

# mytek's Atari 576 NUC+ Quick Reference Guide

Andrew Diller, Summer 2021  
Version 1.0d

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The origin of the 576 NUC starts with mytek (Michael St. Pierre) and the iTari game console- an Atari8 system board that would fit in a miniature compact Macintosh case using an embedded S-Drive Max as the screen and storage for the console. The concept for the iTari was announced in April 2020 on AtariAge.

In order to be portable yet compatible the iTari would be based on the smallest and simplest design of the 8-bit line: the XEGS. It would use the S-Drive Max to hold the software necessary to play games on a SD card. It would be a tiny complete 8-bit system that was simple to use and inexpensive to make.

The creation and rapid evolution of the FujiNet was about to change that idea of iTari into what has become the NUC+.

NUC stands for *Next Unit of Computing*- a design standard from Intel that attempted to shrink and simplify the x86 experience down to the smallest form factor available. With some changes mytek realized the iTari could become an Atari NUC.

The Fujinet would change the NUC in dramatic ways- not only would it have the local storage with the on-board SD card in every FujiNet, but the FujiNet would transform the iTari game console idea into a full NUC sized Atari 8-bit. The FujiNet provides not just serial, disk, cassette, and printer emulation- it provides an entire platform to connect the Atari to the modern world of computing via it's WIFI and networking capabilities. The ESP32 system in the FN provides an entire co-computing system to offload complex loads and buffer the Atari from the complexity and resources required for modern

networked computing. Connectivity scenarios not even imagined would be capable with a FujiNet integrated into the NUC. And so it was. As an option board designed expressly for the NUC, the mytek FujiNet will allow the NUC to remain self-contained and be connected to the larger world of software and services via the Internet.

The NUC took the XEGS platform and expanded it in subtle and capable ways, maintaining the space constraints imagined for the final device. The TK-II keyboard interface was integrated to allow modern PS/2 keyboards, the VGATE circuits allow properly formatted video for authentic retro experience, expanded ROM allows multiple choices of OS and BASIC environments, and the expanded



RAM gives over 500 kilobytes of memory. SIO, dual joystick ports, and the ability for cartridge expansion provide the totality of the classic Atari8-bit experience without emulation.

*When I started this little NUC thing, it was to get my mind off of the whole Covid induced isolation, and do something fun and distracting instead. And... I also wanted something that I could gift to my grandson when he gets old enough to appreciate it. Pretty soon I can check this one off my to do list. - Michale St. Pierre, AtariAge thread*

A team was formed- led by mytek- and eventually the NUC design emerged as we know it today. The team pitched in - prototyping, case design and printing, board builds, FujiNet design and integration, testing and more testing. The core team dove in to develop, design and test the 576 NUC in record time- everyone on the team wanted this amazing device to work. Everyone reading about it wanted one to use.

## History & Story

In June of 2020 (just over a month after the iTari announcement) mytek showed images of completed NUC prototype boards on AtariAge. The threads exploded with comments. The project was already well under way.

November 1, 2020, mytek announced in that thread that The Brewing Academy would be selling assembled systems when they were ready. The testing team already had working test systems and shakedown was on-going for the new system. By the end of November Dr. Venkman was posting images showing the NUC in BASIC and playing Galaxian. Mr. Robot had FujiNet prototype boards connected to it. In March 2021 mytek had developed a few iterations of his NUC-FujiNet board, and Mr. Robot was designing cases that incorporated cartridge slots, using a newly designed FujiNet/Cartridge design.

Design and testing wrapped up quickly- this wasn't the first XEGS based system mytek had built. In June 2021 The Brewing Academy was ready with fully assembled retail versions, and on June 11 I myself made a purchase of the very first retail 576 NUC+. I've been enjoying it so much I committed to writing this guide and short history to help and inform others of the work done to create the NUC. The NUC system with FujiNet can be an enabling device to give a whole new generation of hackers and enthusiasts a reliable and inexpensive platform to enjoy and explore the simple and elegant designs of the Atari platform. Plus, it plays a lot of games.

### Contributors to the 576 NUC+ Project

The core team and their contributions enabled the 576 NUC to evolve into a finished product.

• **Michael St. Pierre (mytek)** – creator of the 576 NUC+, 1088XEL/XLD, TK-II, TK-II Stereo, joy2pic,

mouseAtari and many other hardware upgrades for the Atari 8bits.

