



COMMODORE REV. 586220 DIAGNOSTIC HARNESS

PRESENTATION BY SVEN PETERSEN

COMMODORE USERS EUROPE, DEC. 17TH, 2022

SVEN PETERSEN

- Born 1965 in Germany
- Into electronics since 1979
- Commodore computer user since 1980
- Programming business software for the CBM8032: 1980 – 1991
- Studied electronics at TU Munich
- Hardware developer since 1995
- Back into the Commodore computer hobby since 2018
- Plenty Commodore related open hardware projects on github



C-64 DIAGNOSTIC REV 586220

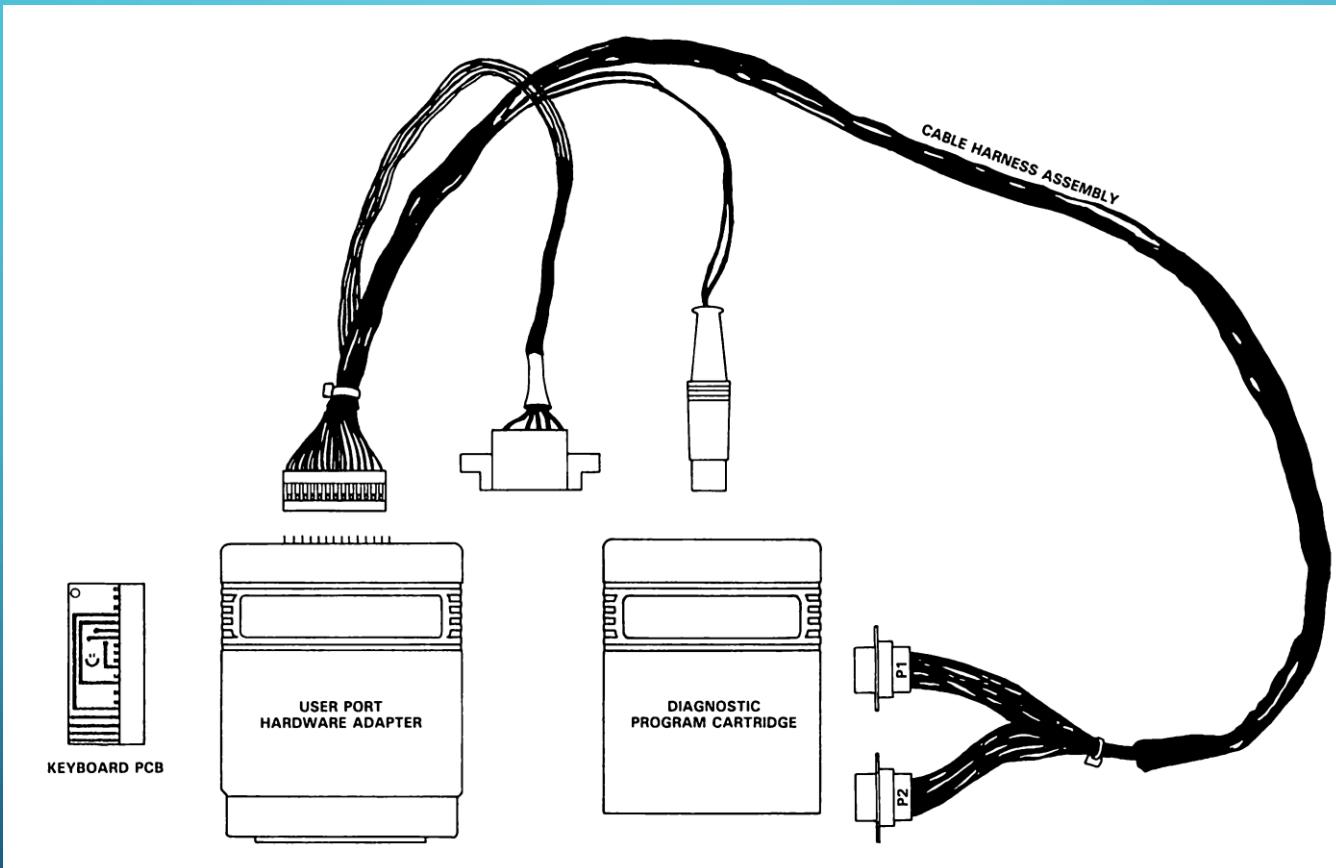
- DIAGNOSTIC REV 586220 is a diagnostic cartridge software provided by Commodore for service purposes and maybe testing in production
- Diagnostic Rev. 586220 tests:
 - The RAM
 - The PLA
 - ROMs (Kernel, BASIC, Character ROM)
 - The interfaces (Cassette, Keyboard, Control Ports, Serial Port, User Port)
 - Timers and interrupts (of the CIAs)
 - Basic sound test

Imagine you have purchased a Diagnostic Cartridge, connect it to your perfectly working C64 and then this happens:



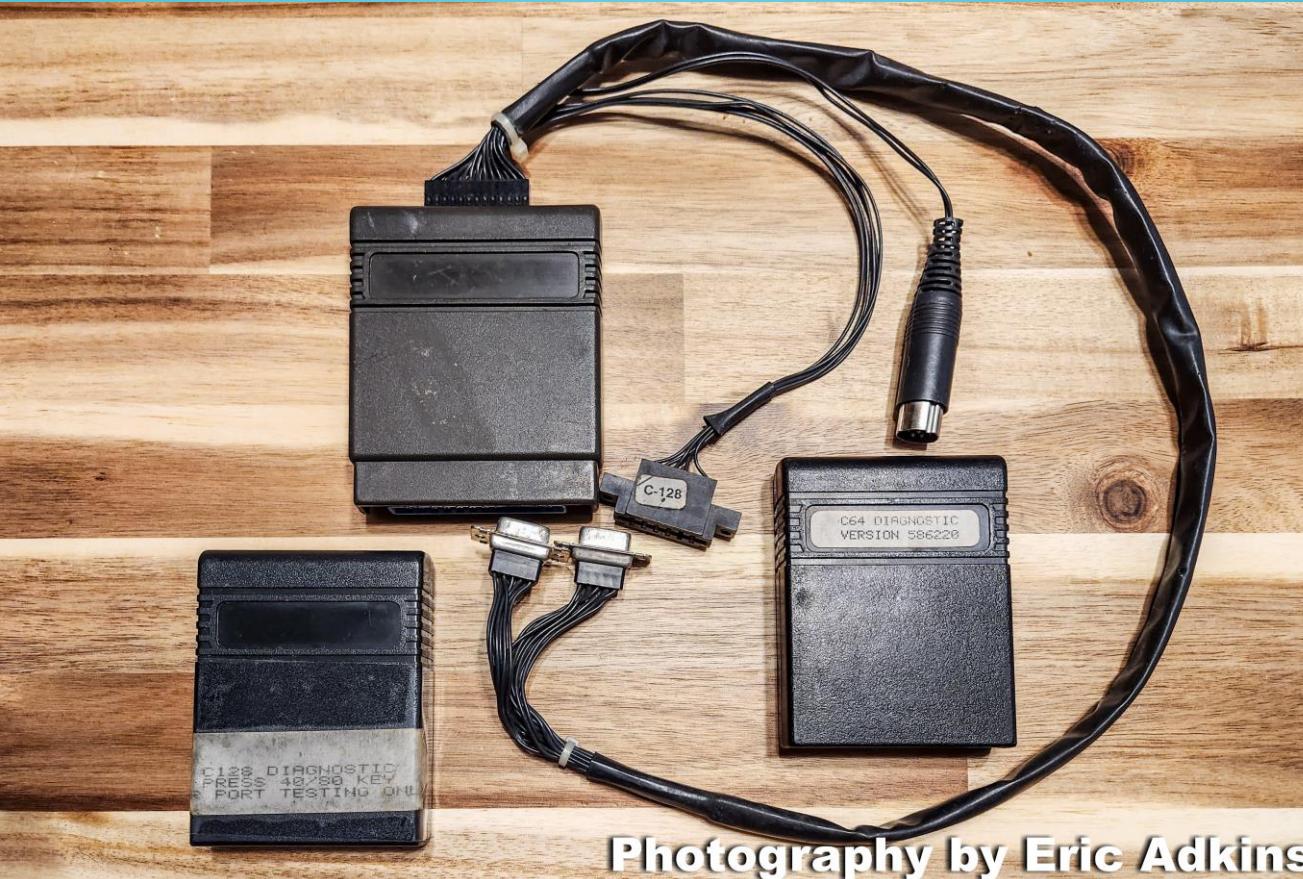
The typical test result of Diagnostic Rev 586220 without the required diagnostic harness as seen many times on social media.

