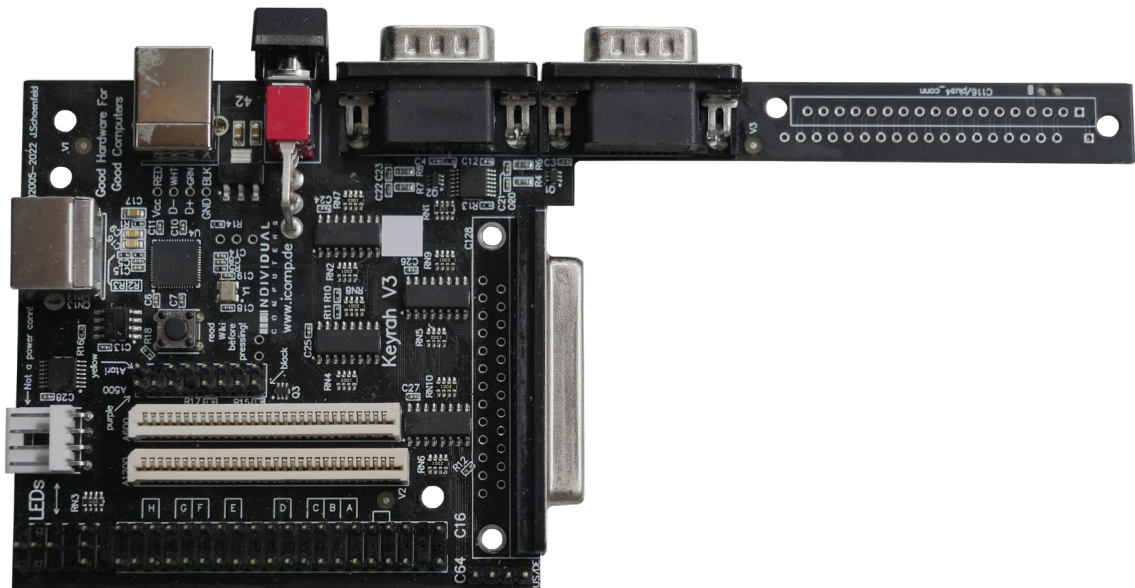

Keyrah v3

User Manual

21/04/23



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2. Introduction

Thank you for purchasing an individual Computers product. It is important to read the following instructions carefully before attempting installation. Individual Computers cannot be held responsible for any damage caused due to incorrect installation.

Before installing Keyrah in the case of a C128, C64, VIC-20 or C-16, please remove the mainboard of the old computer. Use the screws of the mainboard to mount Keyrah. Older "breadbox" models of the C64 and the VIC-20 also have a metal bracket on the side of the mainboard that should be mounted on Keyrah.

Connect the keyboard to the connector that's labelled with the type of your computer. The orientation of the cable is determined by a missing pin ("key pin") in the connector.

Keyrah should not be used without a case.

For connection to a computer, use a USB type-b to type-a cable of your choice. If you're making a special case with Keyrah and a computer mainboard in the same casing, you can also use the internal USB-connector. The pinout is printed on the board itself, including the colours that are usually used for internal USB cabling. You can only use one of the two USB-connections!

You do not need special drivers for using Keyrah on an Amiga, Mac or PC. Just plug it in, and driver installation will happen automatically.

Attaching and detaching Keyrah can be done without shutting down the machine (so-called hot-plugging) – however do not attach or detach it when the host computer is currently in sleep mode.

Changing the switch position can also be done while the computer is in use, re-starting the machine is not necessary.

Technical hints

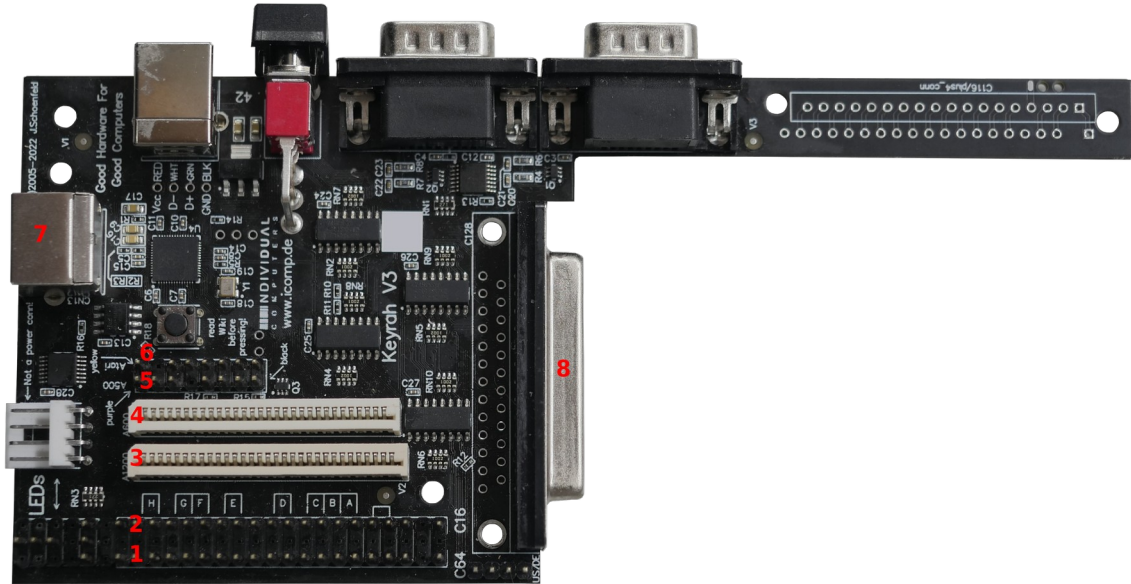
Keyrah is a USB-only device. Connection to a PS/2 port with an adapter is not possible.

The connector for A600 LEDs is exactly the same as the power connector for 3.5" floppy drives. You must not connect any power here! Commodore's choice for this connector is surely a bad one, but we want to keep Keyrah as easy to install as possible, so we've kept the connector shape. We trust that you believe us that Keyrah works fine without additional power!

Please only connect the devices mentioned in 3.1 Keyboards and 3.3 Joystick Ports.

3. Using Keyrah V3

3.1 Keyboards



3.1.1 Matrix Connectors

Some keyboards can be connected to one of the matrix connectors on the Keyrah v3 board:

- (1) VIC20, C64
- (2) C16
- (3) Amiga 1200
- (4) Amiga 600

3.1.2 Serial Connectors

- (5) Amiga 500, Amiga 2000
- (6) Atari ST

3.1.3 PS/2 Connector

(7) The PS/2 connector can be used for these keyboards:

- Amiga 4000,
- Amiga 2000, A3000 via DIN to PS/2 Adapter
- PC (AT) via DIN to PS/2 Adapter
- PC (XT) via DIN to PS/2 Adapter
- PS/2

3.1.4 DB25 Connector

(8) The DB25 connector can be used for these keyboards:

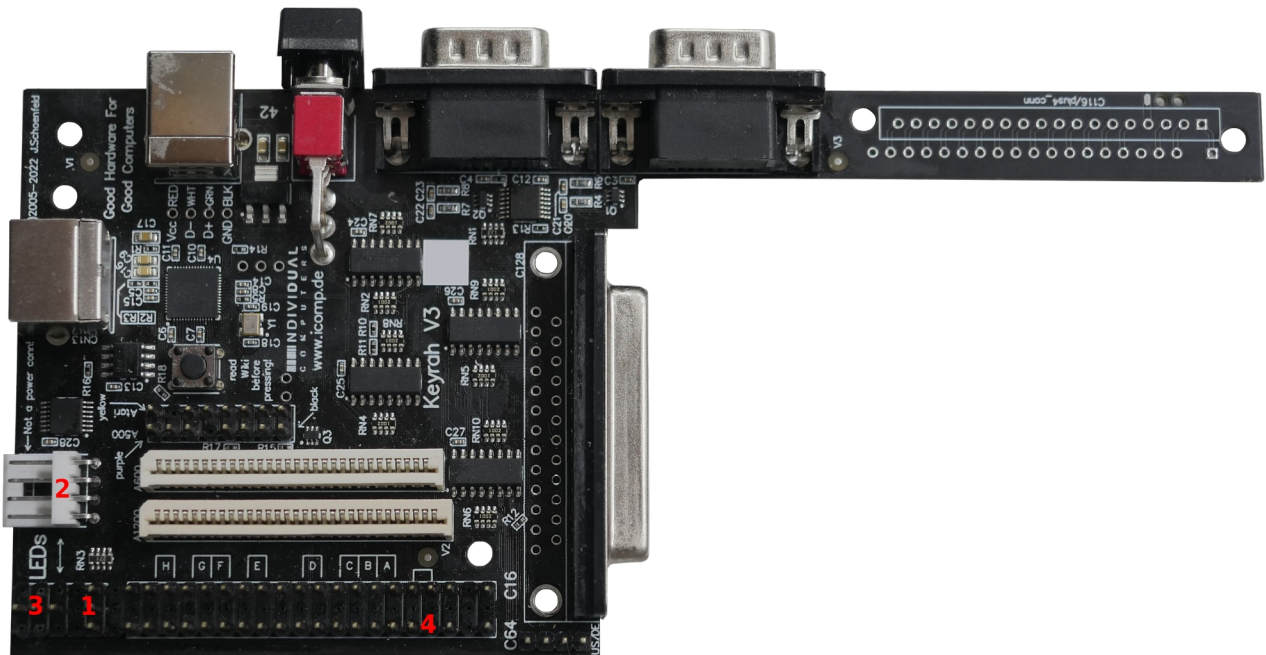
- C128D
- SX64 (requires a simple 1:1 Adapter/Cable)
- PET (requires a passive Adapter)
- CBM2 (requires an active Adapter)

