

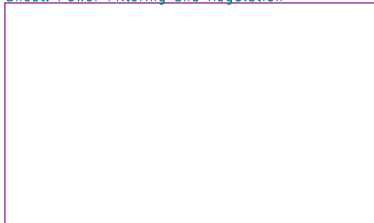
# Delta-Bot Control Electronics

Handles supervisory and control tasks for the delta-robot.  
Designed to reduce wiring complexity and improve functionality.

## Artwork

Input 75VDC from Teknic IPC PSU.  
Filter/protection requirements are minimal.  
Provide regulated 12V for IO Logic Level/Fan/etc.  
Provide regulated 3.3V for microcontroller etc.

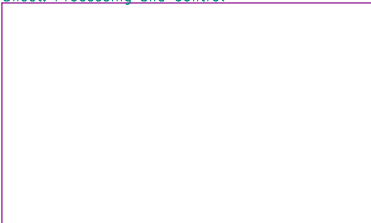
Sheet: Power Filtering and Regulation



File: power.sch

STM32 microcontroller.  
Handles sampling input sensors, aux outputs.  
Generates 4x sets of step/direction control signals.  
Interfacing etc for PC/Phone UI.

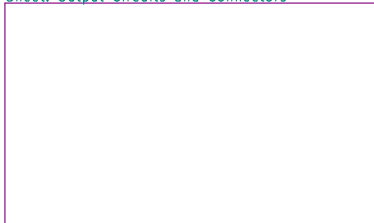
Sheet: Processing and Control



File: microcontroller.sch

Output connectors to Clearpath SDKS servos.  
Output power and data connectors (optocoupled).  
Motor status line input circuit.  
Per-servo current monitoring.

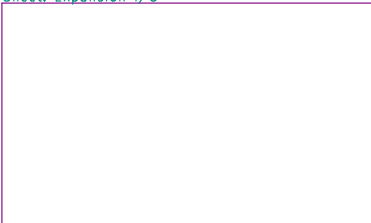
Sheet: Output Circuits and Connectors



File: motor\_outputs.sch

Output for PWM controlled fan, external temp probes.  
Generic outputs for internal or end effector accessories.  
Optocoupled outputs for external device control.  
Optocoupled inputs for inbound control.

Sheet: Expansion I/O



File: expansion\_io.sch

DONT PANIC

Bug Symbol



LOG01



LOG02

WARN Triangle

LOG06



LOG08



LOG010



Lamp Symbol

Thermometre



LOG03



LOG04

LOG07



LOG09



USB Symbol

UART Symbol

Lightning Bolt

Hot Fire



LOG05



LOG013

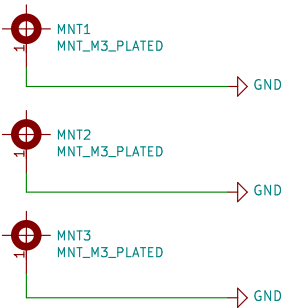


LOG012

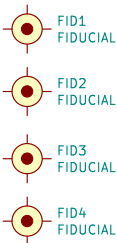


LOG011

## Mechanical Mounts



## Fiducials



PROJECT: DeltaBot Controller

Sheet path: /

Scott Rapson

DESCRIPTION:

Subsystem Overview

DRAWING NUMBER:

20180425-1.0.0

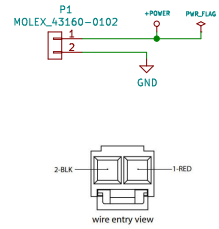
DATE: 2018-07-29

SIZE: A4

SHEET: 1 of 5

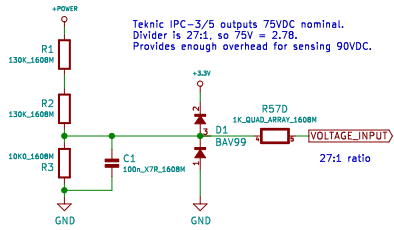
## 75VDC Input Power

SABRE 2-pin connector



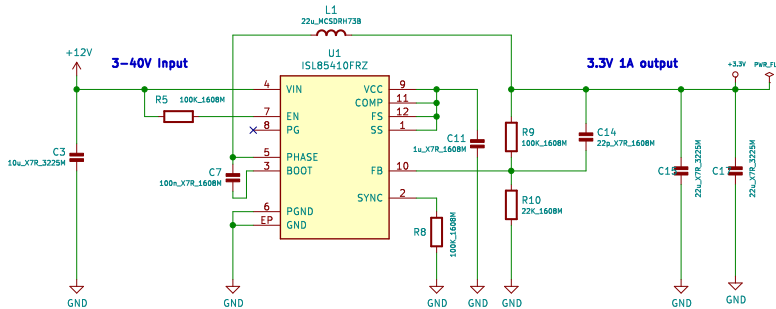
Pin	Color	Name
1	RED	V+
2	BLK	GND

## Input Voltage Monitoring



## 3.3V Regulation

3.3V 1A switchmode regulator.  
Follows Pololu D24V10F3 design.



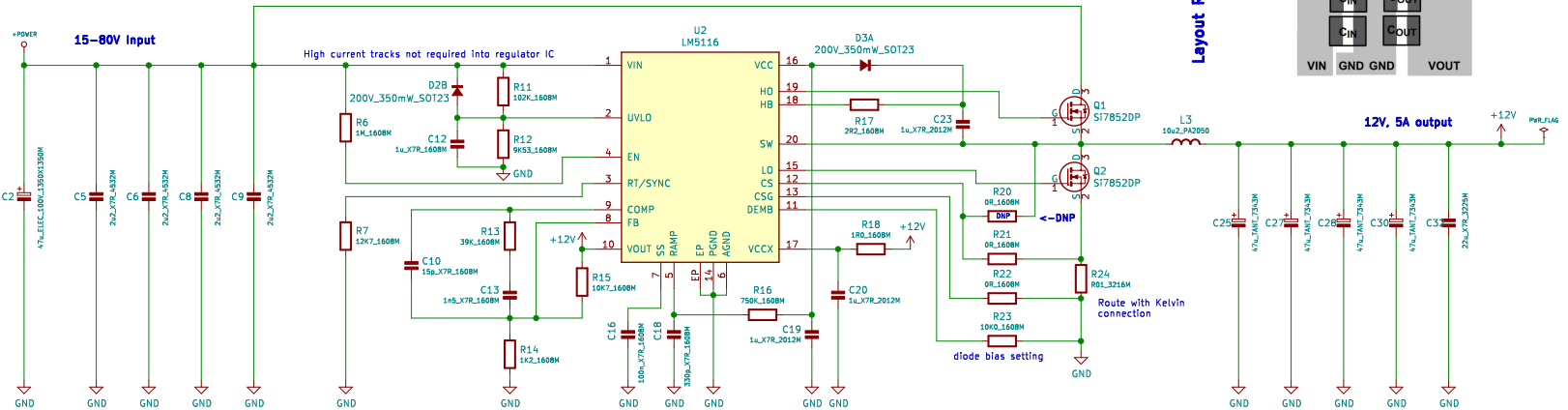
90.9K and 20K are appropriate substitutes

## Testpoints

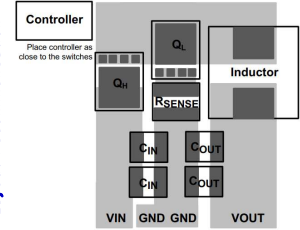


## 12V Regulation

Follows the TI AN-1713 application note for the LM5116.  
250kHz, should achieve >90% efficiency at operating voltage.

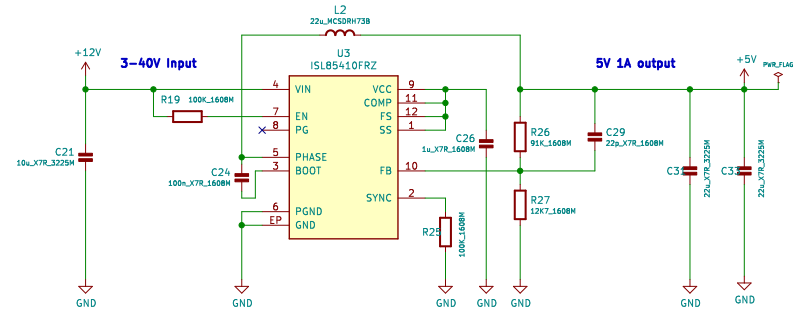


Layout Recommendation



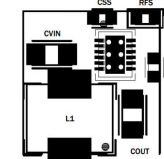
## 5V Regulation

5V 1A switchmode regulator.  
Follows Pololu D24V10F5 design.



