MyExoMy project 2021



# Introduction

# Topics

## Low Power ATmega328

For the MyExomy project the ATmega328P-PU is used with an alternative bootloader which sets the clock to the 8 MHz internal clock. The new board definition (named 'ATmega328 on a breadboard (8 MHz internal clock)') and bootloader is available in the breadboard-1-6-x folder.

See <https://www.arduino.cc/en/Tutorial/BuiltInExamples/ArduinoISP> for how to burn a bootloader on one Arduino board using another Arduino board as ISP.

The 'ATmega328 on a breadboard (8 MHz internal clock)' board is made available to the Arduino IDE by copying the breadboard folder to C:\Program Files (x86)\Arduino\hardware.

See <https://www.arduino.cc/en/Tutorial/BuiltInExamples/ArduinoToBreadboard> for a description of how to connect an ATmega328P on a breadboard and use it.

To make the new board available in Visual Studio Code an Atmega328\_on\_breadboard\_8MHz.json file is added to C:\Users\reneb\.platformio\platforms\atmelavr\boards. This json file is created by copying the uno.json file (which is for the Arduino Uno) and adapted the content with info from boards.txt in breadboard-1-6-x.

## Start and view RTSP stream

* Start RTSP server:  
  raspivid -o - -t 0 -hf -w 1920 -h 1080 -fps 30 | cvlc -vvv stream:///dev/stdin --sout '#rtp{sdp=rtsp://:8554/x}' :demux=h264
* View in VLC:  
  GUI -> Media -> Open Network Stream -> rtsp://192.168.1.170:8554/x

Note: it is needed to give the stream a name, here ‘x’.

## Power Board

The power board has the following features:

* Provides 5V for the RPi and 6V for the servos and the headlights.
* Can turn the MyExoMy into deep sleep mode, consuming only 100 nA.
* Can switch on the MyExomy using an external trigger.
* Has a light sensor to turn on the lights when it is dark.
* Has a charge connection for the batteries.
* Has a trickle charge circuit with voltage protection for the solar panel.

### EasyEda

* To work with EasyEda for the MyExoMy projet first change the Data Directory to the corresponding EasyEda folder with EasyEda -> Setting -> Desktop Edition Setting -> Data Directory. After that with EasyEda -> File -> Open Project the MyExoMy EasyEda project can be opened.
* Switching to another project can be done by setting the Data Directory to a different folder.
* If desired the other projects can be removed from the ‘Opened Projects’ list after EasyEda -> Login and then using the right mouse button -> Refresh List.

### EasyEda PCB settings:

* The track width is chosen to be 0.8 mm with a clearance of 0.4 mm.
* The copper thickness is chosen to be 2 oz = 2x 1.4 mil = 2x 35 μm = 70 μm. Normally it is 1 oz. 2 oz is chosen to allow more current and for robustness. It cannot be set in EasyEda but it can be selected when ordering at JLCPCB.
* According to <https://www.7pcb.com/trace-width-calculator.php> with a track width of 0.8 mm and a thickness of 2 oz the current can be appr. 3A.
* Only the battery tracks have a width of 1.27 mm and with 2 oz thickness can carry appr. 5A.

## Low Power

The Raspberry Pi can be put in low power by issuing a ‘sudo halt’. The power of the Raspberrt Pi 4 model B board will go from appr. 700 mA to appr. 16 mA in low power. For this to work the EEPROM bootloader configuration has to be adapted.

### Default EEPROM bootloader configuration settings, low power settings in red

See also <https://www.raspberrypi.org/documentation/hardware/raspberrypi/bcm2711_bootloader_config.md>

BOOT\_UART=0

WAKE\_ON\_GPIO=1 -> 0

POWER\_OFF\_ON\_HALT=0 -> 1

DHCP\_TIMEOUT=45000

DHCP\_REQ\_TIMEOUT=4000

TFTP\_FILE\_TIMEOUT=30000

ENABLE\_SELF\_UPDATE=1

DISABLE\_HDMI=0 (can be set to 1 if HDMI is not used, makes no difference for low power though)

BOOT\_ORDER=0xf41

To view: rpi-eeprom-config  
To edit: sudo -E rpi-eeprom-config –edit

After editing, whether you changed anything or not, always issue a sudo reboot, otherwise the setting does not seem to have any effect.

# Measurements

## Power consumption, measered with battery voltage = 6.0V

* Fully operational, standing still: appr. 0.90 A
* Fully operational, standing still + lights on: appr. 1.35 A
* Fully operational, driving and steering: appr. 1.5 .. 2.0 A
* Fully operational, driving and steering, lights on: appr. 2.0 .. 2.5 A