• **tf-hh** - instrumental in development of both the 512kb extended memory circuit and EMMU PLD code, and a patched version of the stock XEGS OS.

• **Stephen Anderson (Stephen)** - animated rainbow 576 logo, coding.

• **Steve Boswell (Mr Robot)** - innovative and attractive case designs, collaborated on the original NUC/ FujiNet board and the updated FujiNet/Cartridge board.

• **Orpheuswaking** – extensive testing, feedback, and more testing.

• **DrVenkman** – advice, feedback, extensive testing, and more testing.

• **Marlin Bates (MacRorie)** - builder and enabler, donated many parts to the beta testers, he committed early to assemble and sell the retail version of the 576 NUC (via The Brewing Academy). You can purchase one from him today.

### Additional thanks to:

• **Hias** for his HSIO patch.

• **Avery Lee** for his excellent Altirra Fast Math pack and Altirra BASIC.

• **The Fujinet Core Team** for creating the FujiNet and helping with the Fujinet-NUC design

The FujiNet team itself was composed of these primary contributors:

• **Mozzwald** - hardware guru for FujiNet, designed the modem code and with Thom was co-inventor of FN. Started with an idea of a wifi modem for Atari.

• **Thom Cherryhomes** - co inventor of FN (with Mozzwald), thought leader, demo master, c/wrangler and creator of the N: device

• **Oscar Fowler** - implemented the arduino to platformio code conversion and provided lots of functionality

• **Jeff Piepmeier** - designed and coded printing and cassette emulation

• **Steve Boswell (Mr Robot)** - designed prototype pcbs and helped with case design, prototype builds

• **Montezuma** - contributed the sio2bt code enabling additional wireless options

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When Lotharek released his new improved AKI (Atari Keyboard Interface), he incorporated the DarkAKI revised firmware that was a completely re-written version of the original AKI that had come on the scene over a decade ago. When I saw the mapping of the console keys, and that it was nearly identical to what the Altirra emulator's mapping of those same keys, I liked it and updated the TK-II firmware to incorporate it. So this happened in steps, with a choice added to the standard TK-II line for either the original TK-II mapping or the AKI mapping via the toggle action of the EMU key (CTRL+ALT+E on PS/2 keyboard). When I got to the 576NUC+ project, I decided to drop the selection process and just embrace the AKI mapping from the get go.

- Michael St. Pierre, <https://atariage.com/forums/topic/322350-current-atari-576-nuc-quick-reference-guide/#comments>

CTRL+ALT+V will enable/disable the VGATE chip (non-volatile)

CTRL+ALT+X will toggle between 256K CompyShop or 576K Rambo XRAM modes (non-volatile)

## Keyboard & Booting

### Boot Options

Starting the 576 is done via keyboard only. ALT+0 turns it off. The keys below determine what env is started.

576NUC+ is an Enhanced XEGS Based System, the boot ROM choices by default are...

SELECT	SLOT	POWER	OS	LANG/GAME
ALT+~	0	ON	HSIO+Fast Math	NONE
CTRL+ALT+~	0	ON	STOCK XE	NONE
ALT+1	1	ON	HSIO+Fast Math	ALTIRRA BASIC
ALT+2	2	ON	STOCK XE	BASIC REVC
ALT+3	3	ON	NA	PAC-MAN
ALT+4	4	ON	NA	STAR RAIDERS
ALT+0	NA	OFF	NA	NA

Each new selection re-initializes the system, essentially performing a warm boot.

### TK2 Key Map

The 576 has a slightly different keymap than the 1088XEL. This is a AKI based keymap which mirrors Altirra emulator

### Modern Keyboards on your Atari

There are two hardware interfaces for PS2 keyboards :

