**Instructions on Flashing the Beehive Module**

By Jorsh Bee with additional information by Jason Nolan

This tutorial is designed to explain how to flash IC4 on the module (STM32F373CCT6, Cortex M4), and will work on other similar modules using these chips in the Mutable Instruments family, and perhaps others. Other tutorials are available, but this one tries to add more detailed information and links all in one place

In order to use microprocessor-based modules, it is necessary to install a bootloader on the microprocessor and then the firmware (see Links below for everything mentioned in this tutorial). To do this you need a windows computer or a Mac running windows in Bootcamp or using a virtual machine (VM) like Parallels. You also need the STM32 ST-Link utility and software, as well as precompiled bootloader and firmware hex files.

- Connect power cable to you Beehive, but don't turn on your power supply yet.
- Connect the STM32 ST-Link to the Beehive as shown below
    - The pins of JP6 from nearest the top of the module top to bottom of the Beehive are GND, SWDIO, SWCLK, and RESET.
    - Pins 1 & 19 of the STLink are connected together.
    - Pin 20 of the STLlink goes to GND, pin 7 goes to SWDIO, pin 9 goes to SWCLK, and pin 15 goes to Reset.
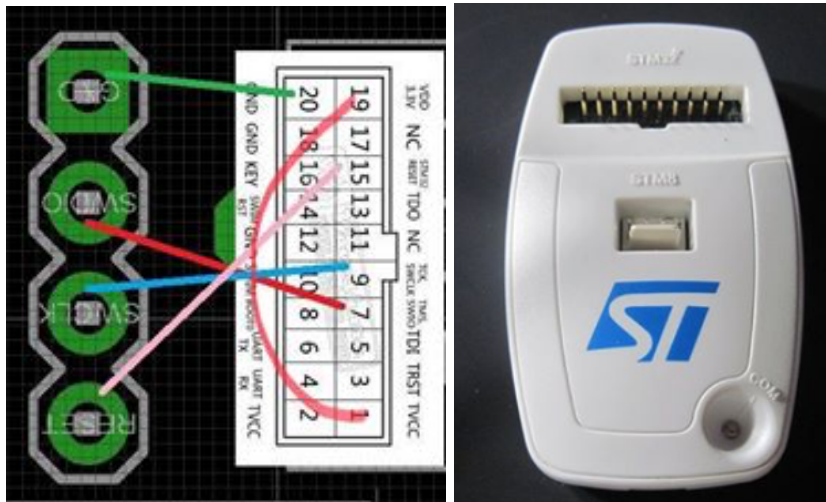