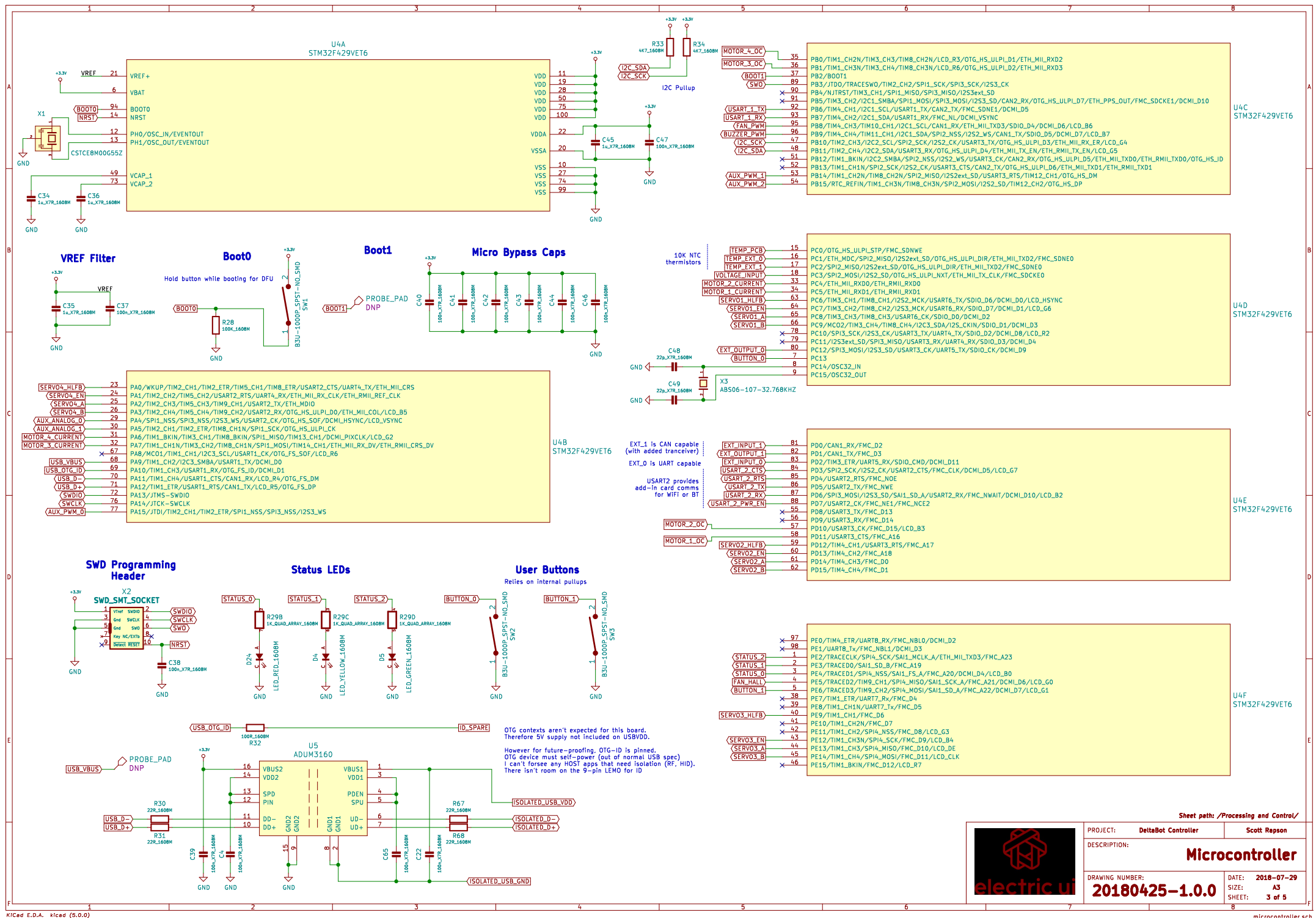
12.4K is an appropriate substitute

Placement Recommendation



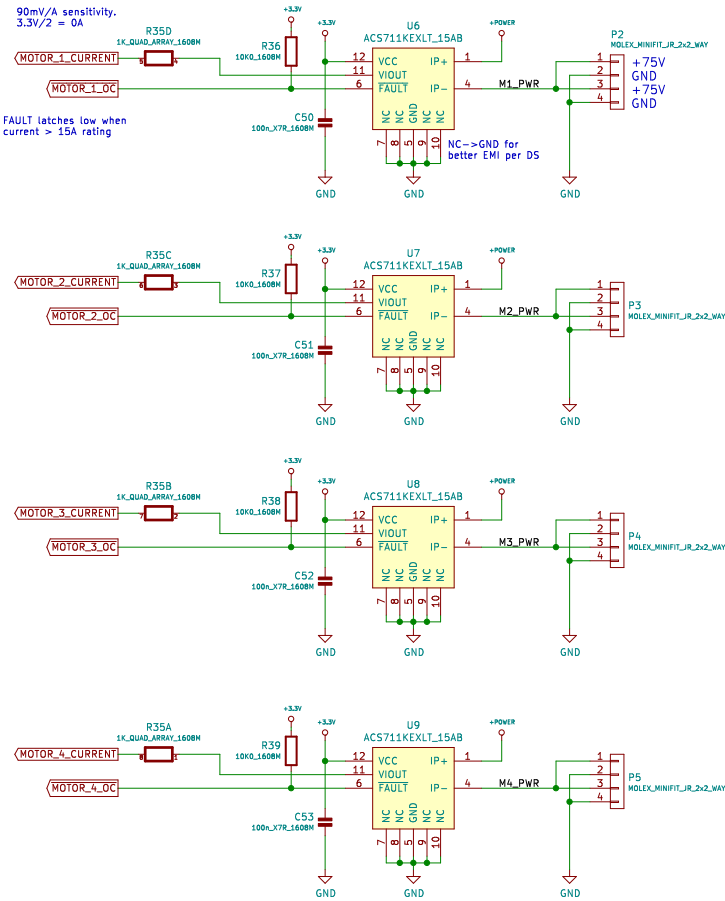
Sheet path: //Power Filtering and Regulation/

	PROJECT: DeltaBot Controller	Scott Rapson
	DESCRIPTION: Power Regulation	
	DRAWING NUMBER: 20180425-1.0.0	DATE: 2018-07-29 SIZE: A3 SHEET: 2 of 5