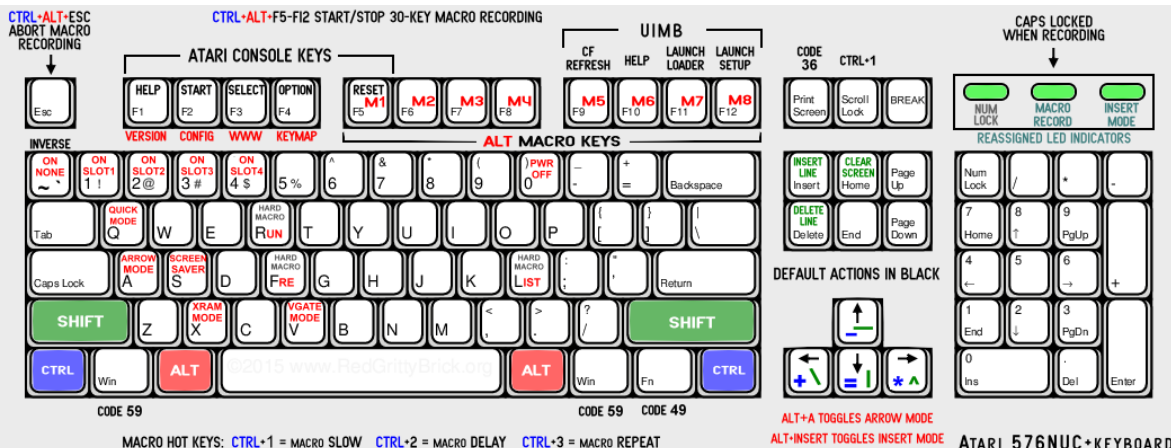
AKI 1.1 by André Bertram/Lotharek (Atari Keyboard Interface)

Tk-II by Michael St. Pierre (mytek) (TransKey)

Both of these handle the generation of Atari key codes slightly differently. The 576 uses an advanced version of the TK-II which follows the AKI maps. The Altirra emulator uses AKI for reference. The major difference is how the 1200XL Function keys are mapped to PS2 Function keys. With AKI F1 - F5 are used to map the XL/XE Option keys.

### AKI EMU on the TKNuc

When in the AKI EMU mode, most of the 1200XL function key codes are no longer available from F1-F4. Although the arrow keys and the Home, End, PageUp, PageDn keys on the navigation area of the keyboard step in to take their place. For the key codes which are not covered elsewhere, they are now accessed by SHIFT+ALT+F1-F4 (TKII EMU mode produces those same key codes with CTRL+F1-F4 instead).



## Extended RAM Modes

### RAM Compatibility

There are two extended RAM modes in the NUC+ :

- RAMBO
- CompyShop

CTRL+ALT+X  
ALT+X

- switch modes  
- print out current mode  
**This setting is non-volatile**

RAMBO was created and sold by ICD. It was a commercialized version of upgrade of same name by Madison Area Atari Users Group around Oct-Nov 1985, itself a close derivative of the Buchholz 130XE-Compatible 800XL 256K Upgrade.

PORTB bank-selection bits used: 2,3,5,6 (only 12 banks available)

Compy Shop was one of the few german Atari 8bit dealers that was well known for their hardware inventions like the famous Speedy 1050, 256KB Ram disks or 16k BiboMon, a hardware monitor for the Atari 8bit.

PORTB bank-selection bits used: 2,3,6,7 (only 12 banks available)  
[http://mrbaecardi.000space.com/games/Compy\\_Shop/compy\\_shop.html?i=2](http://mrbaecardi.000space.com/games/Compy_Shop/compy_shop.html?i=2)

In Atari XL/XE computers, memory location 54017 (\$D301), known as PIA Port B or PORTB, is used to manage access to portions of built-in ROM and RAM that share ranges of memory addresses.

### 130XE Memory Compatibility: Mytek explains

There is a 320K (64K base+256K extended) compy shop mode that mimics the 130XE's separate Antic/CPU banking scheme. It is selectable by using the extended memory toggle command CTRL+ALT+X (ALT+X will show the present setting). This setting is non-volatile, and will be restored upon power-up.

<https://atariage.com/forums/topic/322309-576nuc-is-here/?do=findComment&comment=4855858>

### 576KiB RAM Mode PORTB bits

5 bank-selection bits allows selection of  $2^5 = 32$  16KiB memory banks. If the PORTB bank-selection bits used include 2,3,5,6 then the upgrade is Rambo/Atari Magazin compatible; if they include 2,3,6,7 then the upgrade is Compy-Shop compatible.