3.1.5 Locking Keys

In a modern PC Keyboard layout there are three keys that will toggle a state on and off permanently rather than just producing an down/up event – „CAPS lock“, „NUM lock“ and „Scroll lock“. Their current state is usually indicated by an LED. However, on some of the keyboards that can be used with Keyrah V3, the equivalent keys are either actual mechanically locking keys (eg the CBM keyboards have a mechanical shift-lock key) or the keyboard manages the state of the LEDs on its own and there is no way to modify that state (like with PC/XT keyboards). For those keyboards specific code was added that makes sure the state of those keys is always in sync with a second keyboard connected to the same host. *If the state of the keyboard can not be modified, the host keyboard status follows Keyrah.*

- CBM Keyboards have a mechanically locking shift-lock key. Keyrah will do two things:
 - when it is pressed, remove the left shift key from the matrix, so only „CAPS lock“ is being reported as pressed.
 - when the remote caps lock status does not match the state of the shift-lock key, Keyrah will generate extra „CAPS lock“ keypresses to make sure the remote status changes accordingly.
- PC/XT Keyboards have the usual three LEDs, however there is no way to modify their status. So when the remote status does not match the state of the “CAPS lock”, “NUM lock” or “Scroll lock” LEDs, Keyrah will generate extra keypresses to make sure the remote status changes accordingly.
- Amiga 500 Keyboards (with serial interface) have a “CAPS lock” LED, but manage its state by itself and there is no way to modify its status. When the remote caps lock status does not match the state of the caps-lock LED, Keyrah will generate extra „CAPS lock“ keypresses to make sure the remote status changes accordingly.

3.2 LEDs



3.2.1 Connectors

There are two types of LED connectors

(1) The „C64 Style“ 3 Pin LED Connector next to the keyboard connector. The middle Pin is GND, the pin facing the edge of the board is the Power LED, the pin facing away from the edge is the Num Lock LED.

These two are the only LEDs that can be directly connected without an additional Resistor!

Since the C128 has the LED on a very short cable, you will have to use an extender, which is not included in this package.

(2) The „Amiga 600 Style“ 4 Pin connector.

(3) The „Amiga 1200 Style“ 4 Pin connector (shares the middle pin of the C64 connector).

The Amiga-LED connectors have no resistors in the circuit, so the voltage is too high for an "LED only" cable, you MUST use current limiting resistors or you risk damaging the hardware!

(4) Extra LED on the C64 keyboard connector (see below),

You MUST use a current limiting resistor in series with the extra LED, or you risk damaging the Hardware!

3.2.2 Power LED

The Power LED shows one of three states:

- Blinking. This means the device is in pre-initializing state. If it stays in this state then a power cycle is needed.
- Fading on and off. This means the device has been suspended. It might be possible to wake it up by pressing any key.
- On. Device is ready :)

3.2.3 Keyboard status LEDs

Two keyboard status LEDs are available at the external connectors – „Num Lock“ and „Scroll Lock“. Generally those will indicate the status their names imply, with the following exceptions:

- The „Num Lock“ LED output can **not** be used with keyboards that have a serial interface: Amiga 500, Atari ST, PS/2, PC/XT
- When using a CBM keyboard, the „Scroll Lock“ LED will show the CAPS lock status – except when using a SX64 Keyboard (which has a shiftlock LED).
- When using an Amiga 500 Keyboard, the „Drive“ LED will show the „Num Lock“ Status.
- When using an Atari ST Keyboard, the LED on the Keyboard will show the CAPS lock status. Unfortunately the „Num Lock“ and „Scroll Lock“ LEDs can not be used with this keyboard.

3.2.4 Extra LED

Note that this pin was originally only intended for testing, directly goes to a I/O pin of the CPU and is completely unprotected. Its use is not recommended nor supported – if you don't know what that means skip the following paragraph and do NOT use it.

One extra LED can be connected between Pin 4 of the C64 keyboard connector and GND (for example Pin 1 of the C64 keyboard connector), depending on the keyboard in use it will show one of the following:

- Caps-Lock when an SX64, PC/XT or PS/2 Keyboard is used.
- Num-Lock when an Atari ST Keyboard is used.
- Scroll-Lock when an Amiga 500, C64, C16, C128, CBM2 or PET (via DB25 Adapter) Keyboard is used.

The extra LED can NOT be used with a C64 or Amiga 1200 keyboard.

Remember that you MUST use at least a current limiting resistor in series, preferably a driver IC, with the LED, or you WILL damage the Hardware!

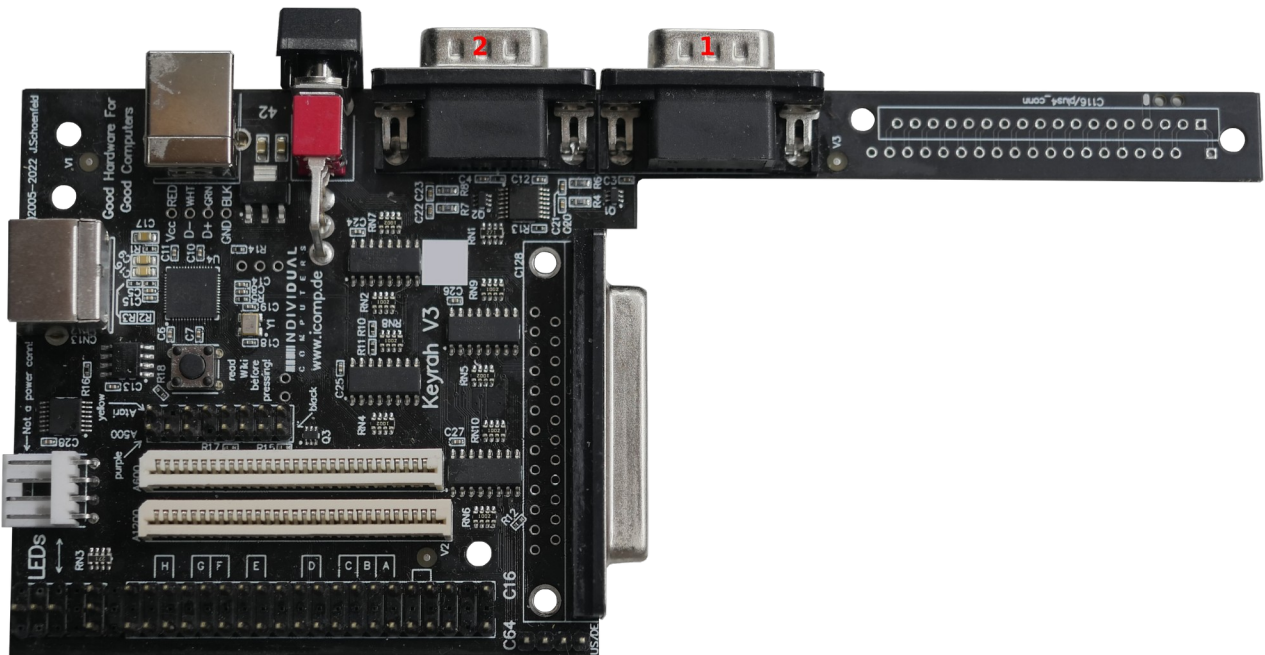
3.2.5 Overview

| Keyboard | Keyboard LEDs | Scroll-lock LED (1) | Num-lock LED (2) | Extra LED |
|------------|---------------------|---------------------|------------------|-----------|
| Amiga 500 | Caps / Num | Num | - / - | Scroll |
| Amiga 1200 | Caps | Scroll | Num | - / - |
| Atari ST | Caps | - / - | - / - | Num |
| C64 | - / - | Caps | Num | - / - |
| C16 | - / - | Caps | Num | Scroll |
| C128 | - / - | Caps | Num | Scroll |
| SX64 | Caps | Scroll | Num | Caps |
| PC XT | Num / Caps / Scroll | Scroll | - / - | Caps |
| PC AT | Num / Caps / Scroll | Scroll | - / - | Caps |
| CBM2 / 7x0 | - / - | Caps | Num | Scroll |
| PET / 8296 | - / - | Caps | Num | Scroll |

*1) Amiga Floppy LED (labelled "F.Disk" on A1200)

*2) Amiga Harddisk LED (labelled "Disk" on A600)