- Be aware of the orientation of the pins. If you orient your PCB facing you, you can see that on the left side there are the 4 pins (JP6) and the top one is the square one
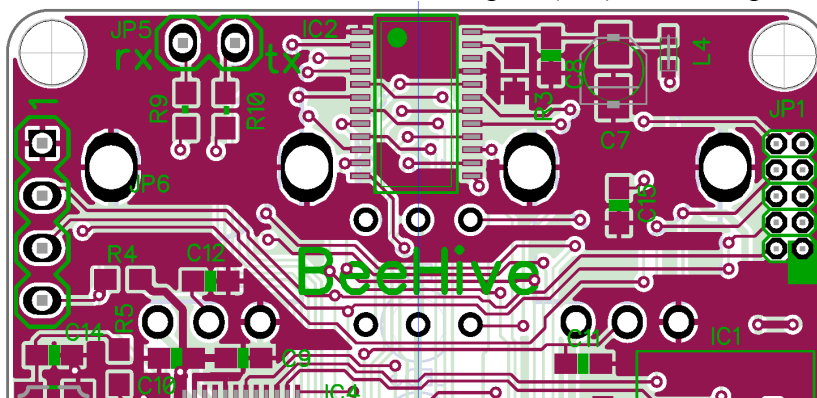
- Power on your Beehive, and connect the USB power from your laptop to your STLink.
- Open the STM32 ST-Link software, and press "connect to target" button (circled).
- If that doesn't work, go to Target/Settings. When it does work, you'll get a screen full of gibberish like can be seen in the background below.
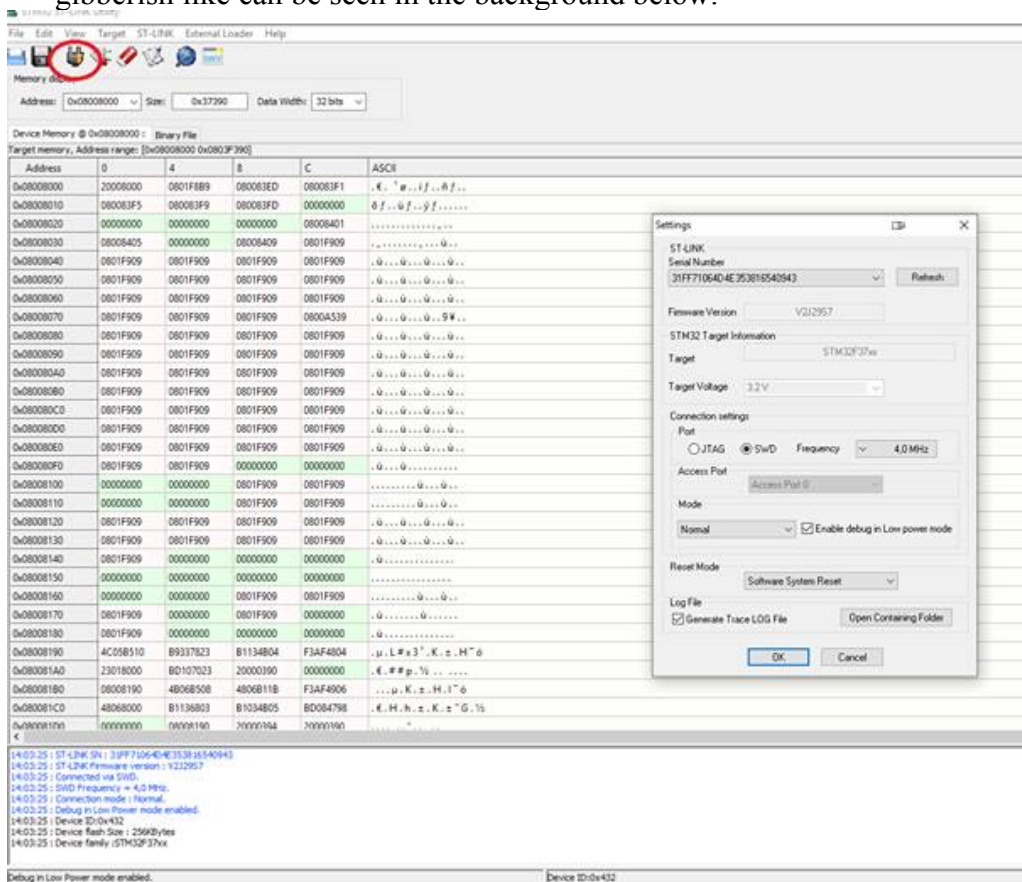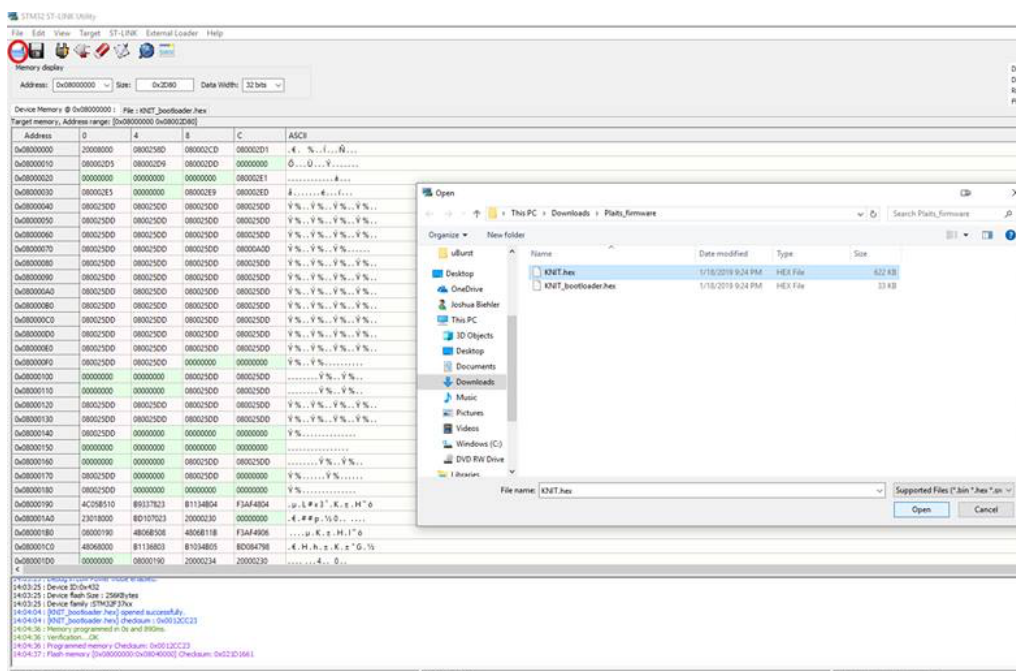