The Diagnostic Rev 586220 Harness provides the required feedback signals, which are defined by the diagnostic software, hence, the interfaces can be tested properly.



Excerpt from "C64 DIAGNOSTIC INSTRUCTION AND TROUBLESHOOTING MANUAL
ASSEMBLY #326070-01" Page 1-1

- The original diagnostic harnesses are rare and probably expensive
- The cable harness assembly is hard to make, so a remake of the original might be expensive as well



This is an original harness minus a keyboard PCB, which got lost.

A HARNESS FOR THE MASSES, NOT THE CLASSES!

It is desirable to have a diagnostic harness for a couple of reasons

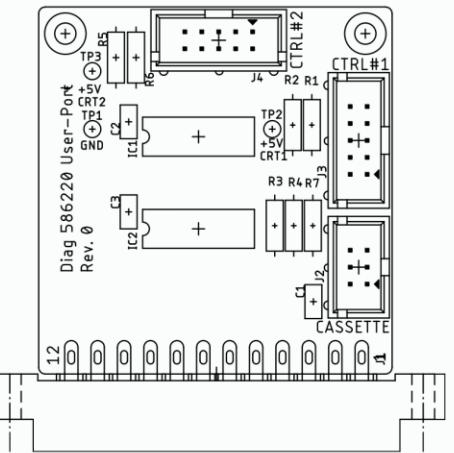
1. There are no official repair shops for Commodore computers anymore
2. You want to test the C64, that you have just bought for your collection
3. You want to prove, that a C64 is working flawlessly to get a better price

⇒ There is a higher demand for a diagnostic harness now, than back in the day

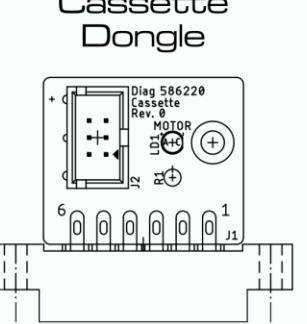
Goal of the development was a harness, that can be built by a little to medium experienced maker

Diagnostic Harness v. 0

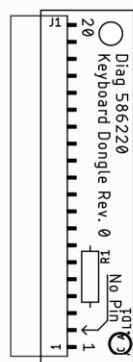
User Port
Dongle



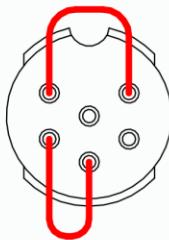
Cassette
Dongle



Keyboard
Dongle



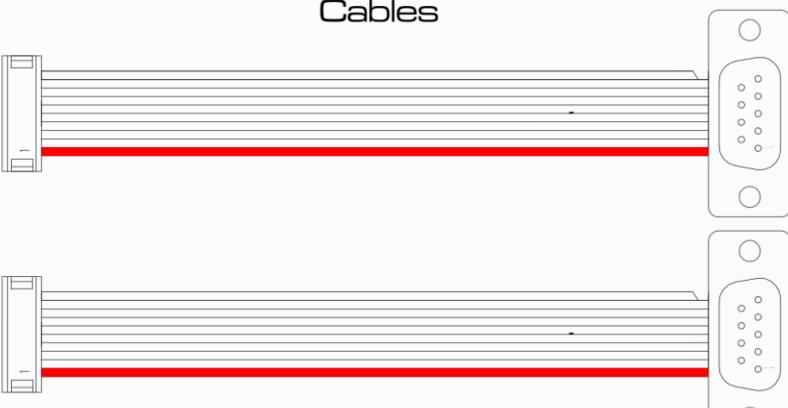
IEC-Bus
Dongle



User Port to Cassette
Cable



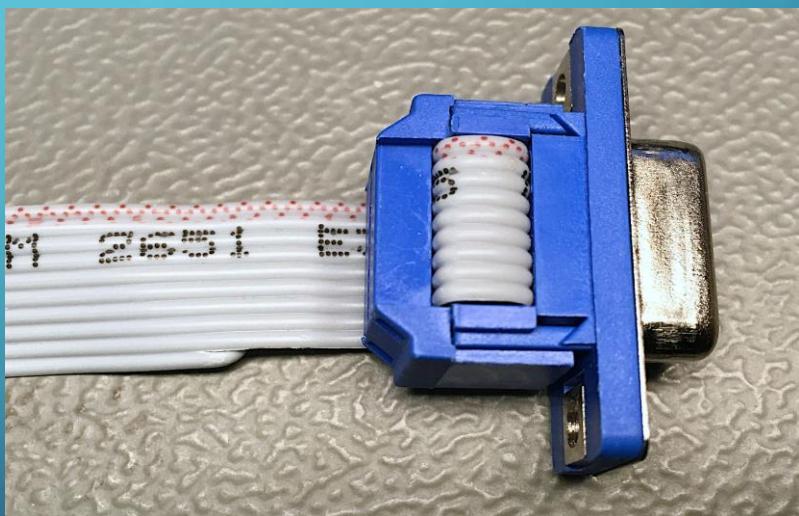
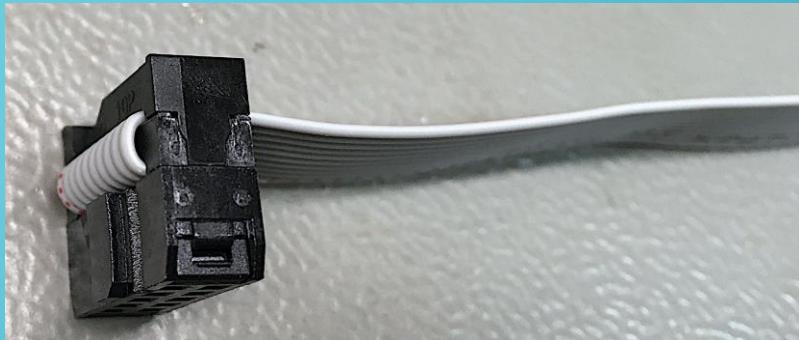
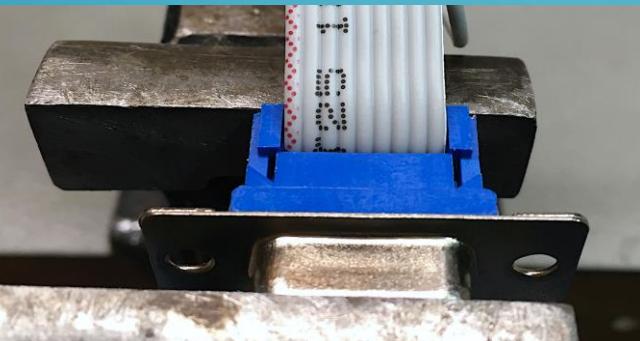
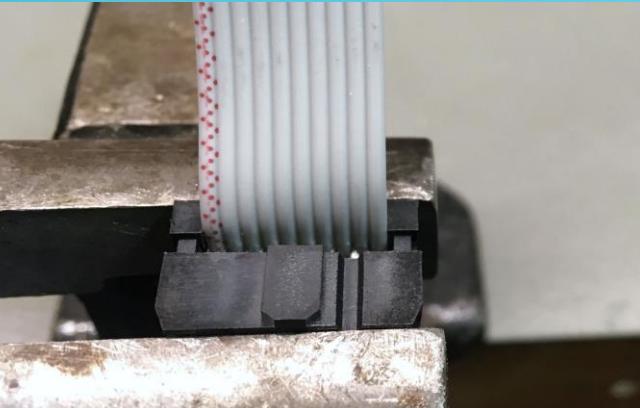
User Port to Control Port
Cables



- The development is based on the information found on worldofjani.com, in particular the schematic drawn by Peter Schepers in 2009.
- Easy to get components
- All cables are ribbon cables (= easy to make)
- No crimp tool required
- No cable soldering
- Through hole components only

Solderless cable making: easy peasy!