3.3 Joystick Ports



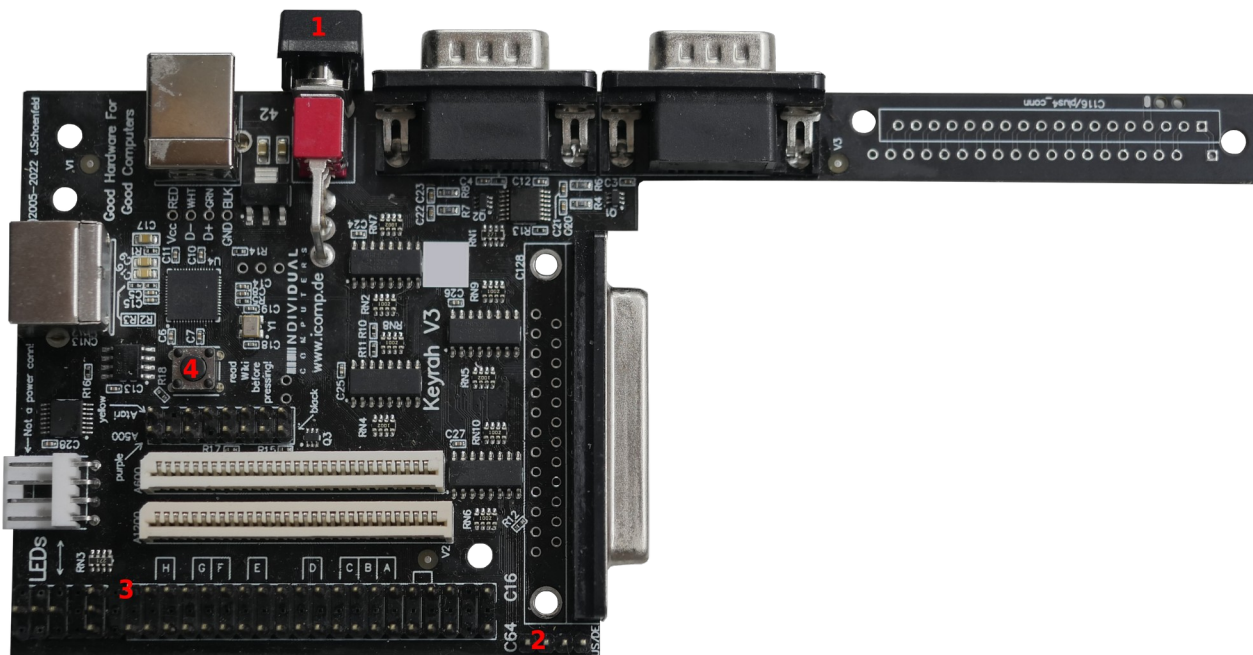
Each Joystick Port will appear as a separate HID game controller.

- (1) The connector further from the power switch is “Port 1”
- (2) The connector next to the power switch is “Port 2”

The following devices are currently supported:

- Standard DE9 joysticks
 - The directions are mapped to the 1st and 2nd controller axis.
 - The button is mapped to the 1st controller button.
 - Additionally “C64 GS Style” 2nd and 3rd joystick button (connected between POTX/Y and VCC) will be mapped to 2nd and 3rd controller button
- Standard “Commodore” paddles (470 kOhm)
 - The paddles are mapped to the 3rd and 4th controller axis.
 - Note that the paddle buttons will appear as “left” and “right” just like on a C64

3.4 Buttons



3.4.1 Power Switch

(1) The Power switch has three functions:

1. Bottom („off“) and middle („on“) position toggles between alternative keymaps (see 3.6 Keyboard Mapping)
2. Press and release top momentary switch to trigger a keypress (by default mapped to the key that brings up the menu and/or disables input capturing in the respective supported emulator).
3. Press and hold top momentary switch (for approx 2 seconds) to put the host into sleep mode.

Keyrah is programmed to wake the computer up on any keystroke if it was switched off using the ACPI key. This can of course only work if the USB port is supplied with power while the PC is in standby mode, and your BIOS is properly configured.

3.4.2 Extra Buttons

- (2) One extra Button/Key can be connected to the Menu_btn keypad on the board. This button is by default mapped to the key that brings up the menu and/or disables input capturing in the respective supported emulator.
- (3) Another extra Button/Key can be connected between Pin 20 of the C16 connector and GND (eg Pin 4 of the C16 connector). This button can not be used with a C16 or Amiga keyboard. By default this is mapped to the Escape key.

3.4.3 Boot Button

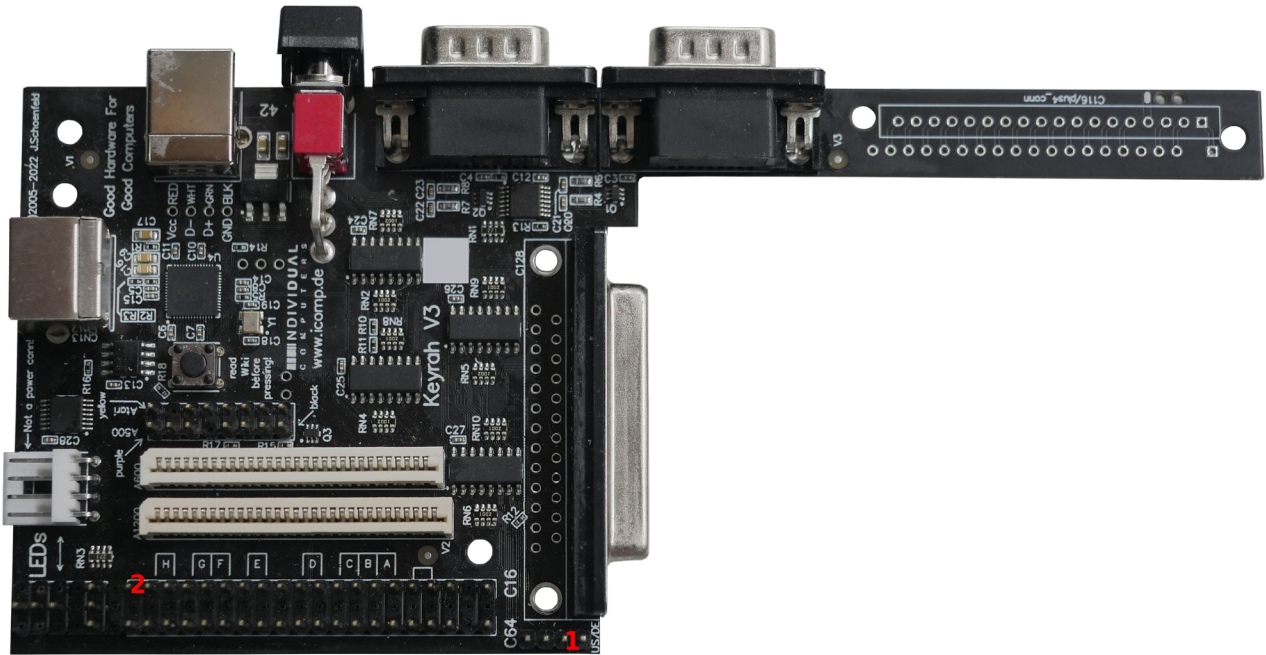
(4) The boot button has two functions:

- Press the button to “type” the shift-lock ADC value (see Shift-lock threshold)
- To enable mass storage mode for updating the firmware or flashing a keymap, press and hold the button at power up, or hold the button for about 5 seconds (see 3.7 Using a custom Keymap).

3.4.4 Overview

| Keyboard | Menu/Power Button | Extra Button |
|------------|-------------------|--------------|
| Amiga 500 | F12 | - / - |
| Amiga 1200 | F12 | - / - |
| Atari ST | Pause | Escape |
| C64 | F12 | Escape |
| C16 | F12 | - / - |
| C128 | F12 | Escape |
| SX64 | F12 | Escape |
| PC XT | F12 | Escape |
| PC AT | F12 | Escape |
| CBM2 / 7x0 | F12 | Escape |
| PET / 8296 | F12 | Escape |

3.5 Jumpers



3.5.1 Keymap select

(1) The jumper marked EN/DE selects an alternative keymap (see 3.6 Keyboard Mapping). When the Jumper is closed the german keymap is selected, when it is open the english keymap is selected.

3.5.2 Keyboard type

(2) Since not every keyboard can be automatically detected, the type can be forced by putting jumpers on the C16 connector:

| | | | | |
|----|--|---|--|-----------------------------------|
| 20 | | o | | |
| 19 | | o | | \ Jumper Pos H |
| 18 | | o | | / |
| 17 | | o | | \ Jumper Pos G |
| 16 | | o | | \ / Jumper Pos F |
| 15 | | o | | / |
| 14 | | o | | \ Jumper Pos E |
| 13 | | o | | / |
| 12 | | o | | |
| 11 | | o | | \ Jumper Pos D |
| 10 | | o | | / |
| 9 | | o | | \ Jumper Pos C |
| 8 | | o | | / \ Jumper Pos B |
| 7 | | o | | \ / Jumper Pos A |
| 6 | | o | | / |
| 5 | | o | | \ Jumper "Manual keyboard select" |
| 4 | | o | | / |
| 3 | | o | | |
| 2 | | o | | |
| 1 | | o | | |

The following keyboards can be selected with jumpers on the C16 pin header. **Note that the “Manual Keyboard select” jumper (5 – 4) must be set for any jumpers to be detected.**

| Mode | Jumper | Pins | |
|-------------|---------------|-------------|-------|
| PS/2 | Pos H | 19 - 18 | 5 - 4 |
| Atari ST | Pos F | 16 - 15 | 5 - 4 |
| PC XT | Pos E | 14 - 13 | 5 - 4 |
| SX64 | Pos A | 7 - 6 | 5 - 4 |

3.6 Keyboard Mapping

Generally for all keyboards one of four keymaps can be selected. This is done by using the “power” switch and the EN/DE jumper.

