

A

A

Arm Block Diagram

B

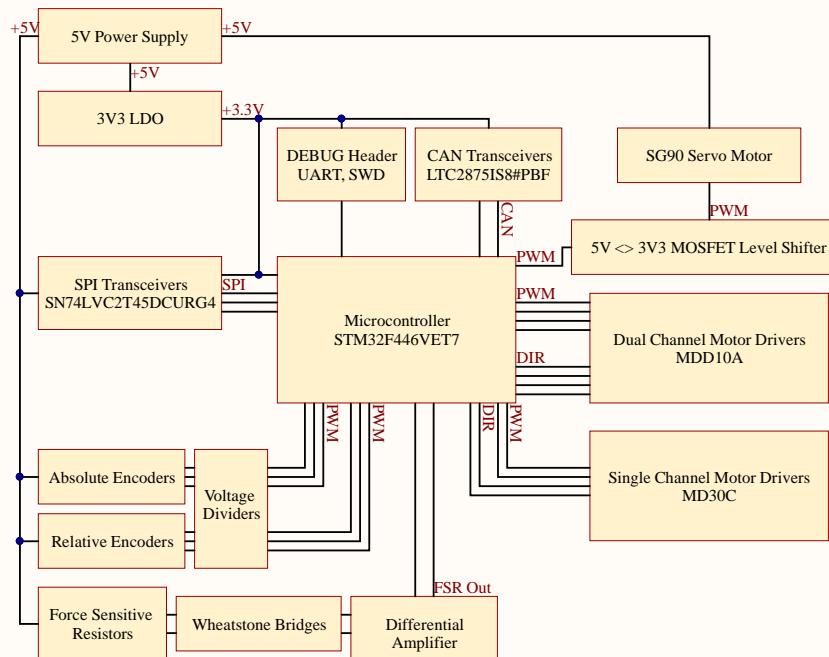
B

C

C

D

D



Title: Arm - Block Diagram

Size: Letter | Drawn By: K. Hong

Date: 2020-06-02

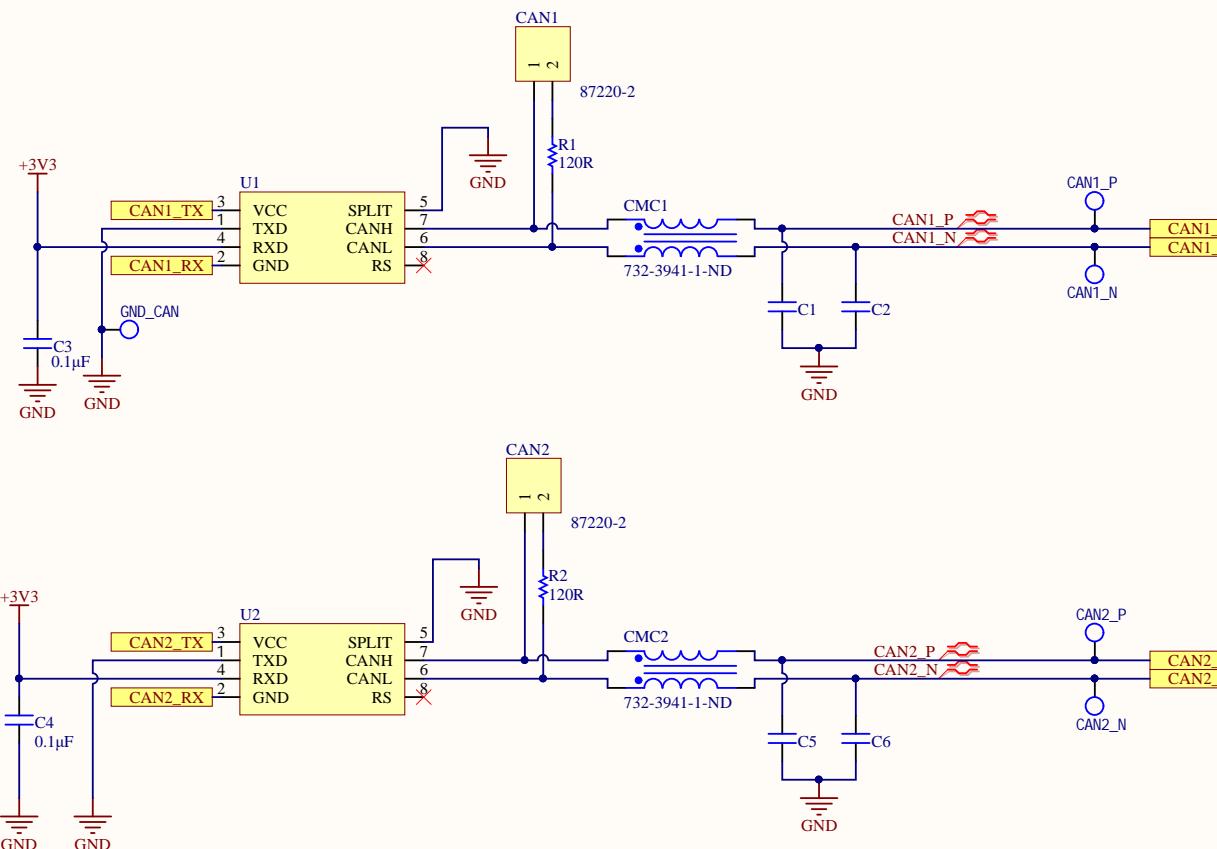