- All you need is a vice
- Strain relief is easy to install

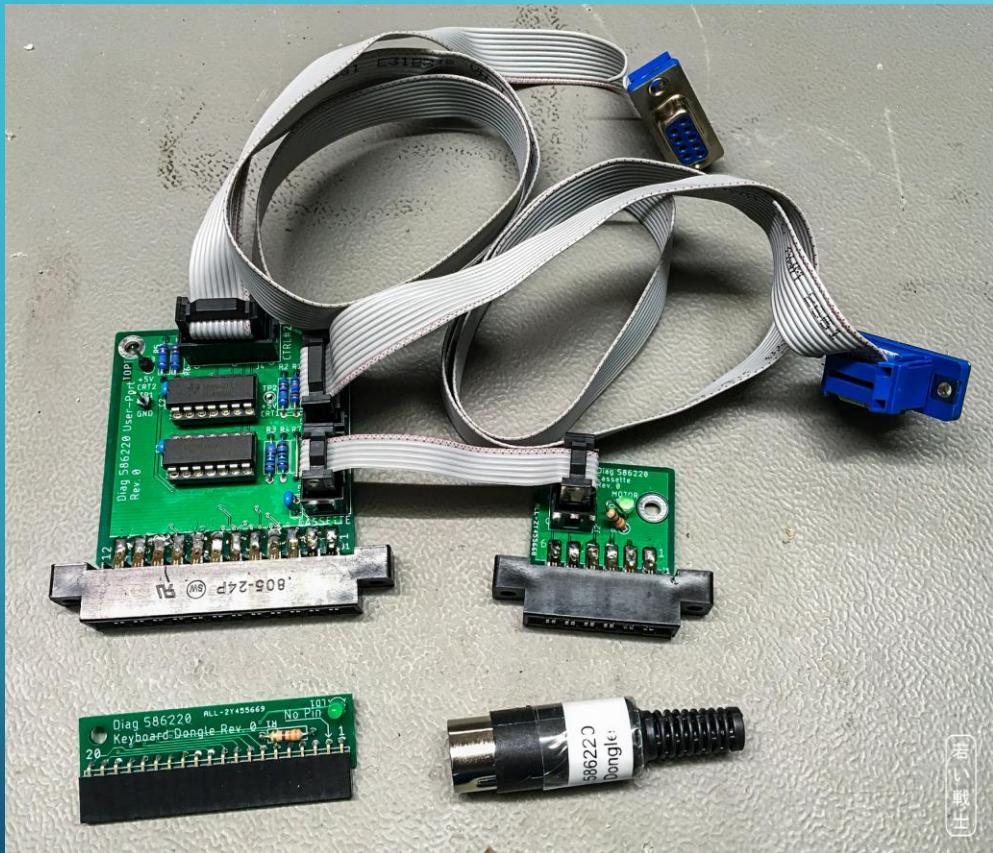


Warning: Do not use the rainbow stuff!
(the pitch might not be accurate)



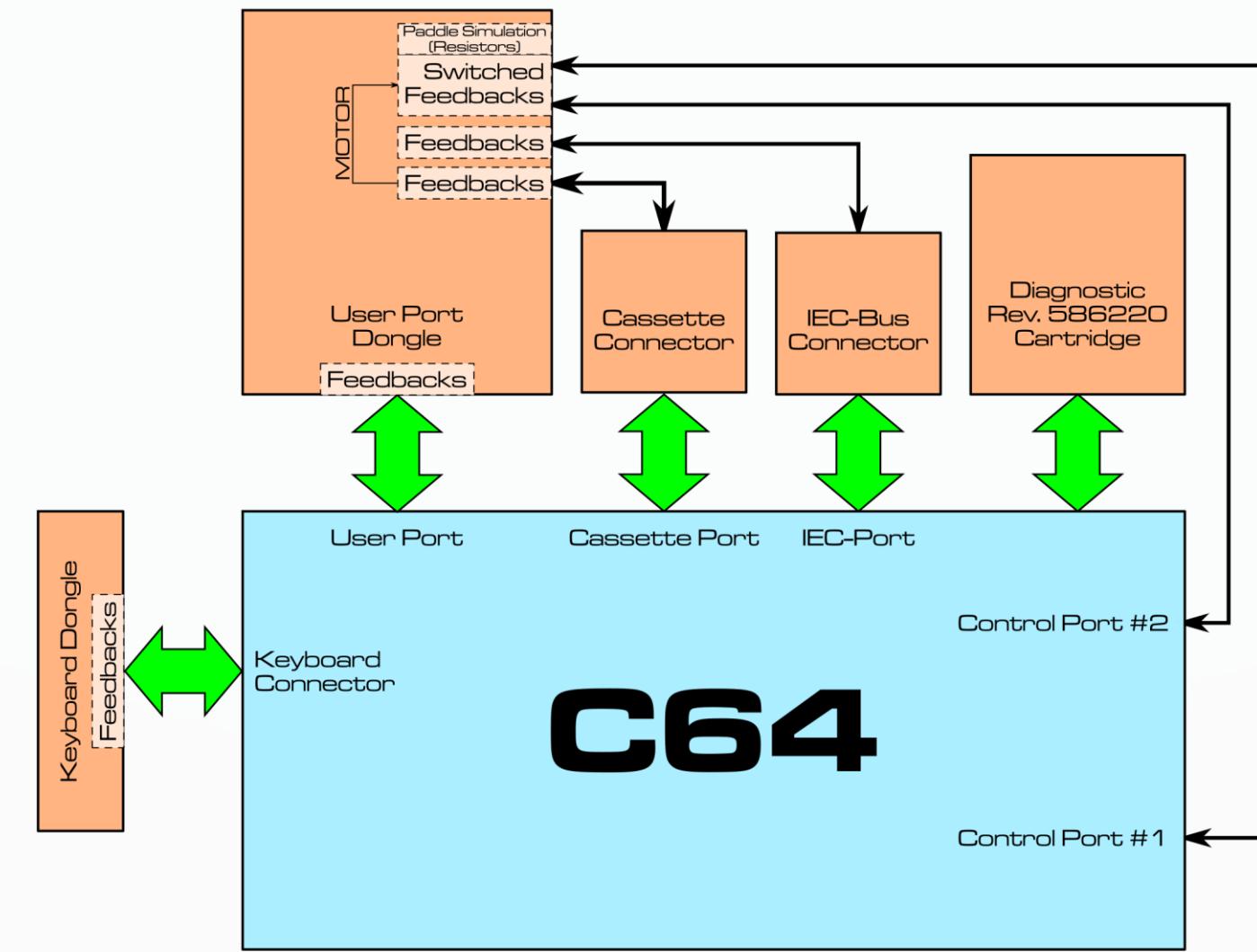
This was neither the
required 1.27mm
pitch, nor a 1mm pitch

The Prototype Rev. 0 (March 2019)