The “power” switch switches between a “normal” and a “emulator” keymap:

- When the switch is in “off” (down) position, a key mapping is used which is optimized for regular PC work. In this mode additional extra layers via a “Fn” and/or right shift key are available.
- When the switch is in “on” (up) position, a key mapping is used which is optimized for being used with an emulator. In particular no extra virtual layers are applied. Unless there is a good reason not to, this setting will also stick to the same mapping that Keyrah V2 used in emulator mode.

The EN/DE jumper switches between what kind of keyboard layout the Keyrah pretends to be (english or german). This is for the most part relevant for the CBM keyboards.

- When the Jumper is closed the german keymap is selected
- When the Jumper is open the english keymap is selected.

3.6.1 VIC20, C64

For switch position "on" (up), an adapted keyboard layout for C64/VIC-20 is chosen that's perfectly suitable for the emulator "VICE" (use "positional" keymap).

For switch position "off" (down), the keyboard layout is adapted for use under the Windows operating system. Most keys have the function that's printed on them, that's why we're only listing the keys here that differ from their print.

In this setting also some keys are mapped differently in combination with the right shift key – that eg makes the cursor keys work.

Note that in most operating systems the left ALT key (ALT gr) can be simulated by pressing (and holding) ALT, then CTRL.

| C64/VIC20 Key | US layout | | DE layout | |
|-----------------|----------------------|----------------------|----------------------|----------------------|
| | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) |
| Arrow left | Escape | ` and ~ | Escape | ^ and ° |
| + | = and + | - and _ | ß and ? | ß and ? |
| - | - and _ | = and + | ´ and ` | ´ and ` |
| Pound | ` and ~ | \ and | < and > | < and > |
| CLR/HOME | Home | Home | Home | Home |
| Inst/del | Backspace | Backspace | Backspace | Backspace |
| CTRL | Control | TAB | Control | TAB |
| Y | Y | Y | Z | Z |
| @ | \ and | [and { | Ü | Ü |
| * | ; and : |] and } | + and * | + and * |
| Arrow up | Page down | End | ^ and ° | End |
| RESTORE | TAB | Page up | TAB | Page up |
| RUN/STOP | Fn | Escape | Fn | Escape |
| Shift/Lock (*1) | CAPS lock | CAPS lock | CAPS lock | CAPS lock |
| : / [| [and { | ; and : | Ö | Ö |
| ; /] |] and } | ' and " | Ä | Ä |
| = | ' and " | Page down | # and ' | # and ' |
| CBM | left ALT | Control | left ALT | Control |
| Left Shift | Left Shift | Left Shift | Left Shift | Left Shift |
| Z | Z | Z | Y | Y |

Using Keyrah V3

| | | | | |
|------------------------|-------------|-------------|-------------|-------------|
| , / < | , and < | , and < | , and ; | , and ; |
| . / > | . and > | . and > | . and : | . and : |
| / ? | / and ? | / and ? | - and _ | - and _ |
| Right Shift (*2) | Right Shift | Right Shift | Right Shift | Right Shift |
| Cursor U/D | Down | Down | Down | Down |
| Cursor L/R | Right | Right | Right | Right |
| F1 | F1 | F1 | F1 | F1 |
| F3 | F3 | F3 | F3 | F3 |
| F5 | F5 | F5 | F5 | F5 |
| F7 | F7 | F7 | F7 | F7 |
| Right Shift+F1 | F2 | Shift+F1 | F2 | Shift+F1 |
| Right Shift+F3 | F4 | Shift+F3 | F4 | Shift+F3 |
| Right Shift+F5 | F6 | Shift+F5 | F6 | Shift+F5 |
| Right Shift+F7 | F8 | Shift+F7 | F8 | Shift+F7 |
| Right Shift+Cursor U/D | Up | Shift+Down | Up | Shift+Down |
| Right Shift+Cursor L/R | Left | Shift+Right | Left | Shift+Right |

*1) Shift lock will produce a “CAPS lock” event. However, due to how CBM Keyboards work, the left Shift key is always detected as pressed when shift lock is pressed – because of this Keyrah will always remove “left Shift” from the Keyboard Matrix when it detects “Shift Lock”.

*2) When “normal” mapping is active, the right Shift key enables extra translation for the cursor- and f-keys (see above)

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the “run/stop” key.

So press and hold the “run/stop” Key, and then press one of the following keys:

| C64 Key | Extra Key |
|----------------|------------------|
| W | Up |
| A | Left |
| S | Down |
| D | Right |
| 4 | PrntScr/SysReq |
| 5 | Scroll lock |
| 6 | Pause/Break |
| R | Insert |
| T | Home |
| Y | Page up |
| F | Delete |
| G | End |
| H | Page down |
| 7 | NumLock |
| 8 | NP / |
| 9 | NP * |
| 0 | NP - |
| U | NP 7 |
| I | NP 8 |
| O | NP 9 |
| P | NP + |
| J | NP 4 |
| K | NP 5 |
| L | NP 6 |
| : | NP , |
| Return | NP Enter |
| M | NP 1 |

Using Keyrah V3

| C64 Key | Extra Key |
|----------------|------------------|
| W | Up |
| , | NP 2 |
| . | NP 3 |
| / | NP 0 |
| F1 | F9 |
| F3 | F10 |
| F5 | F11 |
| F7 | F12 |

3.6.2 C128

The C128 keyboard is a C64 keyboard (see above) with 26 extra keys.

To use the C128 keyboard in VICE, use the Keyrah V3 specific keymap that is provided with VICE – without that a handful of keys will not work as expected, in particular the “locking” keys.

12 extra keys at the top of the keyboard:

| C128-key | US layout | | DE layout | | |
|-------------|----------------------|----------------------|----------------------|----------------------|-------------|
| | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) | |
| ESC | ESC | F9 | ESC | F9 | |
| TAB | TAB | F10 | TAB | F10 | |
| ALT | right ALT | F11 | right ALT | F11 | |
| Ascii/DIN | caps-lock | F12 | caps-lock | F12 | Locking Key |
| HELP | Numlock | F2 | Numlock | F2 | |
| Linefeed | end | F6 | end | F6 | |
| 40/80 disp | F8 | F4 | F8 | F4 | Locking Key |
| NoScroll | scroll lock | F8 | scroll lock | F8 | |
| Arrow Up | Cursor Up | Cursor Up | Cursor Up | Cursor Up | |
| Arrow Down | Cursor Down | Insert | Cursor Down | Insert | |
| Arrow Left | Cursor Left | Cursor Left | Cursor Left | Cursor Left | |
| Arrow Right | Cursor Right | Delete | Cursor Right | Delete | |

14 extra keys on the Numblock:

| C128-key | Mapped Key |
|----------|-------------|
| 0 ... 9 | NP 0 ... 9 |
| + | NP Add |
| - | NP Subtract |
| Enter | NP Return |
| , | NP Decimal |

To use the Numblock in VICE, disable the “Allow keyset joysticks” setting

3.6.3 C16

For switch position "on" (up), the layout for C16 keyboards is adapted to the emulator "VICE" (select "positional" keymap).

| C16 Key | US layout | | DE layout | |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|
| | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) |
| Escape | Escape | ` and ~ | Escape | ^ and ° |
| Inst/del | Backspace | Backspace | Backspace | Backspace |
| CTRL | Control | TAB | Control | TAB |
| Y | Y | Y | Z | Z |
| CLR/HOME | TAB | Home | TAB | Home |
| @ | ; and : | [and { | Ü | Ü |
| + | = and + | - and _ | + and * | ß and ? |
| - | - and _ | = and + | ß and ? | ´ and ` |
| RUN/STOP | Fn | Escape | Fn | Escape |
| Z | Z | Z | Y | Y |
| : / [| [and { | ; | Ö | Ö |
| ; /] |] and } | ' and " | Ä | Ä |
| * | ‘ and “ | Delete | # and ' | # and ' |
| CBM | left ALT | left Control | left ALT | left Control |
| , / < | , and < | , and < | , and ; | , and ; |
| . / > | . and > | . and > | . and : | . and : |
| / ? | / and ? | / and ? | - and _ | - and _ |
| Pound | ` and ~ | Delete | ^ and ° | + and * |
| = | \ and | Insert | < and > | < and > |
| F1 | F1 | F1 | F1 | F1 |
| F2 | F2 | F2 | F2 | F2 |
| F3 | F3 | F3 | F3 | F3 |
| HELP | F8 | F8 | F8 | F8 |

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the “run/stop” key.

