

RVPC

User Manual

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What is RVPC?

RVPC is an attempt to produce very low cost EURO 1.00 educational computer with RISC-V processor which to have everything one complete computer have: Keyboard input, VGA display output and Audio output.

The idea of RVPC evolved on TuxCon 2024 as a Lighting talk <https://youtu.be/YlYE9a7zsQY>.

The goal set was:

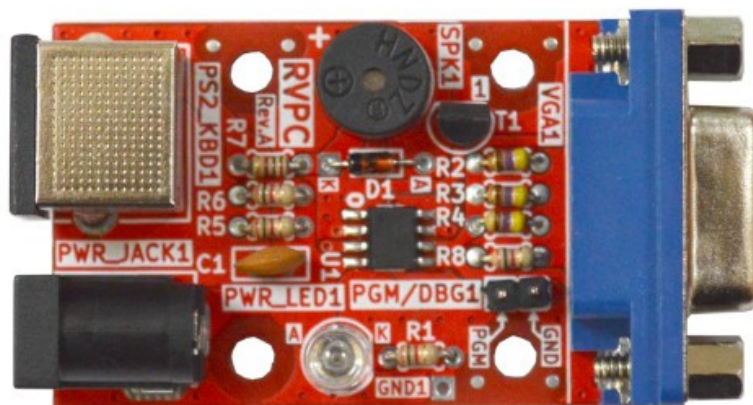
1. Easy to solder DIY kit
2. Complete all in one RISC-V computer with bare minimum Woz like monitor which will allow you to learn the RISC-V instructions by poking, peeking and disassembling the memory
3. Price of EUR 1.00!

Here is the result:

CH32V003 in SO8 package – for easy soldering was chosen. It has just 6 GPIOs

- PS2 takes two GPIOs
- VGA takes three GPIOs – Vsync, Hsync and RGB
- Audio buzzer is connected to the last GPIO