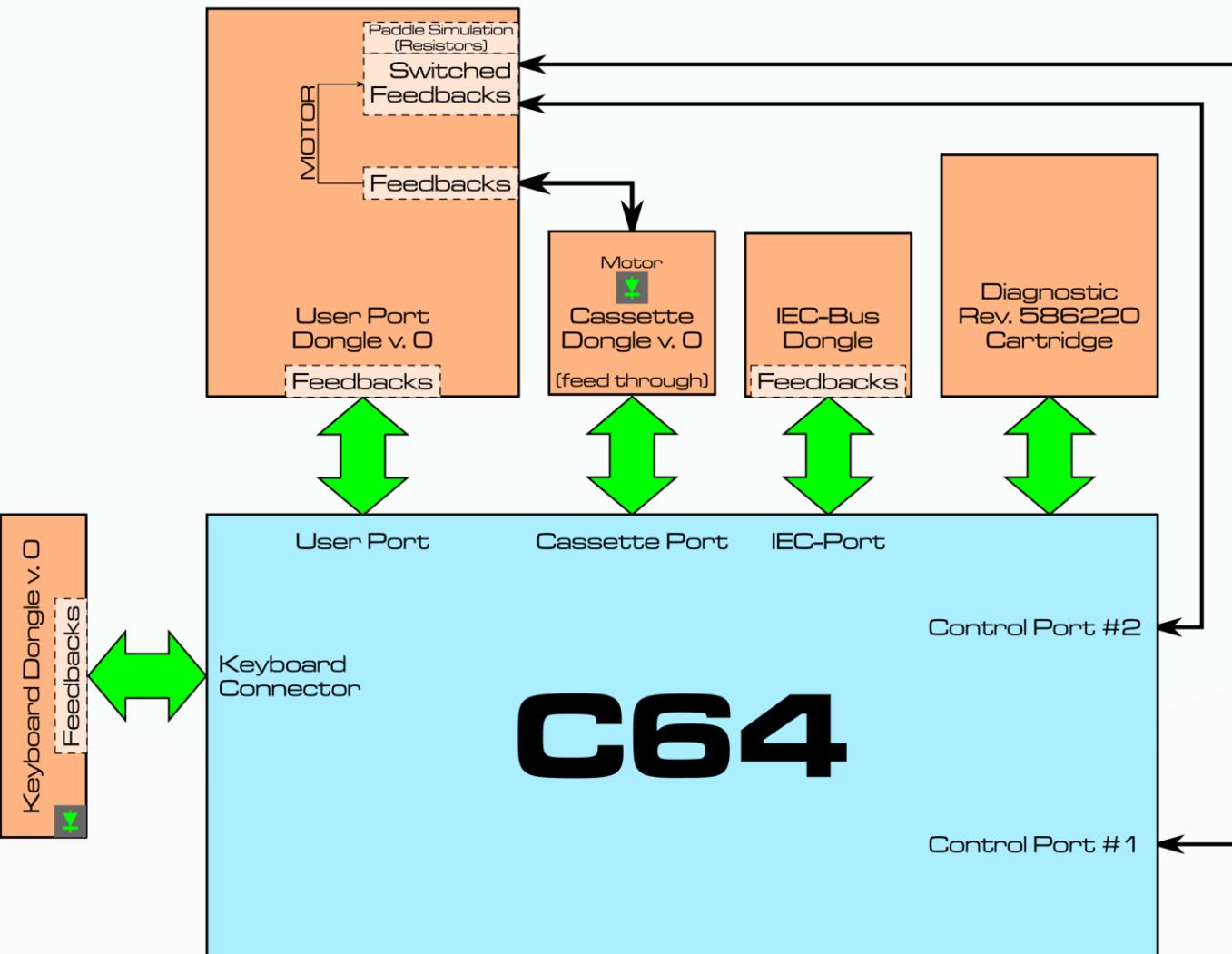


Later in 2019, I had a 3D printer ⇒ I have constructed a case for the user port and the cassette port dongle

Original Commodore Diagnostic Rev. 586220 Harness

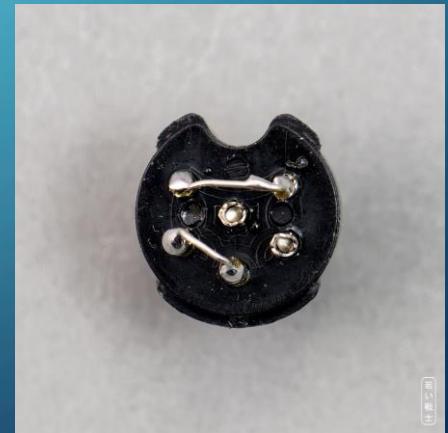


Diagnostic Harness Rev. 0



The differences:

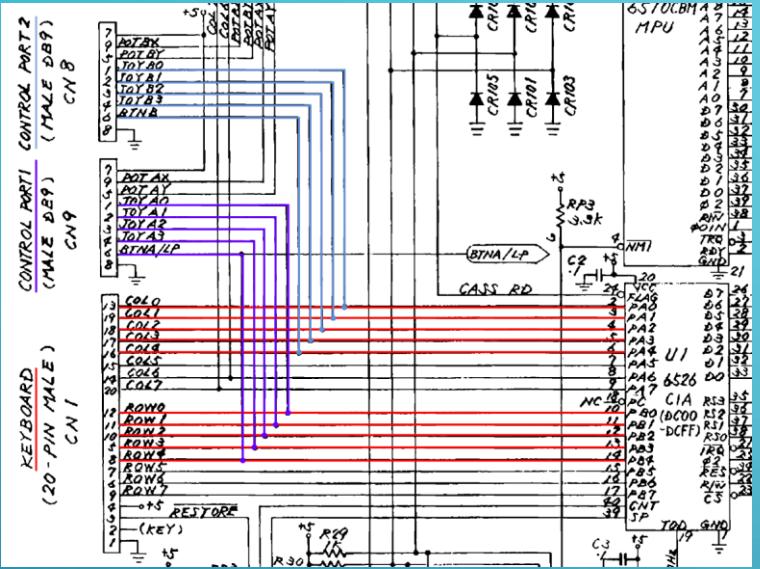
- There is a PCB for the cassette port
- The feedbacks are inside the IEC-Dongle



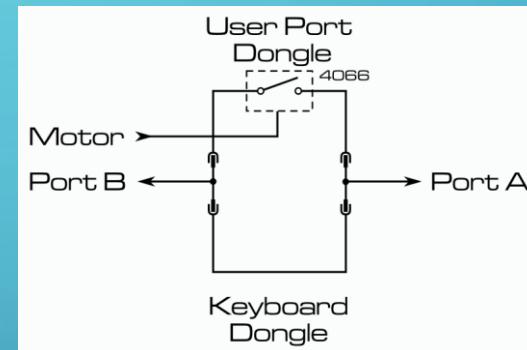
- LED for the **MOTOR** signal
- Power LED on the keyboard dongle

THE PROBLEM

„The harness works perfectly without the analog switches (4066) on the user port dongle!“