So press and hold the “run/stop” Key, and then press one of the following keys:

| C16 Key | Extra Key |
|----------------|------------------|
| W | Up |
| A | Left |
| S | Down |
| D | Right |
| 4 | PrntScr/SysReq |
| 5 | Scroll lock |
| 6 | Pause/Break |
| R | Insert |
| T | Home |
| Y | Page up |
| F | Delete |
| G | End |
| H | Page down |
| 7 | NumLock |
| 8 | NP / |
| 9 | NP * |
| 0 | NP - |
| U | NP 7 |
| I | NP 8 |
| O | NP 9 |
| P | NP + |
| J | NP 4 |
| K | NP 5 |
| L | NP 6 |
| : | NP , |
| Return | NP Enter |
| M | NP 1,,, |

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| C16 Key | Extra Key |
|----------------|------------------|
| W | Up |
| , | NP 2 |
| . | NP 3 |
| / | NP 0 |
| = | ´ and ` (DE) |
| F1+shift | F4 |
| F2+Shift | F5 |
| F3+Shift | F6 |
| Help+Shift | F7 |
| F1 | F9 |
| F2 | F10 |
| F3 | F11 |
| Help | F12 |

3.6.4 Amiga

The emulator keymap was tweaked to be used with the WinUAE emulator. Note that to use the numeric keypad, you must disable keypad joystick emulation.

| Amiga Key | | US Layout | | DE Layout | |
|------------|-----------|----------------------|-----------------|----------------------|-----------------|
| US Layout | DE Layout | Switch down (normal) | Switch up (emu) | Switch down (normal) | Switch up (emu) |
| \ | \ | \ and | F13 | # and ‘ | F13 |
| | # and ^ | \ and | \ and | # and ‘ | # and ‘ |
| | < and > | \ and | \ and | < and > | < and > |
| Del | | Delete | Delete | Delete | Delete |
| Help | | Insert | Page down | Insert | Page down |
| Keypad [(| | Num Lock | F14 | Num Lock | F14 |
| Keypad [) | | Scroll Lock | F15 | Scroll Lock | F15 |

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the left Amiga key.

So press and hold the left Amiga Key, and then press one of the following keys:

| Amiga Key | | Extra Key |
|-----------|-----------|-----------|
| US Layout | DE Layout | |
| | 7 | Keypad 7 |
| | 8 | Keypad 8 |
| | 9 | Keypad 9 |
| | 0 | Keypad * |
| | U | Keypad 4 |
| | I | Keypad 5 |
| | O | Keypad 6 |
| | P | Keypad - |
| | J | Keypad 1 |
| | K | Keypad 2 |
| | L | Keypad 3 |

Using Keyrah V3

| | | |
|--------|-------|---|
| ;/: | Ö | Keypad + |
| M | | Keypad 0 |
| | | |
| ./> | ./: | Keypad , (comma) |
| /? | -/_ | Keypad / |
| +/= | '/` | page up |
|] / } | + / * | page down |
| -/_ | ß / ? | home |
| [/ { | Ü | end |
| F1 | | OSC "scan previous track" |
| F2 | | OSC "rewind" |
| F3 | | OSC "fast forward" |
| F4 | | OSC "scan next track" |
| F5 | | Numlock |
| F6 | | F11 |
| F7 | | F12 |
| F8 | | print screen |
| F9 | | scroll lock |
| F10 | | pause/break |
| Return | | Keypad enter |
| T | | Application launch "local machine browser" |
| E | | Application launch "Email reader" |
| W | | Application launch "audio player" |
| D | | Application launch "command line processor" |
| F | | Application launch "internet browser" |
| C | | Application launch "calculator" |
| Q | | OOB "mute" |
| 1 | | RTC "Volume increment" |
| A | | RTC "Volume decrement" |
| 2 | | OSC "play/pause" |
| S | | OSC "stop" |

3.6.5 Atari ST

The emulator keymap in Atari ST mode was tweaked for use with the STEEM emulator.

Note that to use the numeric keypad, you must disable keypad joystick emulation. To make all keys work correctly, you'll have to set PAUSE for the input capturing mode (instead of the default F11/F12).

| Atari ST key | | US Layout | | DE Layout | |
|--------------|-----------|----------------------|----------------------|----------------------|----------------------|
| US Layout | DE Layout | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) |
| Help | | F11 | Page up | F11 | Page up |
| Undo | | F12 | Page down | F12 | Page down |
| Numpad (| | Num lock | F11 | Num lock | F11 |
| Numpad) | | Scroll lock | F12 | Scroll lock | F12 |
| # and ^ | | ` and ~ | ` and ~ | ^ and ° | # and ’ |
| and ~ | | \ and | \ and | # and ’ | ^ and ° |

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the “left shift” key.

So press and hold the “left shift” Key, and then press one of the following keys:

| Atari ST Key | | |
|---------------------|------------------|------------------|
| US Layout | DE Layout | Extra Key |
| W | | Up |
| A | | Left |
| S | | Down |
| D | | Right |
| 4 | | PrntScr/SysReq |
| 5 | | Scroll lock |
| 6 | | Pause/Break |
| R | | Insert |
| T | | Home |
| Y | | Page up |
| F | | Delete |
| G | | End |
| H | | Page down |
| 7 | | NumLock |
| 8 | | NP / |
| 9 | | NP * |
| 0 | | NP - |
| U | | NP 7 |
| I | | NP 8 |
| O | | NP 9 |
| P | | NP + |
| J | | NP 4 |
| K | | NP 5 |
| L | | NP 6 |
| : | Ö | NP , |
| Return | | NP Enter |

Using Keyrah V3

| Atari ST Key | | |
|---------------------|------------------|------------------|
| US Layout | DE Layout | Extra Key |
| M | | NP 1 |
| , | , | NP 2 |
| . | . | NP 3 |
| / | / | NP 0 |

3.6.6 PET (via DE25 Adapter)

For switch position "on" (up), the layout for PET keyboards is adapted to the emulator "VICE" (select "positional" keymap).

| PET Key | US layout | | DE layout | |
|------------------|----------------------|----------------------|----------------------|----------------------|
| | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) |
| : * | = and + | - and _ | ´ und ` | ß und ? |
| - = | - and _ | = and + | ß und ? | ´ und ` |
| Arrow left | Escape | ` and ~ | Escape | ^ und ° |
| CLR/HOME | Home | Home | Home | Home |
| Inst/Del | Backspace | Delete | Backspace | Delete |
| TAB | Control | TAB | Control | TAB |
| Y | Y | Y | Z | Z |
| \ | \ and |] and } | # and ' | + and * |
| ; + | ; and : | ; and : | Ö | Ö |
| Arrow up | Page Up | Backspace | Page Up | Backspace |
| RUN/STOP | TAB | Escape | TAB | Escape |
| ESC | Fn | F1 | Fn | F1 |
| Shift/Lock (*1) | CAPS lock | CAPS lock | CAPS lock | CAPS lock |
| [| [and { | [and { | Ü | Ü |
|] |] and } | End | + and * | # and ' |
| @ | ' and " | ' and " | Ä | Ä |
| RVS | left ALT | F2 | left ALT | F2 |
| Left Shift | Left Shift | Left Shift | Left Shift | Left Shift |
| Z | Z | Z | Y | Y |
| , / < | , and < | , and < | , and ; | , and ; |
| . / > | . and > | . and > | . and : | . and : |
| / ? | / and ? | / and ? | - and _ | - and _ |
| Repeat | ` and ~ | Page down | ^ und ° | Page down |
| Right Shift (*2) | Right Shift | Right Shift | Right Shift | Right Shift |
| Cursor U/D | Down | Down | Down | Down |
| Cursor L/R | Right | Right | Right | Right |
| Right | Up | Shift+Down | Up | Shift+Down |

Using Keyrah V3

| | | | | |
|---------------------------|------|-------------|------|-------------|
| Shift+Cursor U/D | | | | |
| Right Shift+Cursor L/R | Left | Shift+Right | Left | Shift+Right |

*1) Shift lock will produce a “CAPS lock” event. However, due to how CBM Keyboards work, the left Shift key is always detected as pressed when shift lock is pressed – because of this Keyrah will always remove “left Shift” from the Keyboard Matrix when it detects “Shift Lock”.

*2) When “normal” mapping is active, the right Shift key enables extra translation for the cursor-keys (see above)

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the “ESC” key.

So press and hold the “ESC” Key, and then press one of the following keys:

| PET Key | Extra Key |
|----------------|------------------|
| W | Up |
| A | Left |
| S | Down |
| D | Right |
| 4 | PrntScr/SysReq |
| 5 | Scroll lock |
| 6 | Pause/Break |
| R | Insert |
| T | Home |
| Y | Page up |
| F | Delete |
| G | End |
| H | Page down |
| 7 | NumLock |
| 8 | NP / |
| 9 | NP * |
| 0 | NP - |
| U | NP 7 |
| I | NP 8 |
| O | NP 9 |
| P | NP + |
| J | NP 4 |
| K | NP 5 |
| L | NP 6 |
| ; | NP , |
| Return | NP Enter |
| M | NP 1 |

Using Keyrah V3

| PET Key | Extra Key |
|----------------|------------------|
| W | Up |
| , | NP 2 |
| . | NP 3 |
| / | NP 0 |
| NP 7 | F1 |
| NP 8 | F2 |
| NP 9 | F3 |
| NP 4 | F4 |
| NP 5 | F5 |
| NP 6 | F6 |
| NP 1 | F7 |
| NP 2 | F8 |
| NP 3 | F9 |
| NP 0 | F10 |
| NP . | F11 |
| CLR/HOME | F12 |

3.6.7 CBM2 (via DE25 Adapter)

For switch position "on" (up), the layout for CBM2 keyboards is adapted to the emulator "VICE" (select "positional" keymap).

