Raspberry Pi Modular Hydroponic Controller

Power Budget

	5VDC	12VDC	Total
Amps	**2**	**17.4**	**19.4**
Watts	**10**	**208.8**	**218.8**

Amps	5VDC	12VDC	Interface
Raspberry Pi	2		
Tentacle T3			
Peristaltic PH+		0.3	AO
Peristaltic PH-		0.3	AO
Peristaltic Nutrient 1		0.3	AO
Peristaltic Nutrient 2		0.3	AO
Pump 1		1.2	DO
Chiller 1		5	DO
Chiller 2		5	DO
Chiller 3		5	DO

Monitoring

I2C interface for RTD, PH and EC with two spare channels (one could be adapted for DO).

Whitebox Labs Tentacle T3

https://www.atlas-scientific.com/product_pages/components/tentacle-t3.html
https://www.whiteboxes.ch/docs/tentacle/t3/#/

- 2 fully isolated channels for **Atlas Scientific EZO Circuits**
- 1 non-isolated channel **Atlas Scientific EZO RTD Circuit**
- 2 additional I2C channels for EZO 5pin-sensors and 3rd-party I2C devices works with the EZO-PMP embedded dosing pump.
- I2C only
- Raspberry Pi HAT form factor, but stackable
- EZO RTD
  - https://www.atlas-scientific.com/product_pages/circuits/ezo_rtd.html
  - I2C 0x66
- EZO PH
  - https://www.atlas-scientific.com/product_pages/circuits/ezo_ph.html
  - I2C 0x63
- EZO EC
  - https://www.atlas-scientific.com/product_pages/circuits/ezo_ec.html
  - I2C 0x64

Electrically Isolated EZO™ Carrier Board

https://www.atlas-scientific.com/product_pages/components/single_carrier_iso.html

- EZO DO
  - https://www.atlas-scientific.com/product_pages/circuits/ezo_do.html
  - I2C 0x97

Tentacle T3 4/5	Electrically Isolated EZO™ Carrier Board
INT	-
INT	-
3V3	VCC
GND	GND
SDA	TX
SCL	RX

Dosing

I2C interface with up to four channels (PH up, PH down and two nutrient solutions).

Adafruit DC & Stepper Motor HAT for Raspberry Pi - Mini Kit

https://www.adafruit.com/product/2348
https://learn.adafruit.com/adafruit-dc-and-stepper-motor-hat-for-raspberry-pi/overview

- 4 H-Bridges: TB6612 chipset provides 1.2A per bridge with thermal shutdown protection, internal kickback protection diodes. Can run motors on 4.5VDC to 13.5VDC.
- Up to 4 bi-directional DC motors with individual 8-bit speed selection (so, about 0.5% resolution)
- Up to 2 stepper motors (unipolar or bipolar) with single coil, double coil, interleaved or micro-stepping.
- Big terminal block connectors to easily hook up wires (18-26AWG) and power
- Polarity protected 2-pin terminal block and jumper to connect external 5-12VDC power
- Works best with Raspberry Pi model A+, B+, or Pi 2, but can be used with a model A or B if you purchase a 2x13 extra-tall header and solder that instead of the 2x20
- Install the easy-to-use Python library, check out the examples and you're ready to go!
- Board 0: I2C Address = 0x60 Offset = binary 0000 (no jumpers required)
- Board 1: I2C Address = 0x61 Offset = binary 0001 (bridge A0)
- Board 2: I2C Address = 0x62 Offset = binary 0010 (bridge A1, the one above A0)
- Board 3: I2C Address = 0x63 Offset = binary 0011 (bridge A0 & A1, two bottom jumpers)
- Board 4: I2C Address = 0x64 Offset = binary 0100 (bridge A2, middle jumper)

Peristaltic Liquid Pump with Silicone Tubing - 12V DC Power

https://www.adafruit.com/product/1150

https://learn.adafruit.com/chilled-drinkibot

- Uses approx 4mm outer diameter, 2mm inner silicone tubing, the pump tube size has changed on us, so please measure the tubing that comes with your pump to verify!
- Working Temperature: 0℃ - 40 ℃
- Motor voltage: 12VDC
- Motor current: 200-300mA
- Flow rate: up to 100 mL/min
- Weight: 200 grams
- Dimensions: 27mm diameter motor, 72mm total length
- Mounting holes: 2.7mm diameter, 50mm center-to-center distance

Relay

For 120VAC loads:

CAMDEC Inc Raspberry PI Expansion Board, Relays Board

- Universal relays board, compatible with Raspberry PI ® 3/2/B/B+.
- Relays Deck - Module for connecting peripheral output devices for microcomputers and microcontrollers with a signal voltage of 3.3 - 5 VDC.
- SIMPLE AND RELIABLE WIRING.
- The module is designed for fast and reliable connection of peripheral devices: commutators, starters, indicators, low power load, etc. The module has mounting holes for fixing the Raspberry PI microcomputer with screw connections. The module has connectors for connecting load and protection modules.
- There is a possibility of installation in a special box. All features on our website or by email.