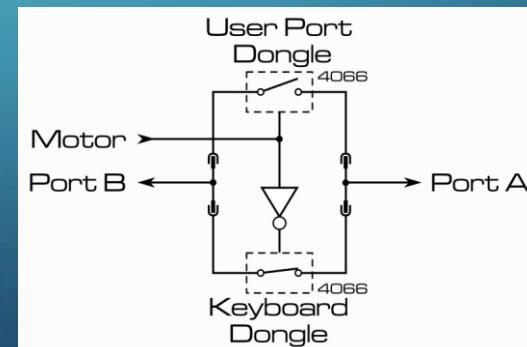


The switch is futile
As long as the keyboard
dongle is attached

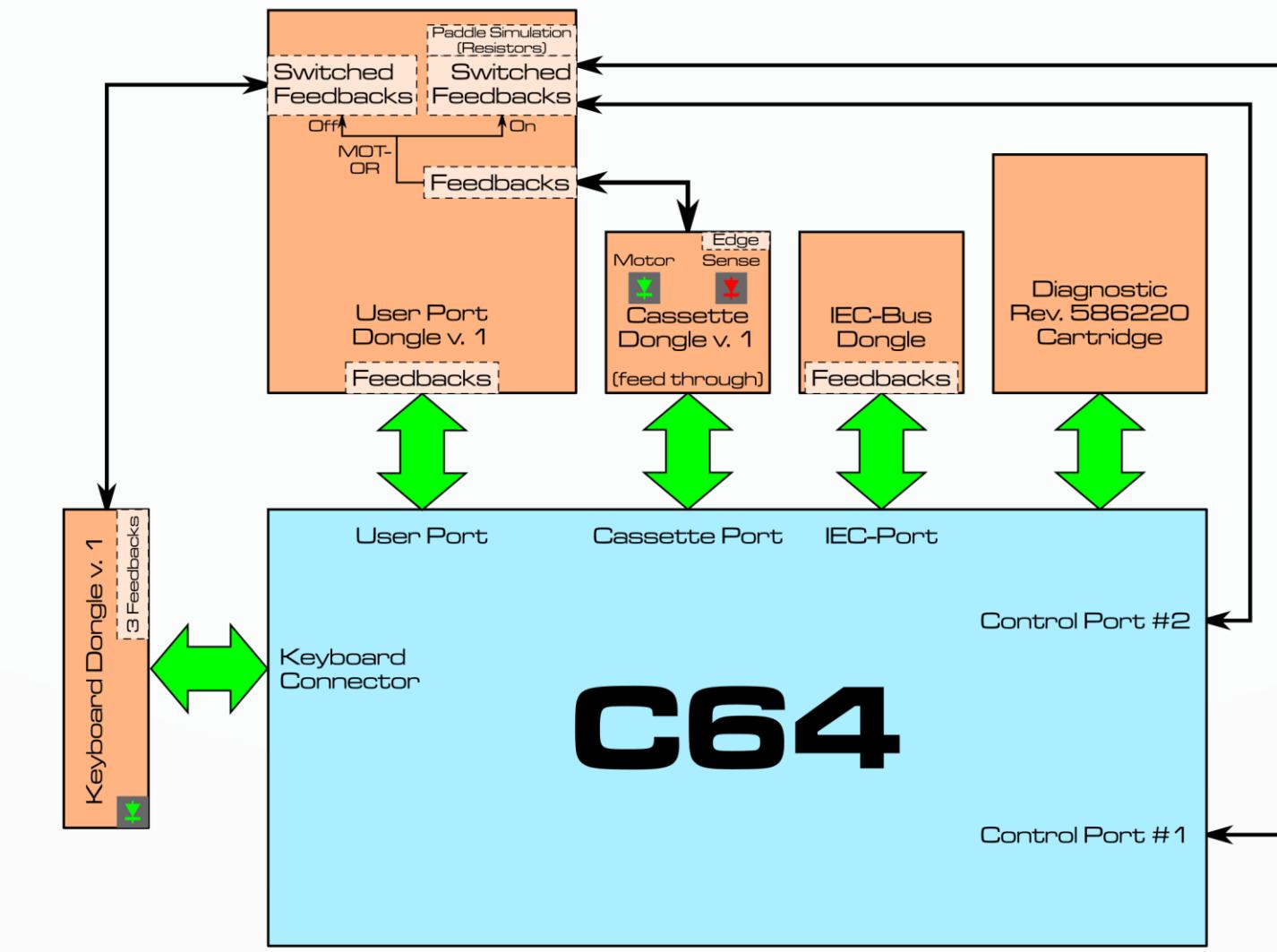


THE SOLUTION

Switching the keyboard feedback
off as long as the control port
feedbacks are switched on

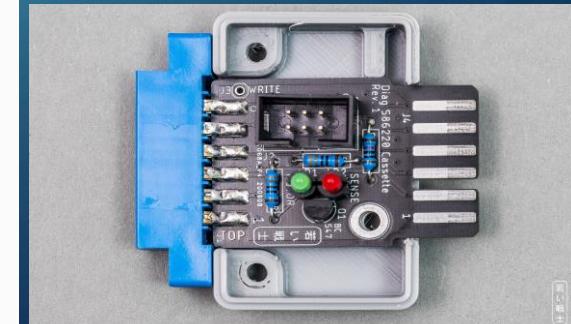


Diagnostic Harness Rev. 1

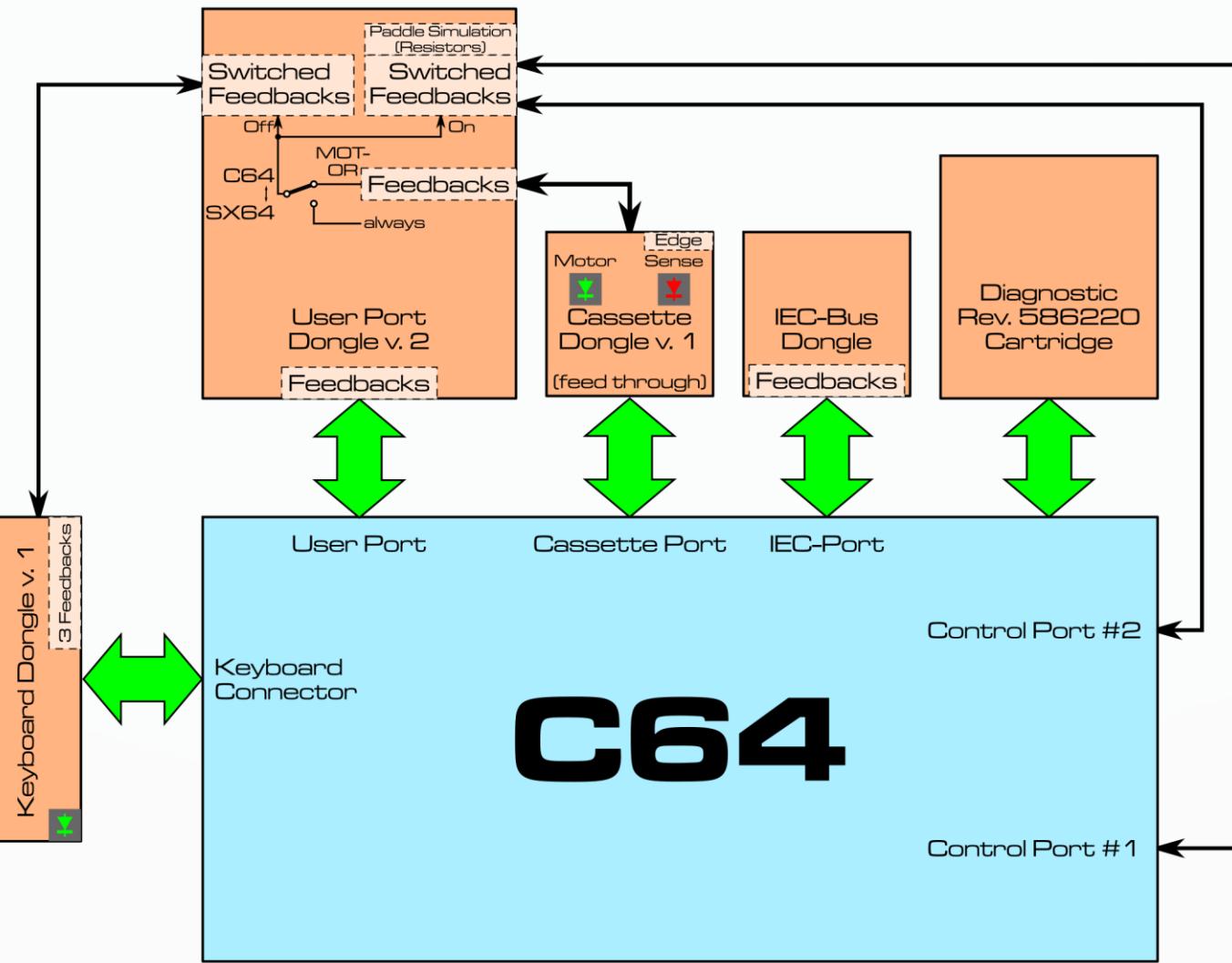


New in Rev. 1:

- Keyboard and user port dongles are connected with a cable
- Additional switches on the user port dongle
- Sense LED on cassette dongle
- Cassette dongle has an edge connector