| CBM2 Key | US layout | | DE layout | |
|--------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | Switch down (normal) | Switch up (emulator) | Switch down (normal) | Switch up (emulator) |
| clr/home | F11 | Home | F11 | Home |
| rvs | F12 | F11 | F12 | F11 |
| cbm | alt left | Right Control | alt left | Right Control |
| KP ? | num lock | Page up | num lock | Page up |
| KP CE | Print screen | KP / | Print screen | KP / |
| KP / | KP / | KP - | KP / | KP - |
| KP - | KP - | KP + | KP - | KP + |
| norm/graph | Insert | F12 | Insert | F12 |
| run/stop | Delete | Escape | Delete | Escape |
| ESC | Escape | ` and ~ | Escape | ^ and ° |
| TAB | TAB | TAB | TAB | TAB |
| CTRL | Control | Left Control | Control | Left Control |
| Shift | Left Shift | Left Shift | Left Shift | Left Shift |
| Inst/Del | Backspace | Backspace | Backspace | Backspace |
| Y | Y | Y | Z | Z |
| Z | Z | Z | Y | Y |
| [| [and { | [and { | Ü | Ü |
|] |] and } |] and } | + and * | + and * |
| ;/: | ;/: | ;/: | Ö | Ö |
| ‘/” | ‘/” | ‘/” | Ä | Ä |
| , / < | , and < | , and < | , and ; | , and ; |
| . / > | . and > | . and > | . and : | . and : |
| / ? | / and ? | / and ? | - and _ | - and _ |
| - | - and _ | - and _ | ß und ? | ß und ? |
| = + | = and + | = and + | ´ und ` | ´ und ` |
| PI | \ and | \ and | # and ' | # and ' |
| Arrow left / Pound | ' and ~ | End | ^ and ° | End |

Using Keyrah V3

| | | | | |
|-----------------|-----------|-----------|-----------|-----------|
| KP 00 | Fn | Delete | Fn | Delete |
| Shift/Lock (*1) | CAPS lock | CAPS lock | CAPS lock | CAPS lock |

*1) Shift lock will produce a “CAPS lock” event. However, due to how CBM Keyboards work, the Shift key is always detected as pressed when shift lock is pressed – because of this Keyrah will always remove “Shift” from the Keyboard Matrix when it detects “Shift Lock”.

Fn Extra Key Layer

When the “power” switch is in “off” (down) position, an extra layer of keys, like on other “reduced” keyboard layouts, can be enabled by pressing the “Fn” key – which in this case is the “00” key on the Keypad.

So press and hold the “00” Key, and then press one of the following keys:

| PET Key | Extra Key |
|----------------|------------------|
| W | Up |
| A | Left |
| S | Down |
| D | Right |
| 4 | PrntScr/SysReq |
| 5 | Scroll lock |
| 6 | Pause/Break |
| R | Insert |
| T | Home |
| Y | Page up |
| F | Delete |
| G | End |
| H | Page down |
| 7 | NumLock |
| 8 | NP / |
| 9 | NP * |
| 0 | NP - |
| U | NP 7 |
| I | NP 8 |
| O | NP 9 |
| P | NP + |
| J | NP 4 |
| K | NP 5 |
| L | NP 6 |
| ; | NP , |
| Return | NP Enter |
| M | NP 1 |

Using Keyrah V3

| PET Key | Extra Key |
|----------------|------------------|
| W | Up |
| , | NP 2 |
| . | NP 3 |
| / | NP 0 |

3.7 Using a custom Keymap

The builtin default keyboard mapping can be replaced by a custom mapping. This mapping needs to be created in an external tool in .uf2 format and then flashed: Either press and hold the button, then connect Keyrah to USB, or press and hold the button for about 5 seconds. Your computer will detect a new mass storage device – open it and then drag&drop the .uf2 file on it. The file will get flashed and the device will unmount itself. The new mapping is now active. This mapping will then be used for ALL keyboards, so in order to use Keyrah with a different type of keyboard (or the default mapping) again, you will have to remove the custom mapping again (just flash an empty file that contains no signature tag).

Details on the .uf2 format can be found on the Microsoft github repository and are out of scope of this document: <https://github.com/microsoft/uf2>

3.7.1 Flash organisation

The last 4KiB of the Flash Memory are reserved for a user defined Keyboard configuration. Those 4KiB are organised in 4 blocks, each of which contains the keyboard mapping for one of the 4 configurations that can be selected by using the power switch and the EN/DE jumper.

| Jumper | Switch | Flash Offset | Block |
|--------|--------|--------------|---------|
| US | normal | 101FF000 | Block 0 |
| US | emu | 101FF400 | Block 1 |
| DE | normal | 101FF800 | Block 2 |
| DE | emu | 101FFC00 | Block 3 |

Now, each block contains 3 keyboard mapping layers, plus a tag at the end.

| Offset | |
|---------|--|
| + 0x000 | Normal Keymap (Layer 1) |
| + 0x100 | (Layer 2) extra Keys with Shift (CBM Keyboards only) |
| + 0x200 | (Layer 3) extra Keys with “Fn” |
| + 0x3F0 | “KeyrahV3 Keymap”, 0 |

The tag is checked per block, so only blocks with a valid tag will enable the custom mapping for that configuration.

Finally each Keymap is organized like this:

| Offset | |
|---------|---|
| + 0x000 | (19 rows * 8 bytes) Keyboard Matrix (rows 0 - 18) |
| + 0x098 | (16 bytes) Extra Keys (part of Matrix, 2 extra rows) (rows 19 - 20) |
| + 0x0a8 | (8 bytes) Global extra keys (row 21) |
| + 0x0b0 | (16 * 2 bytes) Multimedia Key Table (referenced from matrix) |
| + 0x0d0 | (32 bytes) reserved for config data |
| + 0x0f0 | (16 bytes) reserved for signature tag |

- The matrix value are 8bit HID Keyboard codes (Keyboard Page 0x07)
- The Multimedia Key Table contains up to 16 16bit codes (Consumer Page 0x0c), which can be referred to from the keymaps as codes 0xf0-0xff

3.7.2 Keyboard Matrix

CBM Keyboards

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | C16 | C64 | C128 |
|-----|---------|---------------|-------------|---------------|-----------|-------|----------|----------|-----|-----|------|
| 0 | Delete | Return | CRSR L/R | CRSR U/D | F1 | F3 | F5 | F7 | | X | X |
| 1 | 3 | W | A | SHFT L | Z | S | E | 4 | X | X | X |
| 2 | 5 | R | D | X | C | F | T | 6 | X | X | X |
| 3 | 7 | Y | G | V | B | H | U | 8 | X | X | X |
| 4 | 9 | I | J | N | M | K | O | 0 | X | X | X |
| 5 | + | P | L | , | . | : | @ | - | | X | X |
| 6 | Pound | * | ; | / | SHFT R | = | Arrow Up | CLR/HOME | | X | X |
| 7 | 1 | Arrow Left | CTRL | Run/ Stop | Space | CBM | Q | 2 | | X | X |
| 8 | Delete | Return | Pound | @ | F4/F1 | F5/F2 | F6/F3 | F7/Help | X | | |
| 9 | Down | P | L | , < | . > | :[| - | Up | X | | |
| 10 | Left | * | ;] | / ? | Escape | = | + | Right | X | | |
| 11 | 1 ! | CLR/ Home | CTRL | Run/ Stop | Space | CBM | Q | 2 = | X | | |
| 12 | Alt | 0 | . | No Scroll | Down | Left | Right | Up | | | X |
| 13 | Escape | + | - | 3 | NP Return | NP 6 | NP 9 | Linefeed | | | X |
| 14 | Help | NP 8 | NP 5 | NP 1 | NP 2 | NP 4 | NP 7 | Tab | | | X |
| ... | | | | | | | | | | | |
| 19 | Restore | Shift Lock | ASC/DIN | 40/80 Disp | | | | | | X | X |

Row 19 has the keys normally not present in the keyboard matrix.

Note that for technical reasons the “Shift Lock” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

Amiga Keyboards

US Layout

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----|------------|-------------|-------|--------|-----------|-----------|------------|-------------|
| 0 | Help | Up | Left | Right | Down | NP - | | |
| 1 | F10 | \ | Enter | Delete | Backspace | NP 0 | | |
| 2 | F9 | = + |] } | < > | Space | NP 1 | | |
| 3 | F8 | - _ | [{ | # @ | | NP 4 | | |
| 4 | F7 | 0 | P | ; : | / ? | NP 7 | | |
| 5 | NP / | 9 | O | L | . > | NP Return | | |
| 6 | F6 | 8 | I | K | , < | NP 2 | | |
| 7 | Np] | 7 | U | J | M | NP 5 | | |
| 8 | F5 | 6 | Z | H | N | NP 8 | | |
| 9 | F4 | 5 | T | G | B | NP . | | |
| 10 | F3 | 4 | R | F | V | NP 3 | | |
| 11 | F2 | 3 | E | D | C | NP 6 | | |
| 12 | F1 | 2 | W | S | X | NP 9 | | |
| 13 | NP [| 1 | Q | A | Y | NP + | | |
| 14 | Escape | ~ ' | Tab | CAPS | # , | NP * | | |
| ... | | | | | | | | |
| 20 | Left Shift | Right Shift | CTRL | | Left Alt | Right Alt | Left Amiga | Right Amiga |

Row 20 has the keys that are not in the regular keyboard matrix.