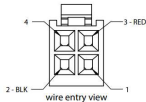


# Servo Power Connectors

Current monitoring is added for some extra visibility

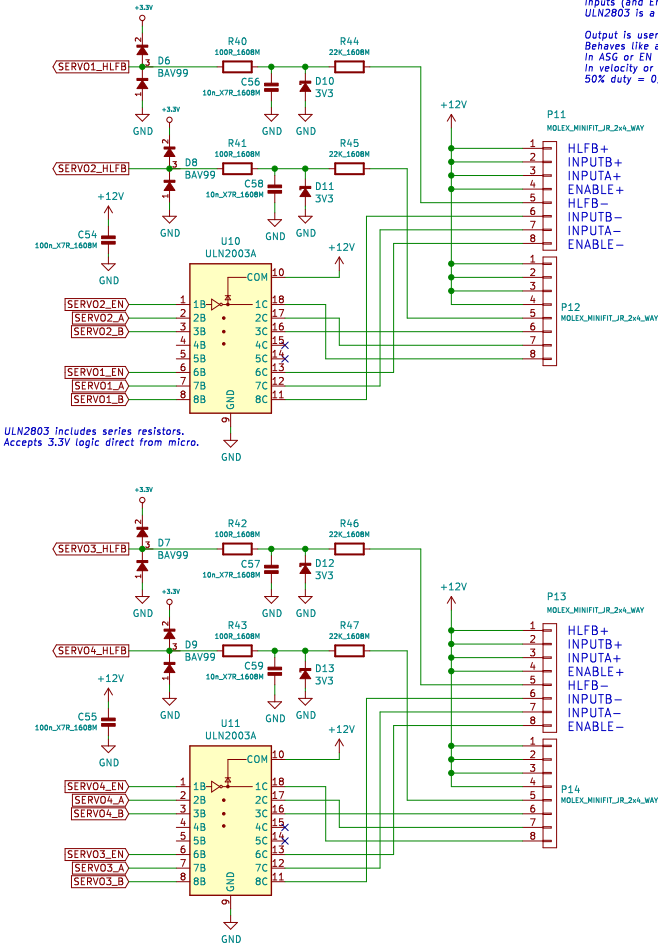


Pin Assignments		
Pin	Color	Name
1	GRN	HLFB +
2	BLK	Input B +
3	WHT	Input A +
4	BLU	Enable +
5	RED	HLFB -
6	YEL	Input B -
7	BRN	Input A -
8	ORN	Enable -