- Select Open (circled in the picture), navigate to your bootloader, and select Open.
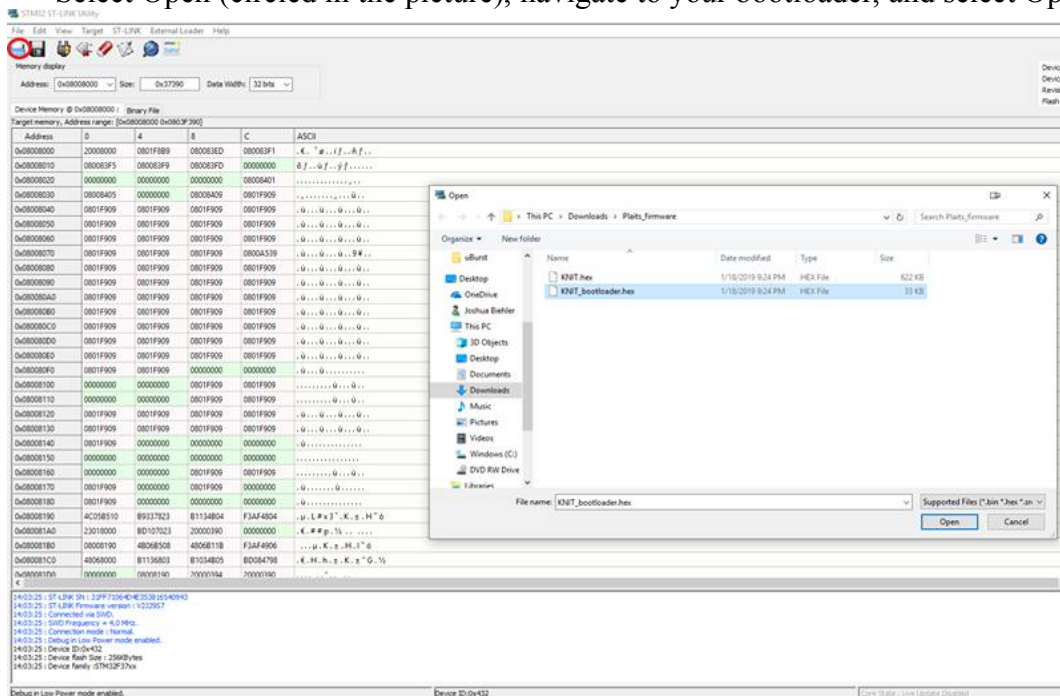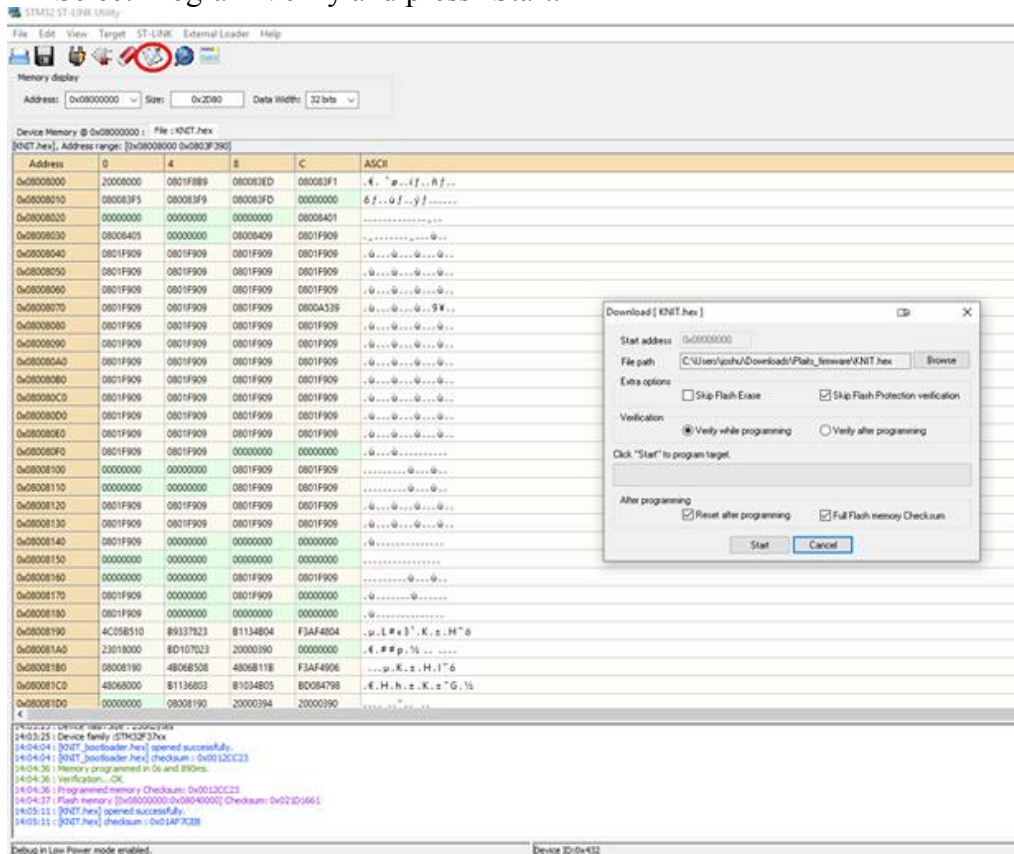