portions derived from:  
<https://mcurrent.name/atari-8-bit/faq.txt>

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## 576NUC+ ROM GEOMETRY

ROM BANK ONE (32Kx8) **HIGH SPEED**

\$0000-\$1FFF **SLOT 3:** PAC-MAN  
\$2000-\$3FFF **SLOT 1:** BASIC ALTIRRA  
\$4000-\$7FFF 16K HSIO OS

ROM BANK TWO (32Kx8) **STOCK SPEED**

\$8000-\$9FFF **SLOT 4:** STAR RAIDERS  
\$A000-\$BFFF **SLOT 2:** BASIC REV-C  
\$C000-\$FFFF 16K XEGS OS

## FujiNet

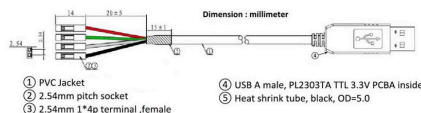
### Your 576 FujiNet

The FujiNet in your 576 is the result of a custom, new board layout (from mytek) and it differs from the official published FN boards-- designed and engineered to be used and to fit perfectly into the limited space of the 576 NUC casing. The NUC/FN is not based on any specific revision of official FN boards, but it incorporates all changes up to the official 1.5 version.

### Updating Firmware

Your retail 576 will have the latest version of the FN firmware flashed. If there are major updates to FN firmware you will want to re-flash to use the new features. To update you will need a cable like this one. It has a built in Prolific USB Adapter:

<https://www.amazon.com/Serial-Adapter-Signal-Prolific-Windows/dp/B07R8BQYW1/>



1*4P Female Socket	Name	Colour	Description
Pin 1	TXD	White	Transmit Asynchronous Data
Pin 2	RXD	Green	Receive Asynchronous Data
Pin 3	GND	Black	Device ground supply
Pin 4	VCC	Red	+5V



### Getting Software

Once booted the FN will need some TNFS host entries in order to pull down images to use. There is a full list of known servers here:

<https://github.com/FujiNetWIFI/fujinet-platformio/wiki/known-TNFS-Hosts>

atari-apps.irata.online  
fujinet.pl

Are two good ones to start with.

### Controlling the FN

There are a number of buttons, one switch, LEDs and a SD card on your embedded FN card. Each one of these matches the function of the external FN - they are located in different spots. Below is a description of the function of each button and LED.

#### Button A

Short press: disk swap

Long press: enable/dis SIO2BT mode

#### Button B

Short press: Turn on cassette emulation

Long press: Safe reset (unmounts SD card)

Double Tap: Print debug info to serial

**Hold during power up to reset FujiNet config**

Three LEDs on the front:

**WHITE** : WiFi

**BLUE** : SIO2BT Mode

**RED** : SIO Activity

Hard Reset Button (on back of NUC)

On/Off switch - disable/enable FujiNet

4 pin FTDI connector- connect to USB and update FN Firmware when necessary

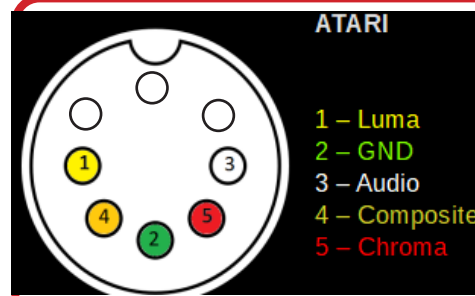
Check the current status of known TNFS servers at:

<https://atari8bit.net/projects/software/fujinet-server-status/>

### TNFS

TNFS (*Trivial Network File Service*) is a communication protocol developed by Dylan Smith for Spectranet and the ZX Spectrum computer. It allowed ZX computers with a ethernet interface to access remote servers for content for the Spectrum. It was adopted by the FujiNet team to host Atari disk images on remote servers. The FN uses WiFi so no wires are needed, ever.

## Video



### DIN8

Another change was a suggestion by @tf-hh to replace the former DIN-5 audio/video jack with a DIN-8 which still allows a DIN-5 plug to be used, while giving us 3 additional pins for routing the audio signals out of a stereo capable upgrade (this would require a DIN-8 plug and custom cable).

### Video on the 576

The Audio/Video output jack on the NUC mimics the standard one as used in a stock Atari 8-bit computer, with all aspects active and usable. The video quality is nearly as good as the UAV, and for the most part will be indistinguishable from it.

Video out is exactly the same as the 800XL, XE and XEGS systems. You can make your own cables, get some from Ebay or brand new ones from The Brewing Academy.