All done in beginner friendly PTH components

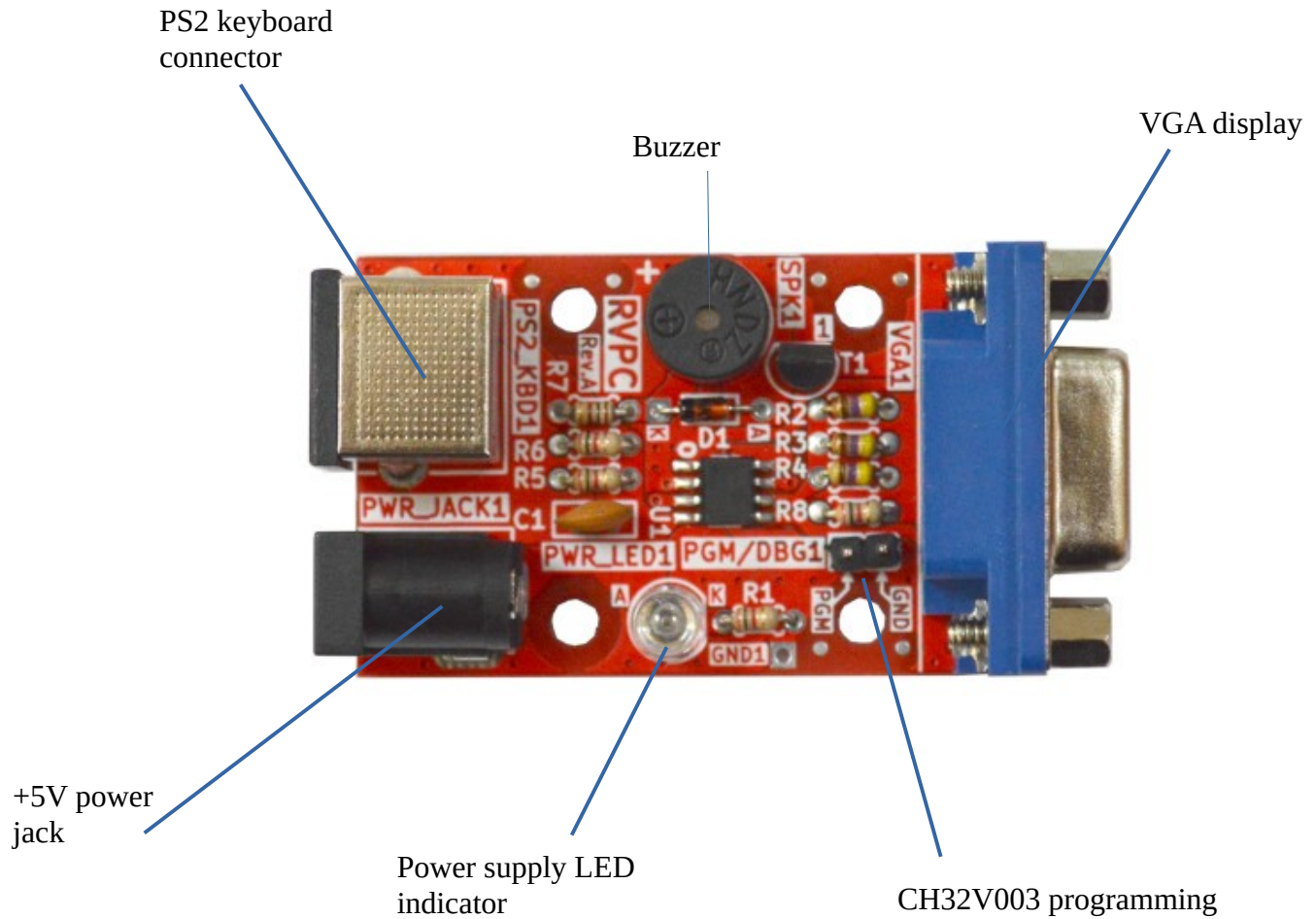


Order codes for RVPC and accessories:

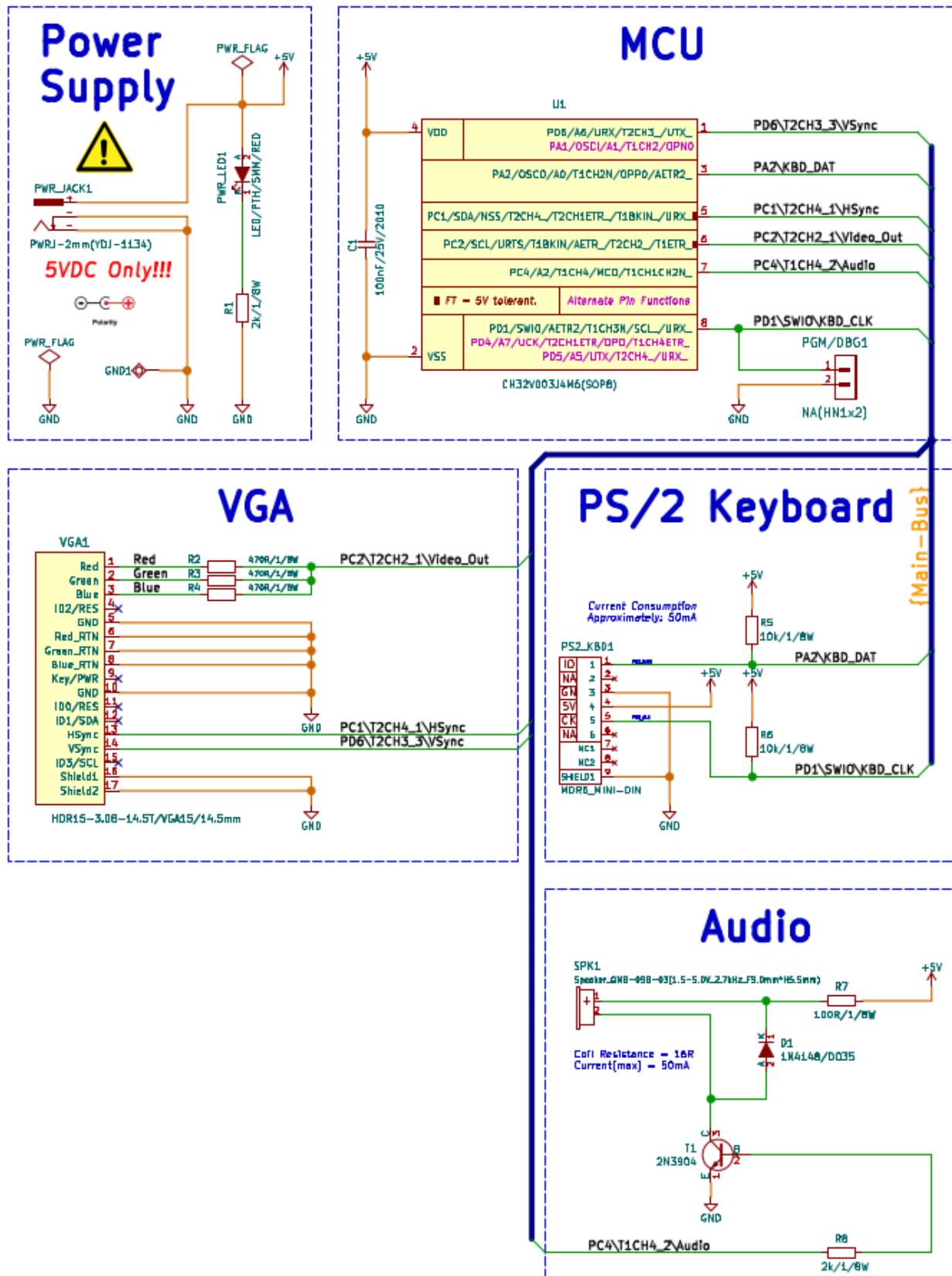
| | |
|-------------------------|---|
| RVPC | Do It Yourself soldering kit |
| SY0605E | 5V power supply adapter |
| PS2-Keyboard | PS2 keyboard |
| ESP32-S2-DevKitLiPo-USB | ESP32-S2 development board which can be used as CH32V003 programmer |