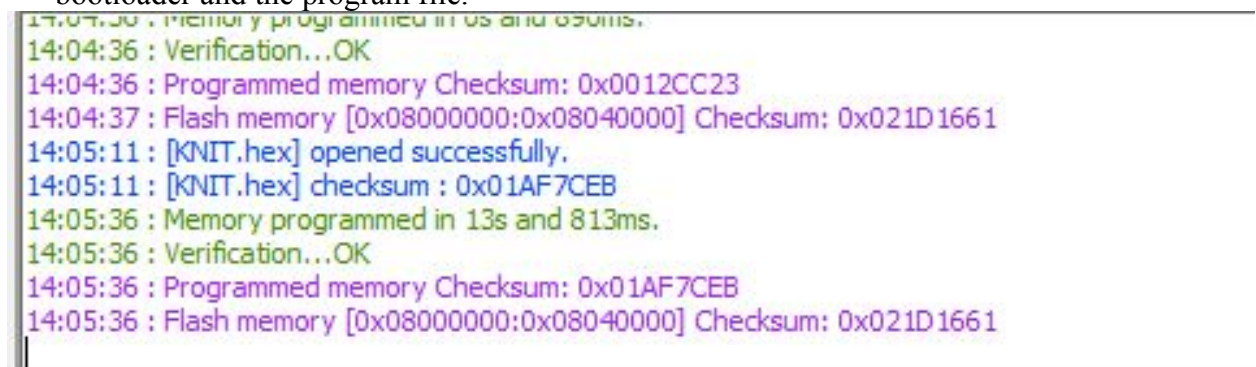- Select Program Verify (circled), and press "Start."
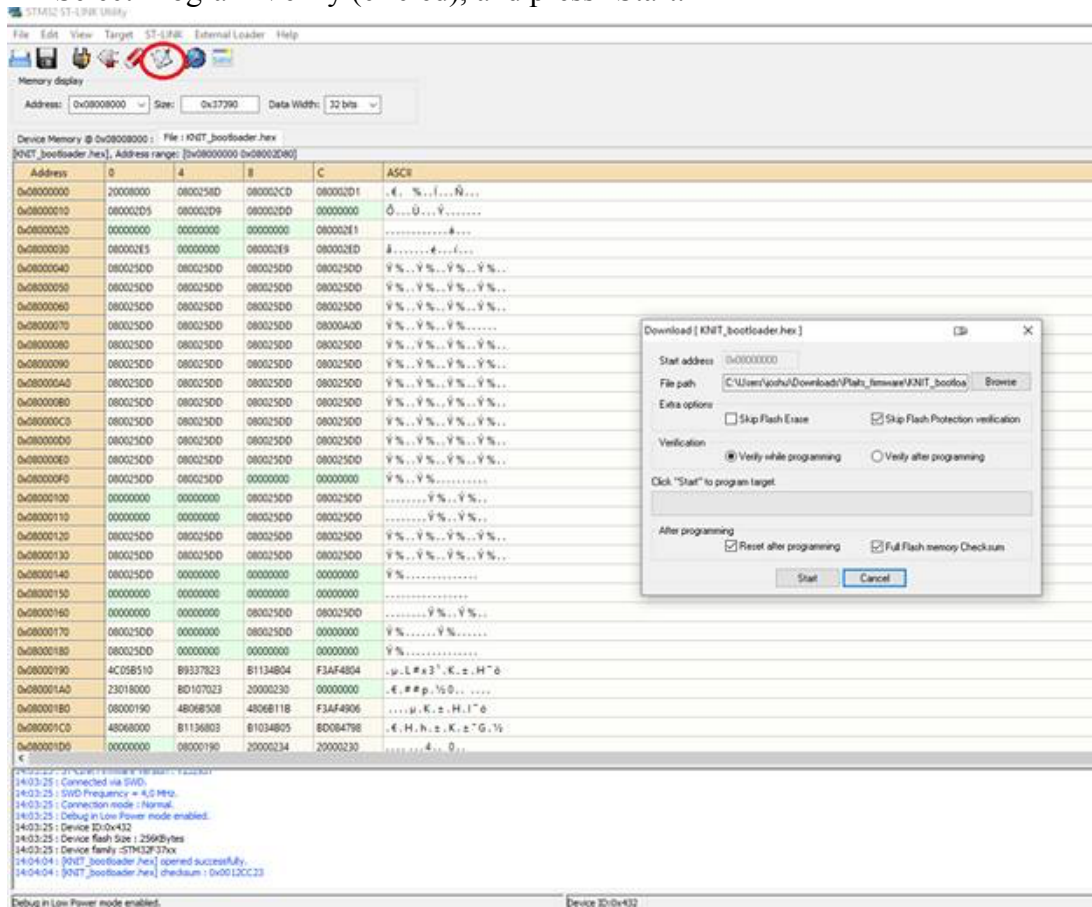
- Open the firmware hex file.