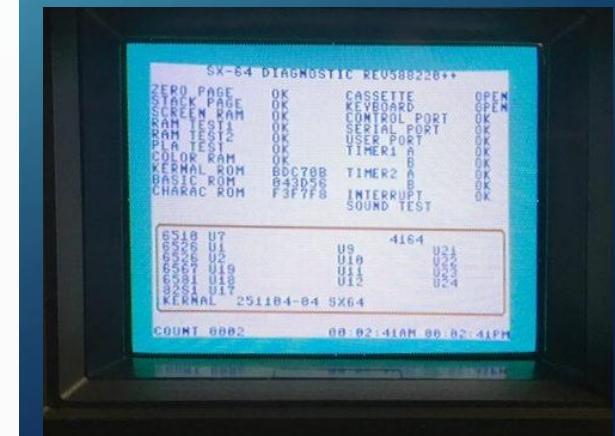
Diagnostic Harness Rev. 2



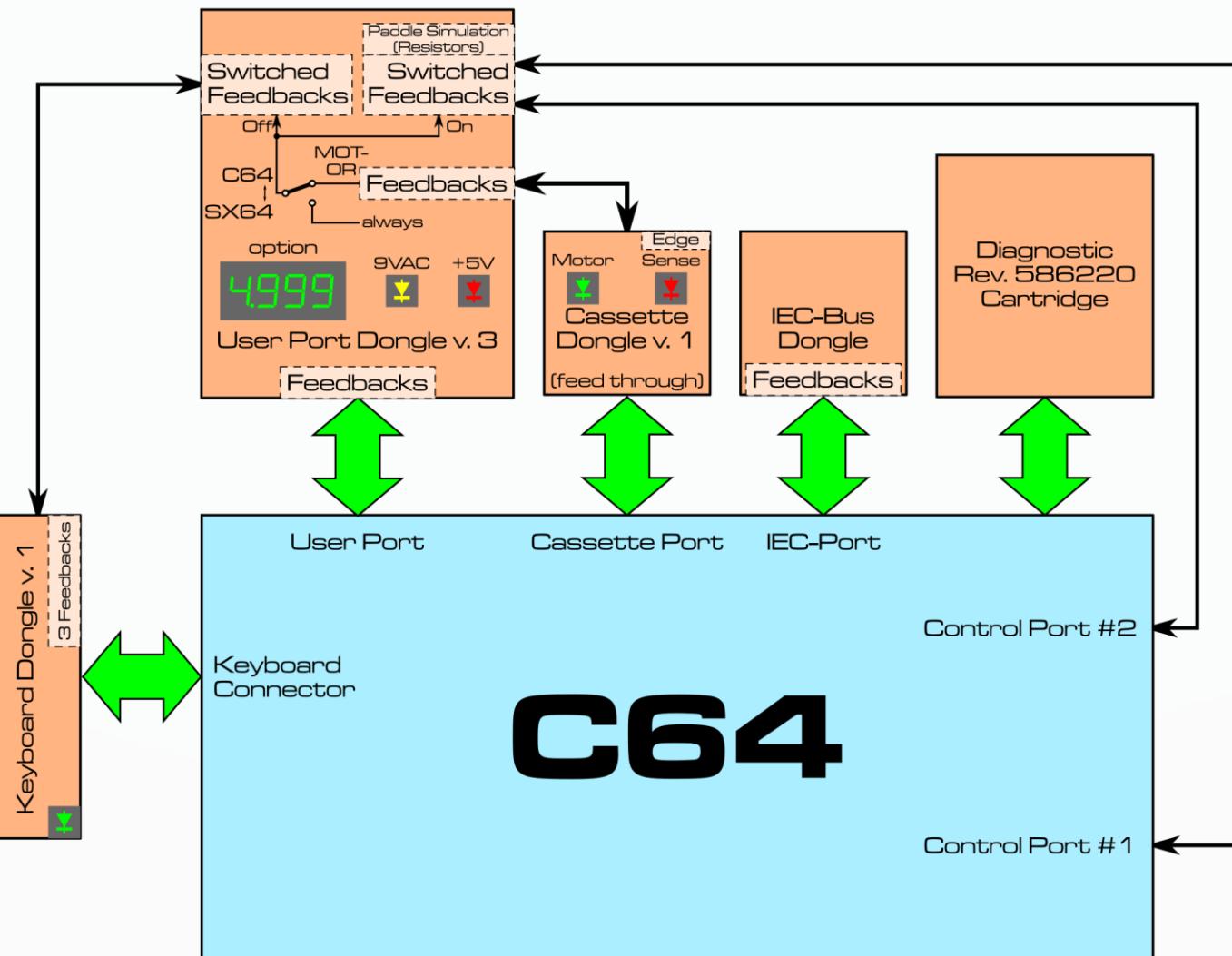
New in Rev. 2:

- The optional switch for the SX-64 mode

The SX-64 does not have a cassette port.
The Control Port feedback have to be switched manually



Diagnostic Harness Rev. 3



New in Rev. 3:

- Voltage measurement at the user port dongle (pins and optional panel meter)
- LEDs for 9VAC and +5V

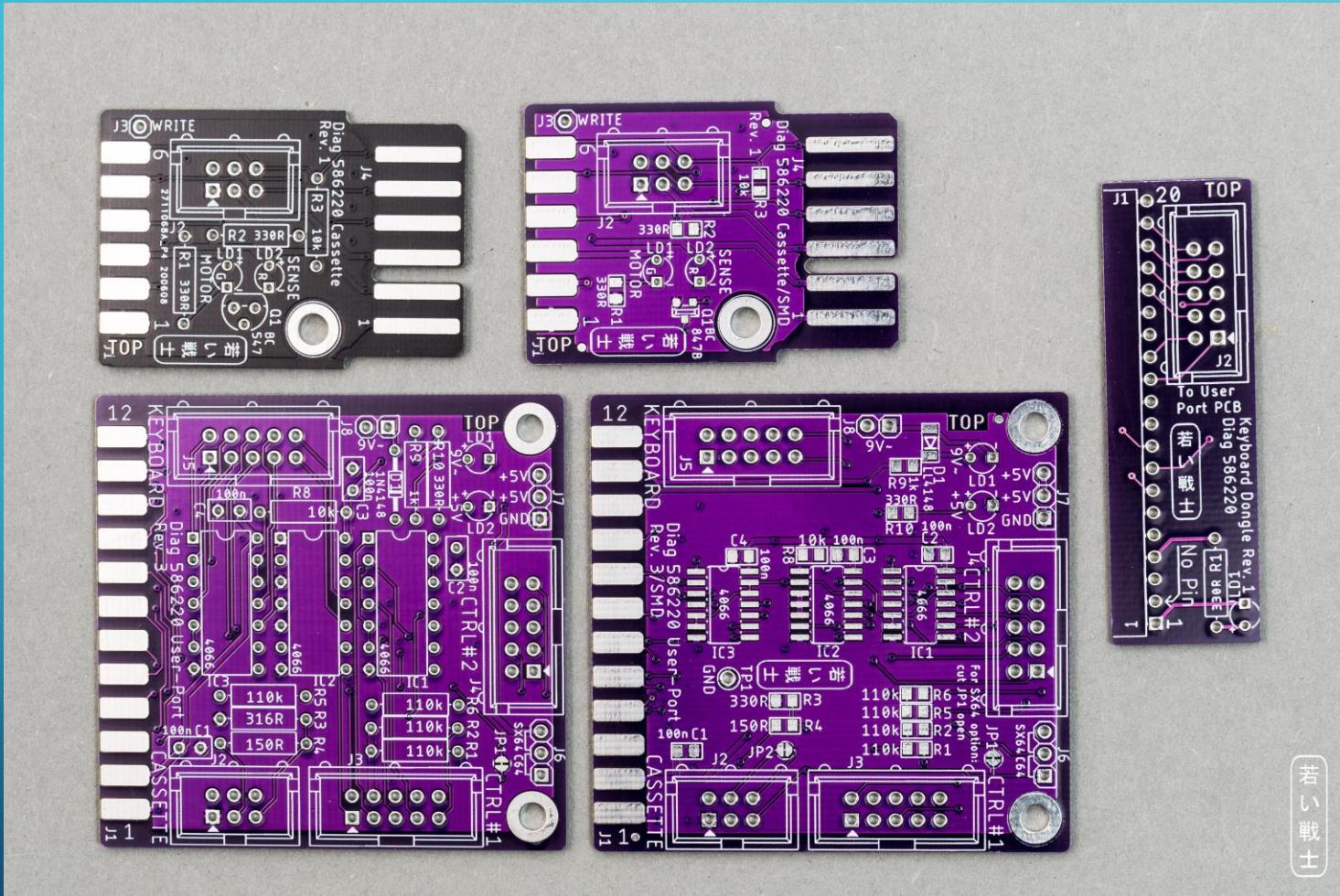
Measuring the voltage inside the C64 makes much more sense than having a voltage indicator on the power supply. There are voltage drops over cables, connectors and the power switch.

