.

Problem: You've tried everything, but the dfu-programmer still can't find the device.

Solution: There is a chance that Windows is not using the right MIDI driver. As a result, it can't get past the first step of putting the 218e into DFU mode. First, check your Device Manager. If the 218e shows up as a USB Device and not a Sound and Gaming device, it will look like this:

Device Manager

File   Action   View   Help

- diman-laptop
  - Audio inputs and outputs
  - Batteries
  - Biometric devices
  - Bluetooth
  - Cameras
  - Computer
  - Disk drives
  - Display adapters
  - Firmware
  - Human Interface Devices
  - Keyboards
  - Mice and other pointing devices
  - Monitors
  - Network adapters
  - Print queues
  - Processors
  - Security devices
  - Sensors
  - Software components
  - Software devices
  - Sound, video and game controllers
    - Haute Technique - Midi Driver
    - Intel® Smart Sound Technology for Bluetooth® Audio
    - Realtek High Definition Audio(SST)
  - Storage controllers
  - System devices
  - Universal Serial Bus controllers
  - Universal Serial Bus devices
    - 218e
  - USB Connector Managers

In that case right click on the device, update the driver, and manually pick the driver. Choose "usb audio" and update. Then try flashing again.
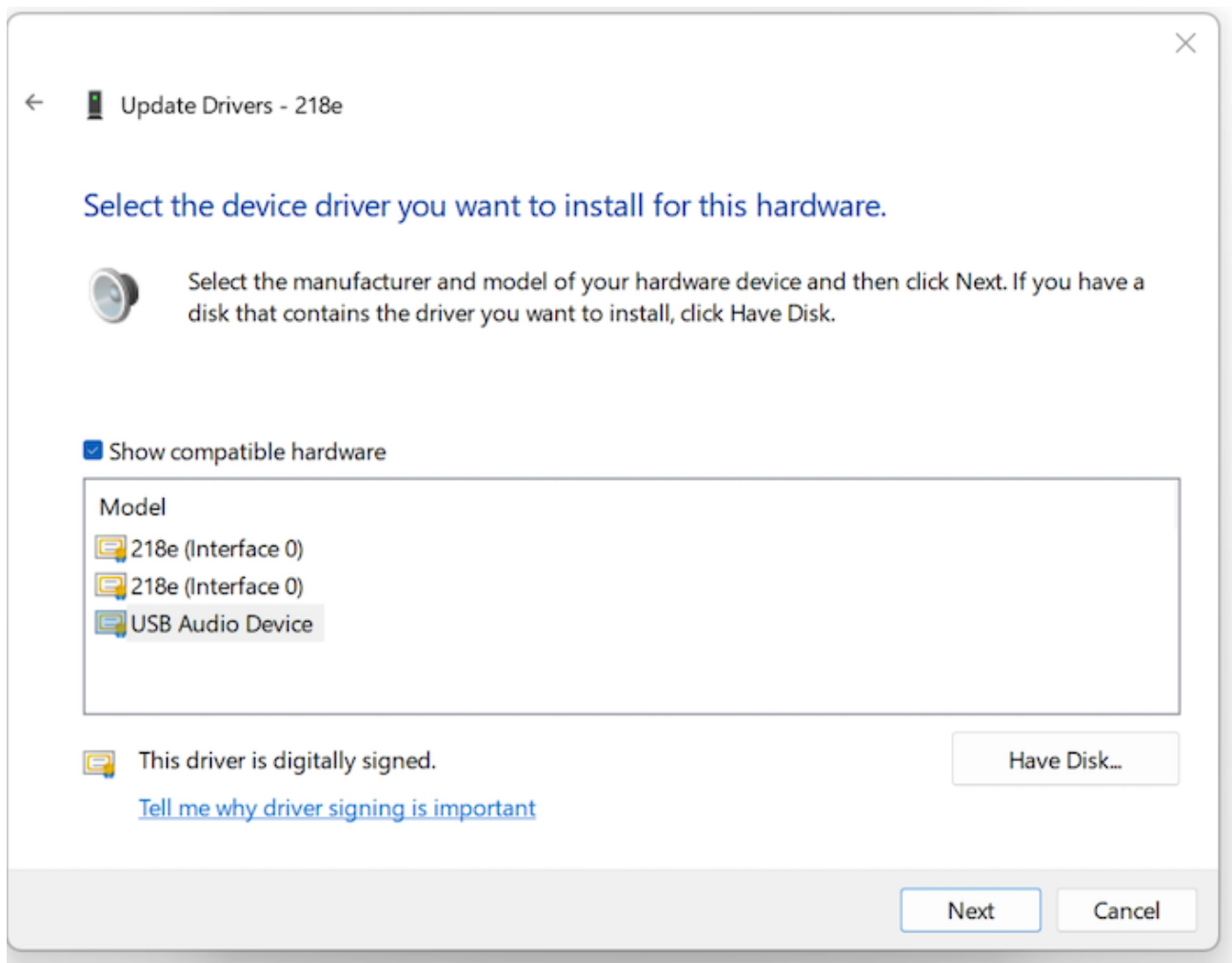
Addendum

Libaries and Dependencies

These scripts include and require the use of several libraries and executable binaries. These may need to be updated in the future. Links are as follows:

- sendmidi - a small commandline utility for sending MIDI to devices. Provided under GPLv3 license.
- VC++ Runtime Library - required by sendmidi. For simplicity, we simply include the msvcp-140.dll file in the same folder to avoid having to run the installer. At some point, sendmidi will be updated to statically link to this dll, deprecating the need to explicitly include the dll. Provided under Microsoft License Terms.
- dfu-programmer - a commandline utility that allows sending firmware over USB. Provided under GPL v2 license.
- Zadig - installs Windows driver for dfu access. The installer can be downloaded here. Zadig installer is distributed under GPL v3.

Save as PDF

[Some options](#) for saving this README.md to pdf. I had the best luck with the `grip` option.

```
pip install grip
grip README.md
```

Then visit http://localhost:6419/ and print to PDF.