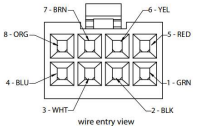


# Servo Data Connectors

Servo IO are optocouplers suitable for 5-24V switched logic. 12V logic is used. Servo IO self-limits current.  
Inputs (and Enable) require min 9mA.  
ULN2803 is a octal NPN (darlington) driver.  
Output is user-configurable.  
Behaves like a NPN (also has internal current limit).  
In ASO or EN modes, acts as a HIGH = GOOD status flag.  
In velocity or torque mode, outputs 45Hz squarewave.  
50% duty = 0, 5% = -MAX, 95% = +MAX



Pin Assignments		
Pin	Color	Name
1	GRN	HLFB +
2	BLK	Input B +
3	WHT	Input A +
4	BLU	Enable +
5	RED	HLFB -
6	YEL	Input B -
7	BRN	Input A -
8	ORN	Enable -



Sheet path: /Output Circuits and Connectors/

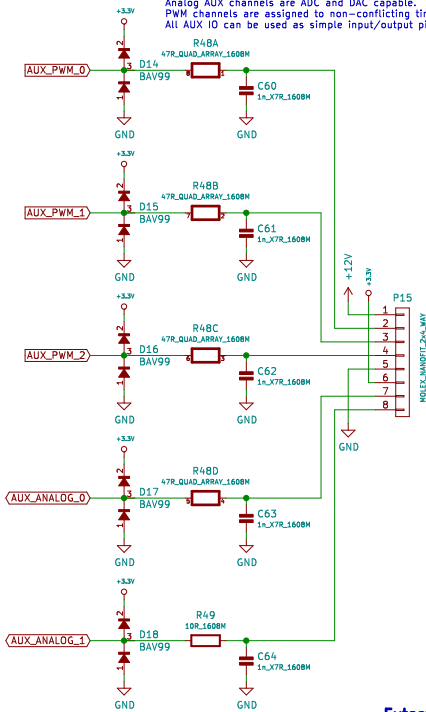


PROJECT:	DeltaBot Controller	Scott Rapson
DESCRIPTION:	Servo Interfaces	
DRAWING NUMBER:	20180425-1.0.0	DATE: 2018-07-29
SIZE:	A3	SHEET: 4 of 5

## Internal Expansion IO

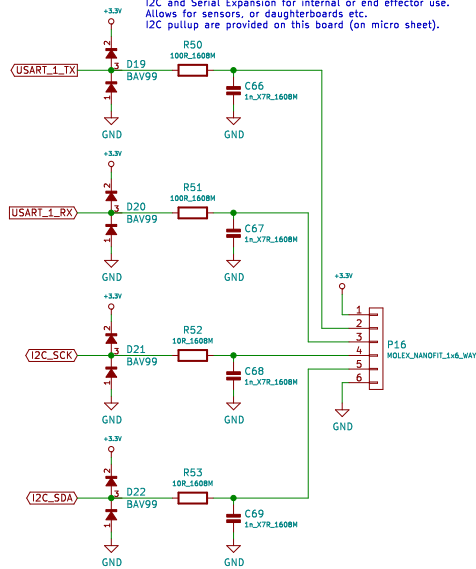
To be used with LED drivers, servos or motors/pumps.

Analog AUX channels are ADC and DAC capable.  
PWM channels are assigned to non-conflicting timers.  
All AUX IO can be used as simple input/output pins.

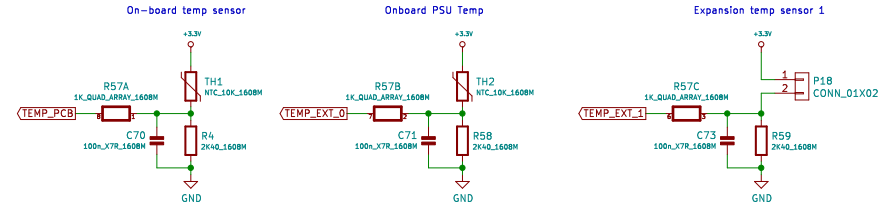


## Internal Expansion Serial

I2C and Serial Expansion for internal or end effector use.  
Allows for sensors, or daughterboards etc.  
I2C pullup are provided on this board (on micro sheet).