<https://dfarq.homeip.net/atari-800-video-cables/>

<https://thebrewingacademy.com/collections/atari-800-x1-xe-xel-xld/products/cable-for-atari-computers-and-ti-99-4a-computers>

### PAL Burst

To support PAL @tf-hh presented the idea of a GTIA piggyback board to provide this missing aspect. And so was born what I call the 'PALburst' board. By plugging this into the GTIA socket, and then plugging GTIA on top of that, the missing PAL color burst circuit will be provided. Then all that's required is to use the appropriate PAL primary oscillator crystal and a PAL Antic and GTIA.

### VGATE 2021

Your 576 system includes an **improved** VGATE from mytek - it now automatically optimizes itself based on PAL or NTSC.

The VGATE mode is controlled by the TK-II. ALT-V enables or disables VGATE.

What does VGATE do?

It's a feature for people that use their Atari on modern screens where there is no over-scan. Older games often took advantage of the over-scan (hidden) areas of the screen on old TVs. With VGATE enabled you can now hide those areas on modern screens where they are visible and often distracting.



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## Programming & Development

Now that you have a NUC you have a stable, modern platform to do the second best thing on the Atari - program. If you have the optional Fujinet then you have the entire Internet available to you courtesy of the innovative N: device from Thom Cherry-homes which can be programmed from BASIC.

The NUC comes ready to go with two versions of BASIC in ROM. The standard Atari BASIC and the recent and fast Altirra BASIC. For a thorough but quick overview of all your BASIC options on the NUC please read the overview at the amazing AtariProjects website. AtariProjects is the brainchild of Jason H. Moore, PhD and contains hundreds of little projects to do with your Atari.

<http://atariprojects.org/2020/08/29/explore-different-basic-programming-languages-for-the-atari-8-bit-computers-30-60-mins/>

There is an excellent manual for Altirra BASIC available in PDF form at:

<https://www.virtualdub.org/downloads/Altirra%20BASIC%20Reference%20Manual.pdf>

More info about the N: device can be found in the video from ThomCH:

<https://www.youtube.com/watch?v=Wk966tAWI1s>

Alternative Cases for NUC  
are available at Mr. Robots website:  
<https://therobotfactory.net/shop/3d-prints/576nuc-case/>

### Firmware Versions

**alt-F1** versions 576. Press in Basic for best results.

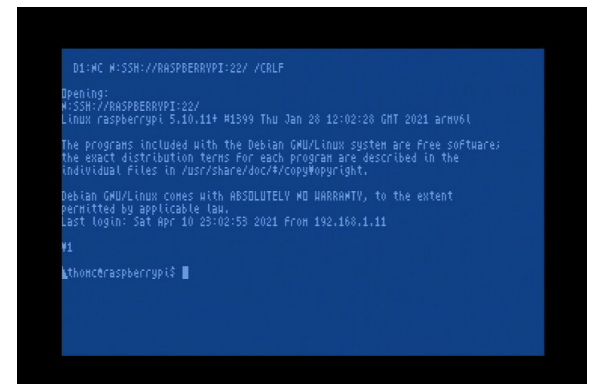
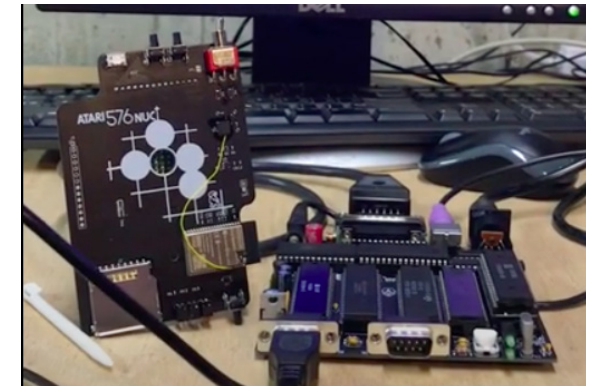
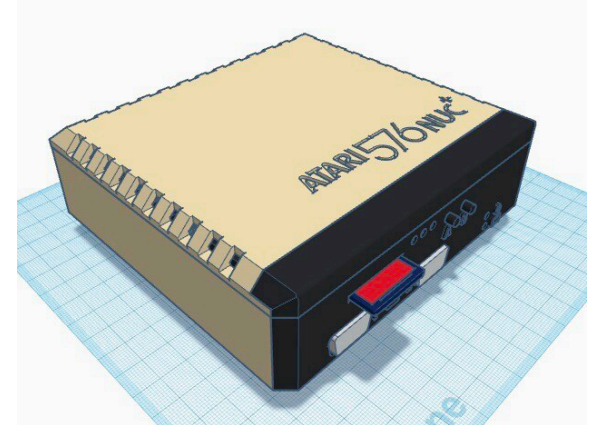
```
VERSION:   TKIINUC V1.5
DATE:      APRIL 24 2021
SYSTEM:    ATARI 576NUC+
```