HARDWARE

RVPC layout:



RVPC schematic:



SOFTWARE:

Here below is our setup under Linux:

Install - packages

```
$ apt-get install build-essential libnewlib-dev gcc-riscv64-unknown-elf libusb-1.0-0-dev libudev-dev  
gdb-multiarch
```

Install - Visual Studio Code

Described here: <https://code.visualstudio.com/docs/setup/linux>

Install - Platform IO

Described here: <https://platformio.org/install/ide?install=vscode>

Install - CH32V-Platform

<https://github.com/Community-PIO-CH32V/ch32-pio-projects?tab=readme-ov-file#installing-the-ch32v-platform>

by default the platformio generates only .elf file, to build firmware.bin and firmware.elf select

> PlatformIO > PROJECT TASKS > Default > Advanced > Verbose build

Sample Beeper project is in RVPC repository.

Prepare the CH32V003 programmer

ESP32-S2-DevKitLiPo-USB can be used as programmer.

The firmware is [here](#) you can build from sources or you can download the ready built binaries from here and use this sequence to prepare the programmer:

1. hold the Boot button and connect the USB cable, the yellow LED will stay ON

check with

```
$ls /dev/ttyA*
```

which is the ttyACM it's usually 0 or 1

execute this command:

```
$ python3 ./rvpc/esptool/esptool.py -p /dev/ttyACM0 -b 460800 --before=no_reset --after=no_reset  
write_flash --flash_mode dio --flash_freq 80m --flash_size 4MB 0x1000 ./rvpc/esp32s2/bootloader.bin  
0x10000 ./rvpc/esp32s2/usb_sandbox.bin 0x8000 ./rvpc/esp32s2/partition-table.bin
```

check if the programmer is already OK with

```
$ dmesg
```

you have to see this message:

```
hid-generic 0003:303A:4004.0015: input,hidraw5: USB HID v1.11 Gamepad [CNLohr ESP32-S2  
CH32V003Programmer] on usb-0000:00:14.0-2/input0
```

which means the ESP32-S2-DevKitLipo-USB now act as programmer and can be used with the demo project above from PlatformIO, but first you have to enable it with:

```
$ sudo cp ./rvpc/tools/ch32v003fun/minichlink/99-minichlink.rules /etc/udev/rules.d/
```

```
$ sudo udevadm control --reload-rules && sudo udevadm trigger
```

Now you can use GPIO6 and GND to connect to RVPC programming connector PGM-GND

Now CH32V003 flashing will work directly from PlatformIO but if you want to use command line this is the command:

```
./rvpc/tools/ch32v003fun/minichlink/minichlink -w ./firmware.bin 0x08000000
```

Create project:

If you create new project to enable the ESP32-S2 programmer you should edit platformio.ini and add this line

```
upload_protocol = minichlink
```

It's already added to the demo project.

Revision History

Revision 1.0 June 2024