A Diagnostic Harness Rev. 3 with voltmeter and Diagnostic Cartridge



若い戦士

THE PRINTED CIRCUIT BOARDS

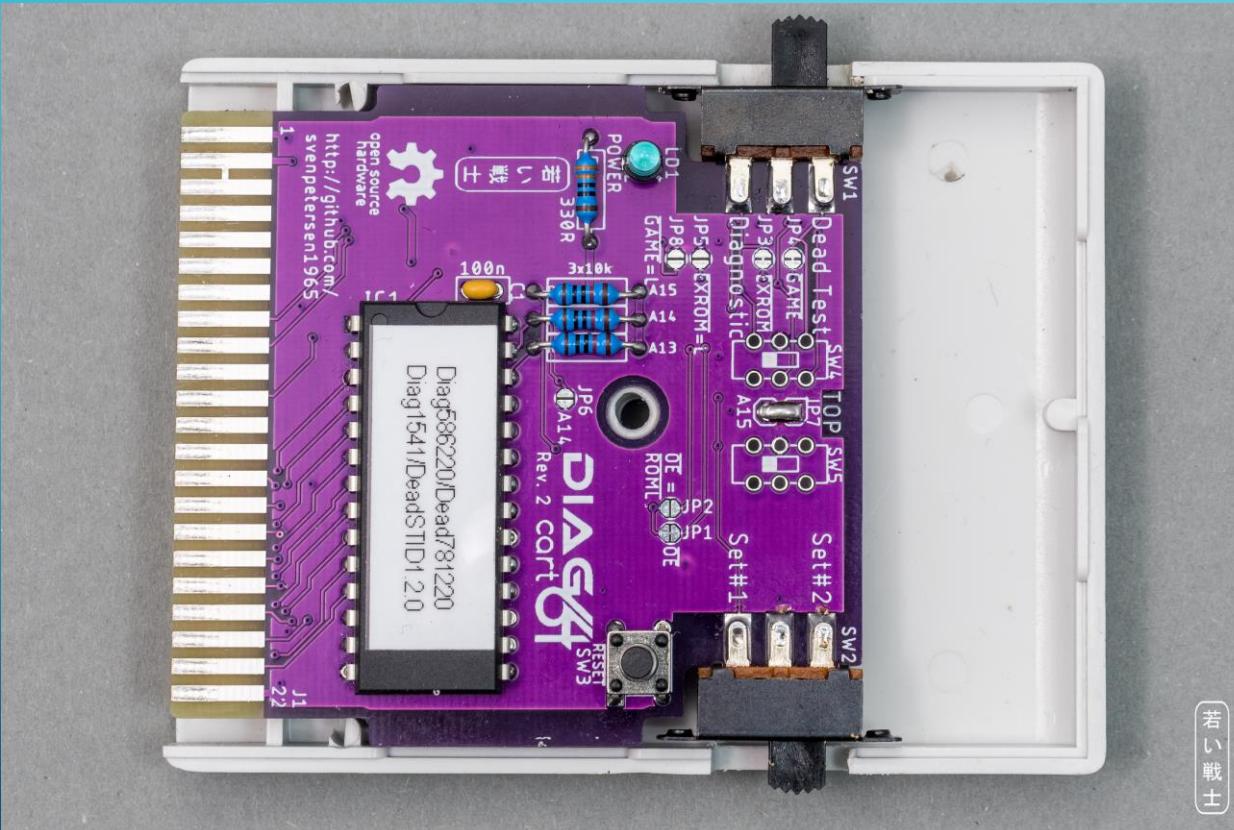


PCBs User Port Dongle Rev. 3 and Cassette Dongle and Keyboard Rev. 1
Through hole and SMD version

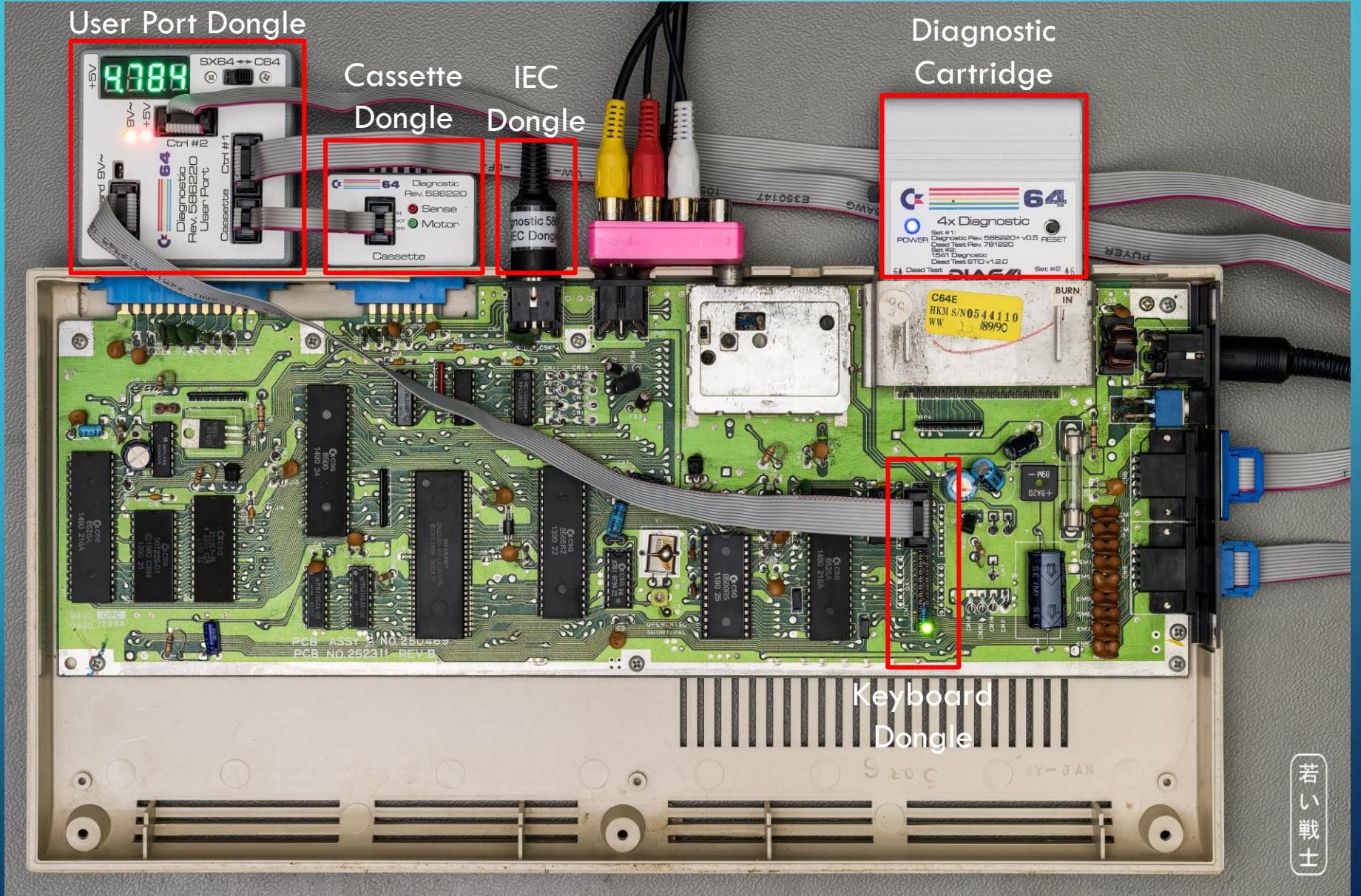
There is a THT and an SMD version of both, the User Port and the Cassette Dongle.

retrorewind.ca in Canada
is „mass-producing“ the
SMD diagnostic harnesses
with a pick and place
machine.

THE DIAGNOSTIC CARTRIDGE



- The Diag64cart contains:
 - Diagnostic Rev. 586220
 - Dead Test Rev. 781220
 - 1541 Diagnostic (World of Jani)
 - Dead Test STID
- A pretty short BOM
- It is very simple to make (EPROM Programmer required!)



C-64 DIAGNOSTIC REV586220++

| | | | |
|------------|--------|--------------|----|
| ZERO PAGE | OK | CASSETTE | OK |
| STACK PAGE | OK | KEYBOARD | OK |
| SCREEN RAM | OK | CONTROL PORT | OK |
| RAM TEST1 | OK | SERIAL PORT | OK |
| RAM TEST2 | OK | USER PORT | OK |
| PLA TEST | OK | TIMER1 A | OK |
| COLOR RAM | OK | TIMER2 B | OK |
| KERNEL ROM | 68A9E5 | INTERRUPT | OK |
| BASIC ROM | 043D56 | SOUND TEST | OK |
| CHARAC ROM | D9F984 | | |