**alt-F2** config of 576

```
■ ■ ■ 576NUC+ CURRENT SETTINGS ■ ■ ■
FUNCTION  SET      TOGGLE
VGATE     = OFF    CTRL+ALT+V
SCREEN SAVE = ON     CTRL+ALT+S
KRAM MODE = RAMBO   CTRL+ALT+K
KEYMAP     = US     CTRL+ALT+F4
NUMLOCK DEF = OFF    CTRL+ALT+NUM
ROM 05H    = 1      ALT+1,2,3,4
ROM 5LDTM  = 1      ALT+1,2,3,4
ARROW MODE = NAV     ALT+A
ARROW SPEED = SLOW   ALT+Q
* CTRL+ALT COMMANDS = NON-VOLATILE *
```

**alt-F4** keymap language

```
KEYMAP = US
```



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## Updating Firmware

### UpdatingFujiNet

The NUC FN will not automatically put itself in program mode like the one more widely available for classic Ataris. You need to enable this mode manually before flashing the ESP32 system on the board.

#### To Enter Program Mode:

Power down the FujiNet, then press & hold Button **A**, then power the FujiNet back up. Hint: This can be done most easily by using the toggle switch in the back to cycle power to the FujiNet while leaving the power pack connected to the NUC. The FujiNet board could also get it's power via the serial cable connected to the PC.

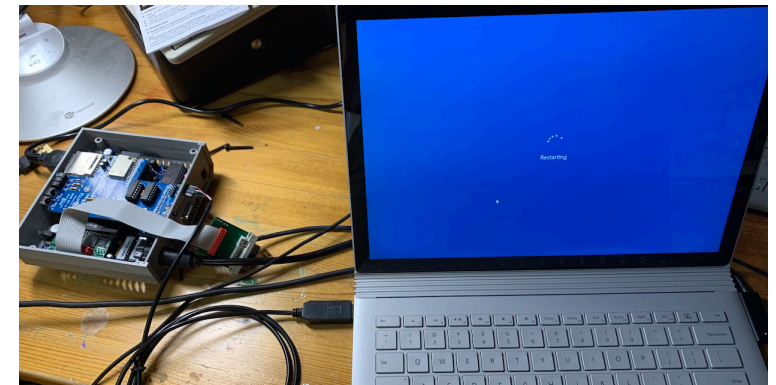
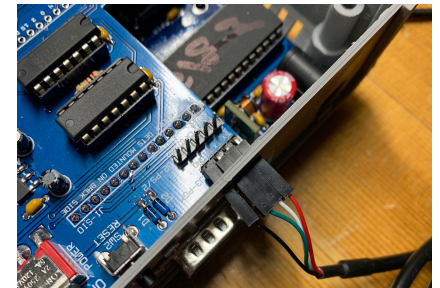
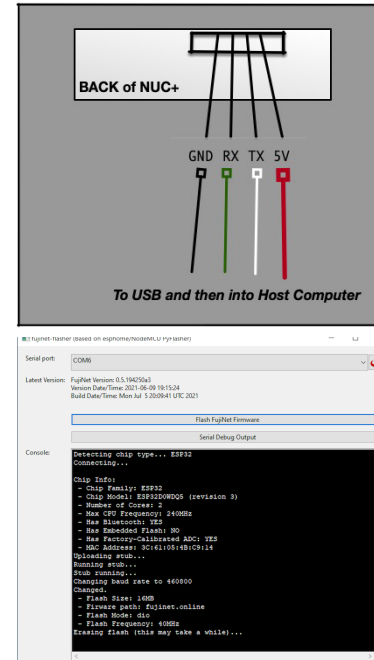
When the FN has entered program mode you'll see all **3 LEDs** dimly light up, that'll let you know you can now proceed with the firmware re-flash via the standard FujiNet Flasher Program.