https://www.amazon.com/CAMDEC-Inc-Raspberry-Expansion-Automation/dp/B071ND1FMR/ref=sr_1_1?s=electronics&ie=UTF8&qid=1547461584&sr=1-1&keywords=CAMDEC+Inc
https://www.camdec.net/relays-deck

For 12VDC loads (chillers, pumps, etc.):

Diymore 4 Channels 4 Route MOSFET Button IRF540 V2.0 + MOSFET Switch Module for Arduino

Source
https://www.amazon.com/Diymore-Channels-MOSFET-Button-Arduino/dp/B01MRQFYJN/ref=asc_df_B01MRQFYJN/?tag=hyprod-20&linkCode=df0&hvadid=198109700569&hvpos=1o3&hvnetw=g&hvrand=14181850422871514 70&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9007347&hvtargid=pla-385355383830&psc=1

Pinout
https://www.amazon.com/gp/customer-reviews/RPG913UBDK3T6/ref=cm_cr_dp_d_rvw_ttl?ie=UTF8&ASIN=B01MRQFYJN

Datasheet
https://www.vishay.com/docs/91021/91021.pdf

N-channel power MOSFET - 30V / 60A

- N channel power MOSFET
- TO-220 Package
- Vds = 30V max
- Max current = 62A
- Vgs = 2.35V max
- Rds_on = as low as 8.7 milliohm - depending on Vgs

https://www.adafruit.com/product/355
https://learn.adafruit.com/rgb-led-strips/usage

Equipment

IceProbe Thermoelectric Aquarium Chiller

https://smile.amazon.com/IceProbe-Thermoelectric-Aquarium-Chiller/dp/B001JSVLBO/ref=cm_cr_arp_d_product_top?ie=UTF8

- 12V, 5A DC
- 10 gal: 6-8F, 10-12F
- 20 gal: 3-4F, 6-8F
- 40 gal: 1-2F, 3-4F

12v Submersible Water Pump 206 GPH

https://www.amazon.com/dp/B01816E1YU/ref=psdc_402303011_t2_B01267CT80?th=1

- Power consumption: 14.4W
- Rated voltage: 12V
- Rated current: 1.2A
- Max flow rate: 13L/MIN (3.43G/MIN)
- Max static head: 4.0m (13.1ft)
- Diameter of inlet: 20.0mm(0.78inch) thread
- Diameter of outlet: 20.0mm(0.78inch) thread
- Waterproof level: IP68

Power

SUPERNIGHT 12V 30A Switching Power Supply, 110-240 Volt AC to DC 360W Universal Regulated Switching Transformer

- Over Load and Short Circuit Protection
- Auto-recovery after protection
- AC input: 100-120V; 200-240V

- Output: 12V , 0 ~ 30A

https://smile.amazon.com/SUPERNIGHT-Switching-Universal-Regulated-Transformer/dp/B01LATMSGS/ref=sr_1_20?ie=UTF8&qid=1547384587&sr=8-20&keywords=12vdc+power+supply

ZYAMY 12A High Power DC-DC Buck Converter Adjustable Step Down Power Supply Module 4.5-30V to 1.2-30V

https://smile.amazon.com/dp/B07GGRCCRL/ref=sspa_dk_detail_0?psc=1

- Type: High Power DC-DC Buck Converter, non-isolated step-down power module
- Input Voltage: 4.5V to 30V, Output Voltage: 1.2V to 30V (continuously adjustable, default 5V)
- Output Current: 0A to 12A 100W, up to 200W with enhanced heat dissipation
- Two large aluminum heat sinks ensures a better heat dissipation and more stable performance. 5pcs 470uf/35V high frequency low resistance capacitors in parallel special for switch-mode power supply lower output ripple.
- 23mm large magnet and 1.0 copper wire provides high efficiency work. LED indicator light on board make work state more intuitive. TVS diode can prevent voltage spike from chip breakdown and ensures module safety.
- Widely used for storage battery, power transformers, DIY adjustable regulated power supply, industrial equipment, 12V to 3.3V, 12V to 5V, 24V to 5V, 24V to 12V, etc.

Construction (preliminary)

GPIO Ribbon Cable for Raspberry Pi Model A+/B+/Pi 2/Pi 3 - (40 pins)

https://www.adafruit.com/product/1988

IDC Breakout Helper - 2x20 (40 pin)

https://www.adafruit.com/product/2270

Reference

Reef-pi
https://learn.adafruit.com/search?q=reef-pi

Kessil (A80, A160, A360)
https://www.kessil.com