- Select Program Verify and press "Start."

- You should get a message that says "Verification OK" after programming both the bootloader and the program file.


```
14:04:36 : Memory programmed in 0s and 890ms.
14:04:36 : Verification...OK
14:04:36 : Programmed memory Checksum: 0x0012CC23
14:04:37 : Flash memory [0x08000000:0x08040000] Checksum: 0x021D1661
14:05:11 : [KNIT.hex] opened successfully.
14:05:11 : [KNIT.hex] checksum : 0x01AF7CEB
14:05:36 : Memory programmed in 13s and 813ms.
14:05:36 : Verification...OK
14:05:36 : Programmed memory Checksum: 0x01AF7CEB
14:05:36 : Flash memory [0x08000000:0x08040000] Checksum: 0x021D1661
```

Once programmed successfully, close out of STM32 ST-Link utility. Then you can power off your module and disconnect the pins from JP6. Calibrate per instructions available in the Mutable Instruments' documentation for Plaits.

Links & Comments
- ST-LINK/V2 hardware can be bought from many vendors and there are cheap knock-offs for a few bucks. You only need the version with the jumper cables.
- STSW-LINK004 is the software, and can be downloaded from https://www.st.com/en/development-tools/stsw-link004.html
- Bootloader and Firmware are on the Antumbra Knit page: http://antumbra.eu/bom/knit/v1-0
- Calibration software can be found on the Mutable Instruments' Plaits manual page: https://mutable-instruments.net/modules/plaits/manual/ at the bottom.