

Power consumption

Below is a table of the components of our microscope (equivalent for fluorescence and brightfield modes). A typical 8hr day is used for comparison, and the data for the 3D printer is also included for completeness. However, this will of course only be used during assembly and is not included in the running consumption. Note that in reality, all three motors will not be running constantly for the entire period of use and therefore the total below is a worst-case power consumption for our microscope.

Component	Power per unit / watts	kWh/day for 8 hours use
Raspberry Pi 2 Model B ^[1]	4 *	0.032
1W LED ^[2]	1.0 **	0.008
Stepper motors x3	0.60 **	0.043
22" LCD Monitor	30 **	0.240
Arduino uno ^[3]	0.25 ***	0.002
TOTAL		0.325
3D printer (Ultimaker 2) ^[4]	221 **	1.768

* Based on 900MHz quad-core ARM Cortex-A7 CPU

** Numerous models with different characteristics. Values given represent the appliances we've used

*** Based on ATmega328 processor

Comparison to commercial microscope

Component	Power per unit / watts	kWh/day for 8 hours use
HBO 100 Mercury lamp ^[5]	100*	0.800
Tungsten-Halogen lamp ^[5]	100*	0.800
XBO 75 Xenon arc lamp ^[5]	75*	0.600

*Most commonly used lamp wattages according to ZEISS Microscopy Online Campus ^[5]

Equations:

1. Conversion to kWh from W

$$E_{(\text{kWh/day})} = P_{(\text{W})} \times t_{(\text{h/day})} / 1000_{(\text{W/kW})}$$

2. Conversion to kW from A (based on 5V power supply from USB port)

$$P_{(\text{kW})} = I_{(\text{A})} \times V_{(\text{V})} / 1000$$

References

- [1] Raspberry Pi, (2015). Raspberry Pi 2 Model B. [online] Available at: <https://www.raspberrypi.org/products/raspberry-pi-2-model-b/> [Accessed 30 Jul. 2015].
- [2] RS Components UK, (2015). Lighting | RS Components. [online] Available at: <http://uk.rs-online.com/web/c/lighting/> [Accessed 31 Jul. 2015].
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- [4] Ultimaker.com, (2015). Ultimaker 2 | Ultimaker. [online] Available at: <https://ultimaker.com/en/products/ultimaker-2-family/ultimaker-2> [Accessed 30 Jul. 2015]. Zeiss-campus.magnet.fsu.edu, (2015).
- [5] ZEISS Microscopy Online Campus | Light Source Power Levels. [online] Available at: <http://zeiss-campus.magnet.fsu.edu/articles/lightsources/powertable.html> [Accessed 30 Jul. 2015].