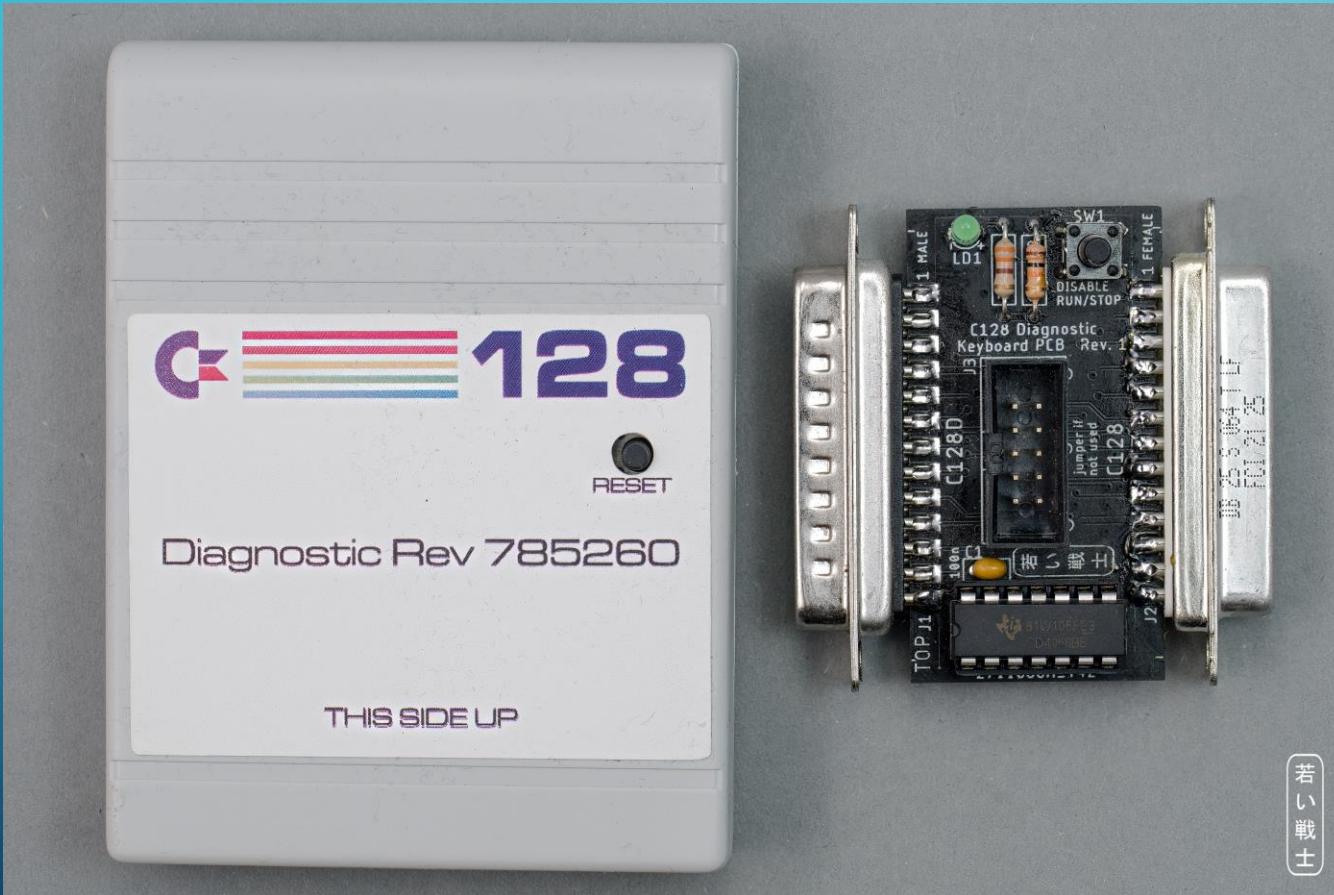
| | | | |
|----------|--|------|-----|
| 6510 U7 | | 4164 | |
| 6526 U1 | | U9 | U21 |
| 6526 U2 | | U10 | U22 |
| 6567 U19 | | U11 | U23 |
| 6581 U18 | | U12 | U24 |
| 82S1 U17 | | | |

KERNEL JIFFYDOS 6.01

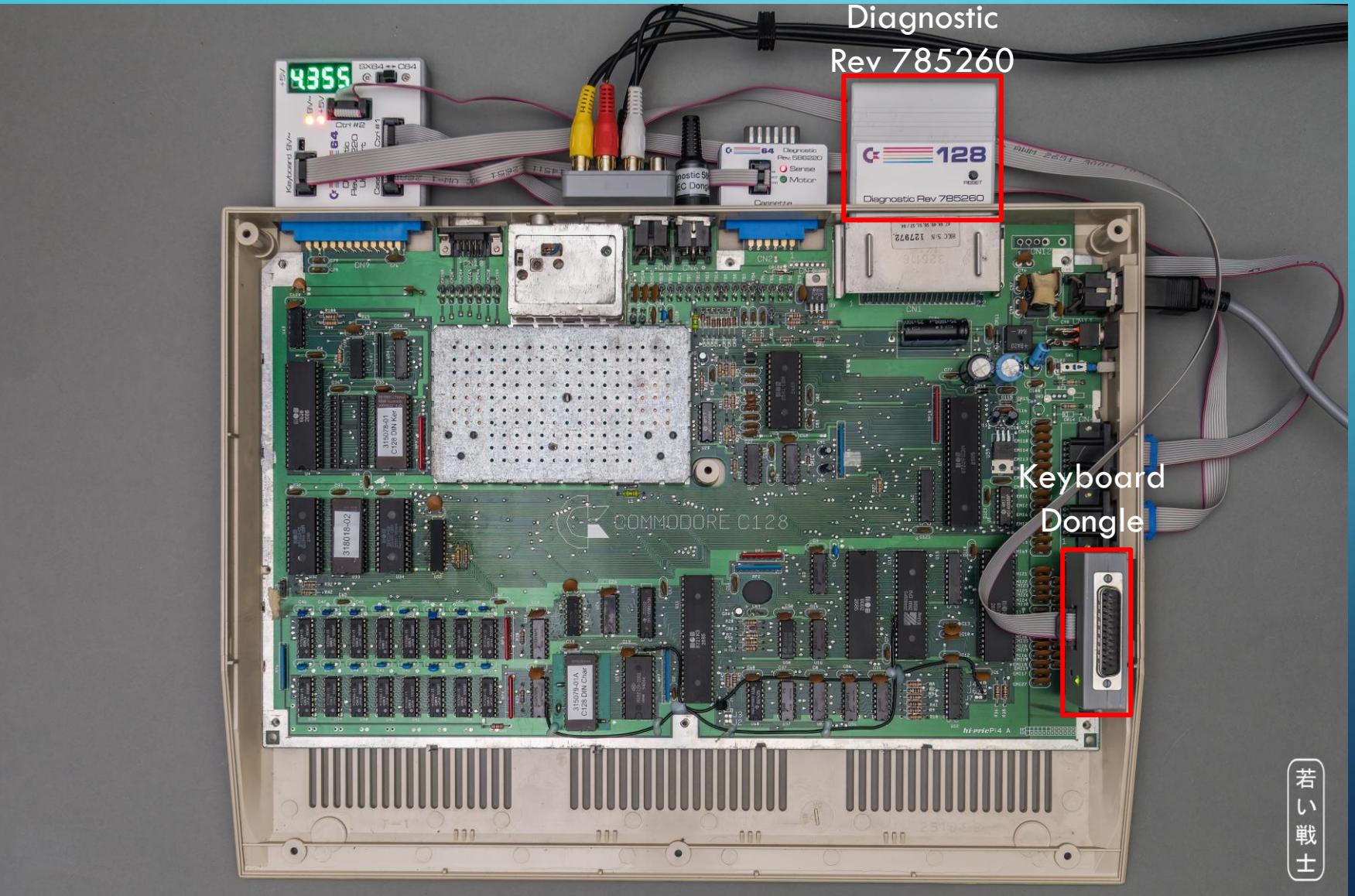
COUNT 0004

00:04:03AM 00:00:05PM

TESTING THE C128



- The C128 can be tested with the same harness
- This requires a different cartridge and a special keyboard dongle
- Some of the cables need to be longer



C128/128D DIAGNOSTIC REV 785260

| | | | |
|--------------|----|--------------|----|
| ZERO PAGE | OK | CASSETTE | OK |
| STACK PAGE | OK | KEYBOARD | |
| SCREEN RAM | OK | CONTROL PORT | |
| COLOR RAM | OK | SERIAL PORT | |
| HI RAM BANK0 | OK | USER PORT | |
| HI RAM BANK1 | OK | TIMER1 | A |
| LO RAM BANK0 | OK | TIMER2 | B |
| LO RAM BANK1 | OK | INTERRUPT | |
| KERNEL ROM | FD | SOUND TEST | |
| BASIC LO ROM | 51 | | |
| BASIC HI ROM | 41 | | |
| CHARAC ROM | F7 | | |
| PLA TEST | OK | | |

| | | | |
|-------|-----|-----------|-----------|
| 8502 | U6 | BLK0-2164 | BLK1-2164 |
| 6526 | U1 | U | U |
| 6526 | U4 | 4398 | 4398 |
| 65264 | U21 | 4399 | 4399 |
| 65001 | U5 | 44 | 44 |
| 8721 | U11 | 41 | 45 |

COUNT 0000

00:02:21AM 00:02:21PM

RESOURCES

- Cartridge Software: <http://blog.worldofjani.com/?p=164>
- Harness Hardware: <https://github.com/svenpetersen1965>
- C64 and C128 Diagnostic Instruction and Troubleshooting Manuals:
<https://archive.org/details/@svenpetersen1965>
- My website: <http://tech.guitarsite.de/>

Thank you for your attention.