### Tips

Tested USB to serial cable: **DTECH USB to TTL Serial Converter Cable** (from Amazon)

Use a SD card to save your FN config. Remove it before you reflash.

With the NUC un-plugged, just remove the USB from the laptop, press A button and insert the USB into the laptop, the NUC FN will power up in program mode. Leave NUC unplugged till the flash is complete.



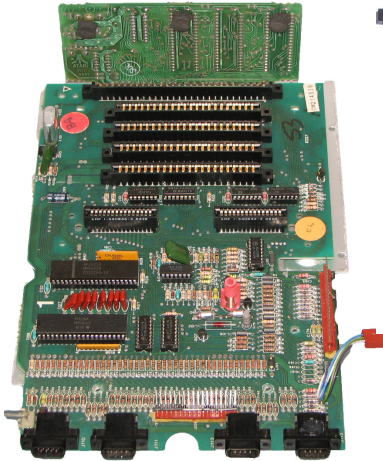


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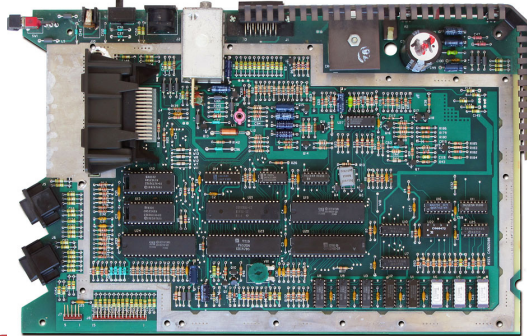
## Evolution of Atari Hardware

The 576 NUC is the result of a long line of hardware re-designs around the same basic system as published in November 1979 when the prototype designs Candy and Collen became the Atari 800 and 400.

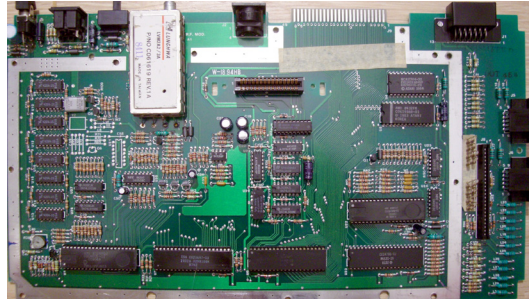
**Atari 800**  
1979 \$1,050



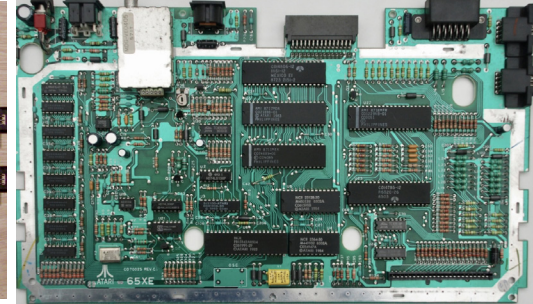
**Atari 1200XL**  
1983 \$899



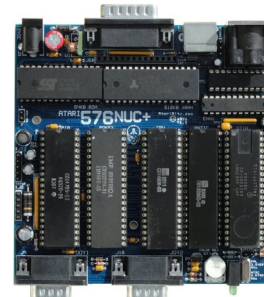
**Atari 800XL**  
late 1983 \$199



**Atari 65XE**  
1985 \$120



**Atari XEGS**  
1987 \$159



**mytek 576NUC+**  
2020 \$250

**January 2017 mytek introduces the IO88XEL**

three years later...

**April 2020 mytek announced the 576 NUC+**

Mytek had this to say about his NUC: *"The 576NUC+ was built on the idea of creating the smallest form factor Atari 8-bit computer while still being based on 'REAL' Atari VLSI chips inside. It was something that you could toss into a small bag with an equally small keyboard, and some controllers to easily take with you anywhere. It was suppose to be the most portable 'REAL' Atari 8-bit computer ever conceived.*

*A central part of this concept was to not have to lug around a disk drive, cassette drive, or even carts. Fujinet with it's WiFi connect-ability and SD drive was included as an integral part of this portable system in order to achieve this vision. The development phase has now ended, and what came out of that process is now for sale."*

**Read the blog...**

the ataribits blog contains valuable information from mytek as he was building the nuc:  
<https://ataribits.weebly.com/blog/category/576nuc>