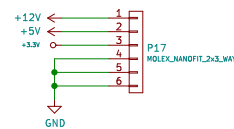


## Temperature Sensors



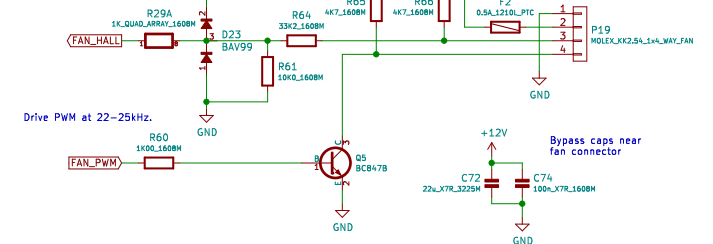
## Power Outputs

Regulated outputs



## Fan Control Circuit

Tachometer uses 12V pullup.  
2.3:1 divider on tach.  
BAV99 prevents input damage.

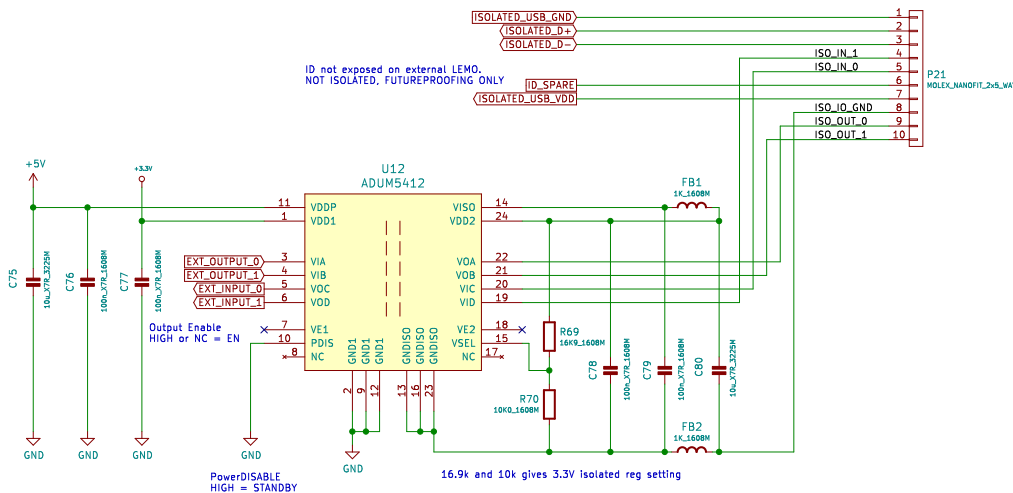


<https://electronics.stackexchange.com/questions/153846/arduino-how-to-read-and-control-the-speed-of-a-12v-four-wire-fan>

## External Isolated Expansion IO

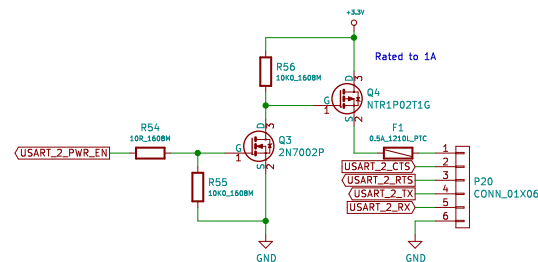
USB FS connection is galvanically isolated.  
See microcontroller page for USB circuit.

Provide 2 isolated input/output pairs.  
Pair 0 is UART capable, Pair 1 is CAN capable.  
Pins can be used as normal IO.  
Isolation IC provides internal isolated supply



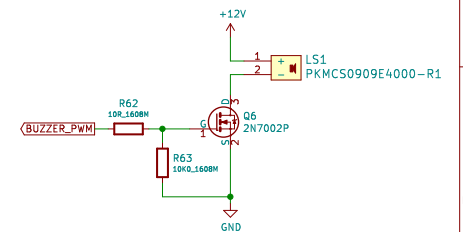
## Add-in Card

Expansion Header for ESP8266/32 or BLE module.  
Provide USART with external power control.




## Buzzer

Used for potential indication of state/warnings



Sheet path: /Expansion I/O/

	PROJECT: DeltaBot Controller	Scott Rapson
	DESCRIPTION:	Expansion IO
	DRAWING NUMBER: 20180425-1.0.0	DATE: 2018-07-29 SIZE: A3 SHEET: 5 of 5