Note that for technical reasons the “CAPS” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

Atari Keyboards

US Layout

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----|------------|--------|------------|------------|--------|-------------|-------------|------|
| 0 | | Escape | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 7 | 8 | 9 | 0 | - | = | Backspace | TAB |
| 2 | Q | W | E | R | T | Y | U | I |
| 3 | O | P | [|] | Return | CTRL | A | S |
| 4 | D | F | G | H | J | K | L | ; |
| 5 | ' | ` | Left Shift | \ | Z | X | C | V |
| 6 | B | N | M | , | . | / | Right Shift | |
| 7 | ALT | Space | Caps lock | F1 | F2 | F3 | F4 | F5 |
| 8 | F6 | F7 | F8 | F9 | F10 | | | Home |
| 9 | Arrow Up | | KP - | Arrow Left | | Arrow Right | KP + | |
| 10 | Arrow Down | | Insert | Delete | | | | |
| 11 | | | | | | | | |
| 12 | ISO | UNDO | Help | KP (| KP) | KP / | KP * | KP 7 |
| 13 | KP 8 | KP 9 | KP 4 | KP 5 | KP 6 | KP 1 | KP 2 | KP 3 |
| 14 | KP 0 | KP . | KP Enter | | | | | |

Note that for technical reasons the “Caps lock” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

PC Keyboards

US Layout

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----|------------|------------|-------------|----------------|-------------|-------------|-------------|-------------|
| 0 | | F9 | F5 | F3 | F1 | F2 | F12 | F10 |
| 1 | F8 | F6 | F4 | TAB | ` | Left Alt | Left Shift | Left CTRL |
| 2 | Q | 1 | Z | S | A | W | 2 | C |
| 3 | X | D | E | 4 | 3 | Space | V | F |
| 4 | T | R | 5 | N | B | H | H | Y |
| 5 | 6 | M | J | U | 7 | 8 | , | K |
| 6 | I | O | 0 | 9 | . | / | L | ; |
| 7 | P | - | ' | [| = | Caps lock | Right Shift | Enter |
| 8 |] | \ | < | Backspace | KP 1 | KP 4 | KP 7 | KP 0 |
| 9 | KP . | KP 2 | KP 5 | KP 6 | KP 8 | Escape | Num lock | F11 |
| 10 | KP + | KP 3 | KP - | KP * | KP 9 | Scroll lock | F7 | Search |
| 11 | Right Alt | PrintScrn | Right CTRL | Previous Track | Favour ites | Left GUI | Refresh | Volume Down |
| 12 | Mute | Right GUI | Stop | Calculator | Apps | Forward | Volume Up | Play |
| 13 | Power | Back | WWW Home | Stop | Sleep | My Computer | Email | KP / |
| 14 | Next Track | Media | KP Enter | Wake up | End | Left Arrow | Home | Insert |
| 15 | Delete | Down Arrow | Right Arrow | Up Arrow | Page Down | Printscrn1 | Page Up | Pause |

Note that for technical reasons the “Caps Lock” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

PET Keyboards

US Layout

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|----------|------------|----------|------------|-----------|------------|----------|----------|
| 0 | - = | 5 % | 8 (| 2 “ | KP 8 | CRSR right | | |
| 1 | . > | C | B | L Shift | KP . | | R Shift | KP 3 |
| 2 | U | E | T | Q | CRSR down | O | [| KP 4 |
| 3 | Y | W | R | TAB | \ | I | P | DEL |
| 4 | J | D | G | A | RETURN | L | @ | KP 6 |
| 5 | H | S | F | ESC |] | K | ; + | KP 5 |
| 6 | 0 | 4 \$ | 7 ‘ | 1 ! | KP 7 | ^ | | KP 9 |
| 7 | , < | V | N | Z | KP 0 | | repeat | KP 2 |
| ... | | | | | | | | |
| 12 | M | X | space | RVS | Home | | / ? | KP 1 |
| ... | | | | | | | | |
| 14 | 9) | 3 # | 6 & | Left arrow | Run/Stop | : * | | |
| ... | | | | | | | | |
| 19 | | Shift Lock | | | | | | |

Row 19 has the keys normally not present in the keyboard matrix.

Note that for technical reasons the “Shift Lock” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

CBM2 Keyboards

US Layout

| | 0 | 1 | 2 | 3 | 4 | 5 |
|-----------|-------------|-------------|--------------|----------|----------|----------|
| 0 | F1 | ESC | TAB | Shift | | CTRL |
| 1 | F7 | 7 | U | M | J | Space |
| 2 | F6 | 5 | 6 | H | Y | N |
| 3 | F5 | 4 | R | G | T | B |
| 4 | F4 | 3 | E | F | D | V |
| 5 | F3 | 2 | W | X | S | C |
| 6 | F2 | 1 | Q | Z | A | |
| 7 | F8 | 8 | I | , < | K | . > |
| 8 | F9 | 9 | O | ; : | L | / ? |
| 9 | F10 | 0 | - | [| P | ' " |
| 10 | Cursor down | = + | Arrow left | Return |] | Pi |
| 11 | Cursor up | Cursor left | Cursor right | CBM | INS DEL | |
| 12 | CLR Home | KP ? | KP 7 | KP 1 | KP 4 | KP 0 |
| 13 | RVS | KP CE | KP 8 | KP 2 | KP 5 | KP . |
| 14 | Graph | KP * | KP 9 | KP 3 | KP 6 | KP 00 |
| 15 | Run Stop | KP | KP - | KP Enter | KP + | |
| ... | | | | | | |
| 19 | | Shift Lock | | | | |

Row 19 has the keys normally not present in the keyboard matrix.

Note that for technical reasons the “Shift Lock” key **must** always be mapped to `HID_KEY_CAPS_LOCK`.

3.7.3 Global extra Keys

Appended to the Keyboard specific keymap there is an additional row containing the mapping for features that are always available:

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----|-------------|-----------|------------|--------------|---|---|---|---|
| 21 | Menu Button | Power Key | ACPI Sleep | Extra Button | | | | |

- **Menu Button:** this is an extra button that can be connected to the “Menu Button” jumper pad. In the default keymaps this is the key that opens the menu/settings and/or disables input capturing of the supported emulator.
- **Power Key:** when the power switch is pressed and shortly released after, this keycode will be produced. In the default keymaps this is always the same keycode as the “Menu Button”
- **ACPI Sleep:** Sleep Mode to be used when holding the power button switch for longer than 2 seconds. Must contain either 1 (Power Down) or 2 (Put to Sleep mode)
- **Extra Button:** Button connected to Pin 20 of the C16 connector. This key is always mapped to ESCAPE in the default keymaps

3.7.4 Configuration Data

The last block (before the ID tag) are 32 bytes of configuration data

| Offset | Len | Description |
|--------|-----|---|
| 0xD0 | 1 | Left shift row (C16) |
| 0xD1 | 1 | Left shift column (C16) |
| 0xD2 | 1 | Right shift row |
| 0xD3 | 1 | Right shift column |
| 0xD4 | 1 | Fn key row (for layer 3 check) |
| 0xD5 | 1 | Fn key column |
| 0xD6 | 1 | Fn key 2 row (C16) |
| 0xD7 | 1 | Fn key 2 column (C16) |
| 0xD8 | 1 | Scan line for reading shift-lock (0..14, see below) |
| 0xD9 | 1 | Shift-lock threshold low |
| 0xDA | 1 | Shift-lock threshold high |

Shift-lock threshold

To determine the Shift-lock threshold do the following:

- on the PC open a text editor
- press the boot-button on the Keyrah.
- press and hold left shift on the keyboard, then press the boot-button
- press shift-lock, then press the boot-button

The output in the text editor will now look like this:

```
0x0fff =X=FFF
```

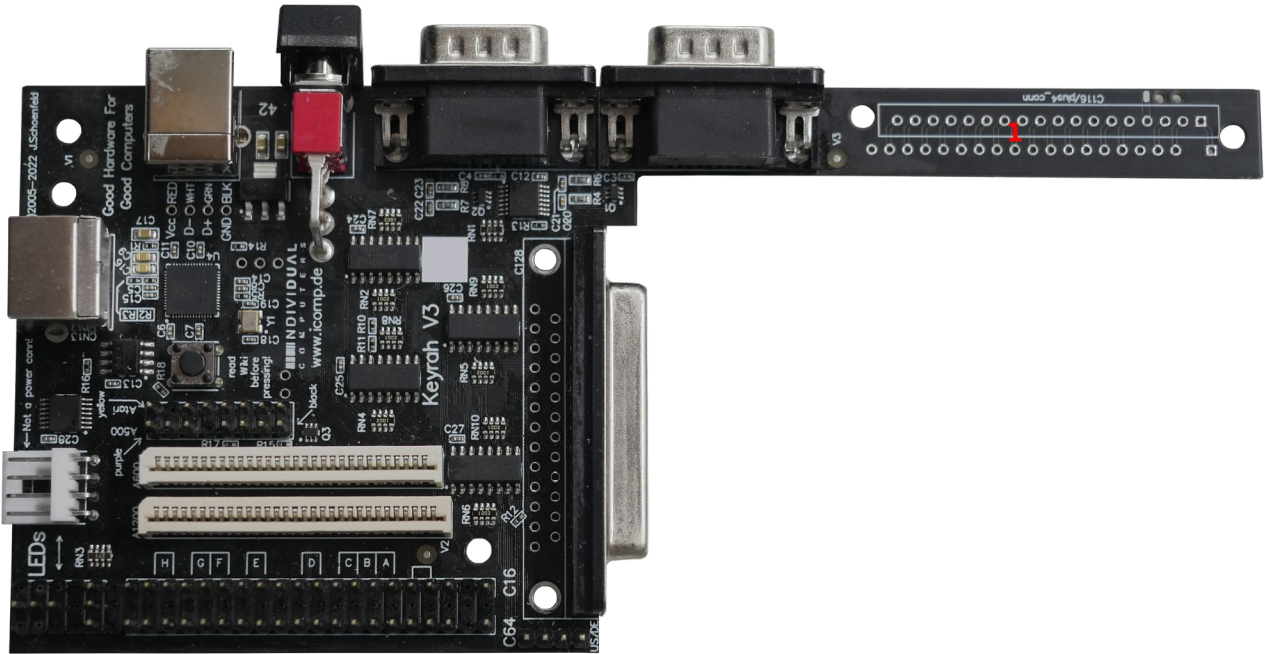
```
0x036c =X=§&C
```

```
=X=! =! 0x0101
```

For the threshold, pick a value that is significantly higher than the last value, and smaller than the second value, for example 0x0230 in this example.

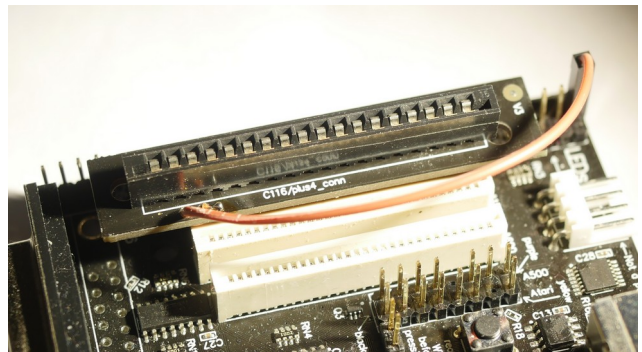
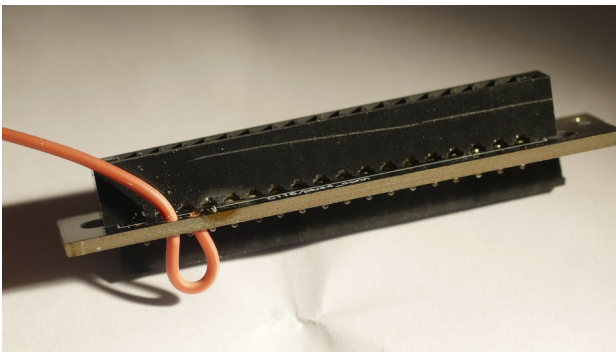
4. Appendix

4.1 C116/Plus4 Adapter



(1) Like Keyrah V2, Keyrah V3 comes with preparations for building an adapter that will allow you to connect a C116 / Plus4 keyboard. The “tail” of the circuit board can be cut off (be careful, use a sharp knife) and contains the required traces and solder pads for soldering an FPC connector for the keyboard cable, and a female pin header that can be connected to the C16 pin header on Keyrah.

Pin 1 of each connector is marked with a square pad, other pads are round. The single solder pad next to the 2 small holes near the edge can be used to connect the LED of the Plus4 keyboard – if you want to do this connect a wire to this pad and route it to the Amiga LED connector.



Please note that this is unsupported, and the default keymap was created for a C16 keyboard – you will have to make your own custom keymap for a C116/Plus4 keyboard (see 3.7 Using a custom Keymap)

4.2 Pinouts

4.2.1 DE9 Connectors

```
1  o  o  o  o  o  o  5
6  o  o  o  o  o  9
```

The joystick ports are wired the same way as on a C64:

| Pin | Function |
|-----|-------------------|
| 1 | Up |
| 2 | Down |
| 3 | Left |
| 4 | Right |
| 5 | POT Y |
| 6 | Fire |
| 7 | +5V (max. 100 mA) |
| 8 | GND |
| 9 | POT X |

For much more elaborate technical information about this port, visit our wiki at [http://wiki.icomp.de/wiki/DE-9 Joystick](http://wiki.icomp.de/wiki/DE-9_Joystick)

4.2.2 DB25 Connector

13 o o o o o o o o o o o o o o 1
 25 o o o o o o o o o o o o o o 14

| Pin | SX64 Kbd | C128D Kbd | CBM8296 adapter | CBM7x0 adapter |
|-----|------------|---------------|----------------------|----------------|
| 1 | GND | GND | GND | GND |
| 2 | n/c | n/c | ID bridge to pin #22 | SR Cascade |
| 3 | Restore | Restore | | |
| 4 | VCC | VCC | VCC | VCC |
| 5 | Column 3 | Column 3 | Column 7 | n/c |
| 6 | Column 6 | Column 6 | Column 6 | n/c |
| 7 | Column 5 | Column 5 | Column 5 | Column 5 |
| 8 | Column 4 | Column 4 | Column 4 | Column 3 |
| 9 | Column 7 | Column 7 | Column 3 | Column 4 |
| 10 | Column 2 | Column 2 | Column 2 | Column 2 |
| 11 | Column 1 | Column 1 | Column 1 | Column 1 |
| 12 | Column 0 | Column 0 | Column 0 | Column 0 |
| 13 | Row 0 | Row 0 | Row 0 | Row 0 |
| 14 | Row 6 | Row 6 | Row 1 | Row 1 |
| 15 | Row 5 | Row 5 | Row 2 | Row 2 |
| 16 | Row 4 | Row 4 | Row 3 | Row 3 |
| 17 | Row 3 | Row 3 | Row 4 | Row 4 |
| 18 | Row 2 | Row 2 | Row 5 | Row 5 |
| 19 | Row 1 | Row 1 | Row 6 | Row 6 |
| 20 | Row 7 | Row 7 | Row 7 | Row 7 |
| 21 | Shift lock | Keypad row 0 | Row 9 | SER |
| 22 | Shift LED | Keypad row 1 | ID bridge to pin #2 | RCLK |
| 23 | GND | Keypad row 2 | Row 8 | SRCLK |
| 24 | GND | 40/80 Key | | |
| 25 | n/c | ASCII/DIN key | | |

4.2.3 C64 and C16 Keyboard Connectors

| | C64 | C16 | |
|----|-----|---------|---------------------------------|
| 20 | o | o | |
| 19 | o | o \ | Jumper Pos H |
| 18 | o | o / | |
| 17 | o | o \ | Jumper Pos G |
| 16 | o | o \ / | Jumper Pos F |
| 15 | o | o / | |
| 14 | o | o \ | Jumper Pos E |
| 13 | o | o / | |
| 12 | o | o | |
| 11 | o | o \ | Jumper Pos D |
| 10 | o | o / | |
| 9 | o | o \ | Jumper Pos C |
| 8 | o | o / \ | Jumper Pos B |
| 7 | o | o \ / | Jumper Pos A |
| 6 | o | o / | |
| 5 | o | o \ | Jumper "Manual keyboard select" |
| 4 | o | o / | |
| 3 | o | o | |
| 2 | | | |
| 1 | o | o | |

| Pin | C64 Connector | C16 Connector |
|-----|---------------|--|
| 20 | Column 7 | Extra Button (see 3.4.2 Extra Buttons) |
| 19 | Column 1 | Row 8 |
| 18 | Column 2 | Column 0 |
| 17 | Column 3 | Column 7 |
| 16 | Column 4 | Row 7 |
| 15 | Column 5 | Column 1 |
| 14 | Column 6 | Column 2 |
| 13 | Column 0 | Row 5 |
| 12 | Row 0 | Row 3 |
| 11 | Row 1 | Row 4 |
| 10 | Row 2 | Column 6 |
| 9 | Row 7 | Column 5 |
| 8 | Row 4 | Row 2 |
| 7 | Row 5 | Column 4 |

Appendix

| | | |
|---|-------------------------------------|-------------------------------|
| 6 | Row 6 | Row 1 |
| 5 | Row 3 | Manual keyboard select jumper |
| 4 | Extra LED (see 3.2.4 Extra LED) (*) | GND |
| 3 | Restore | Column 3 |
| 2 | n/a | n/a |
| 1 | GND | Row 6 |

***) This pin was originally only intended for testing the hardware, directly goes to a I/O pin of the CPU, and is completely unprotected. Its use is not recommended nor supported – if you don't know what that means do not use it!**

This Pin can NOT be used as a +5V source, like on the original C64 connector.

5. Credits

- Jens Schönfeld – Hardware design and production
- Tobias Korbmacher – Firmware, Manual
- Daniel Falkenberg – Beta testing
- Martin Oswald – Beta testing

6. Fine print

The Keyrah V3 is not designed, authorized or warranted to be suitable for use in life-support devices or systems or other critical operations. Inclusion of the product in such applications is understood to be fully at the customer's risk.

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For updates and further information visit <http://wiki.icomp.de/wiki/KeyrahV3>.

Join our forum at <http://forum.icomp.de>

Please understand that we can not provide support via email.

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good hardware for good computers.