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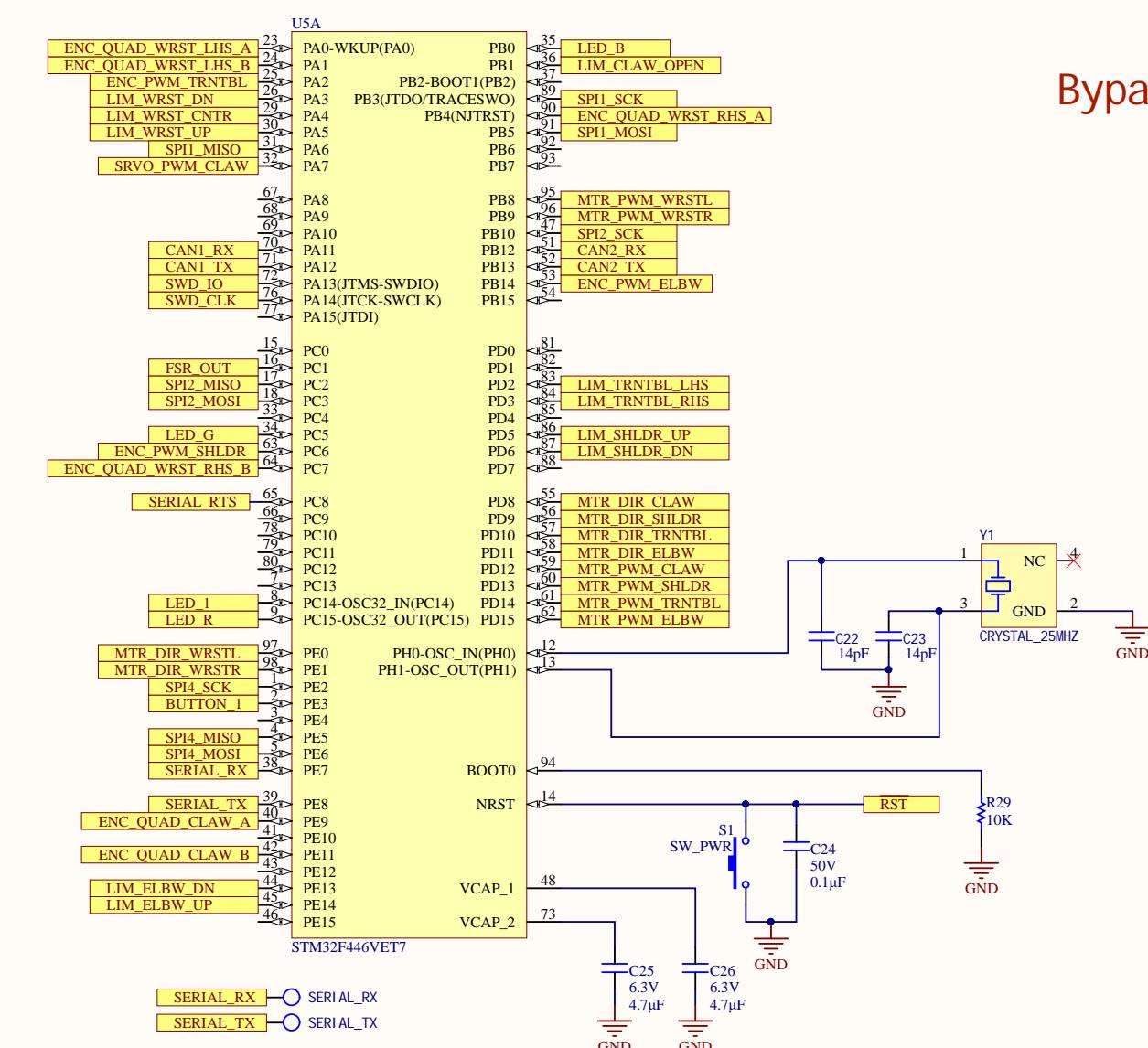
UW Robotics
200 University Avenue
Waterloo
Ontario
Canada N2L 3G6



CAN Transceivers



STM32F446VET7



A

A

B

B

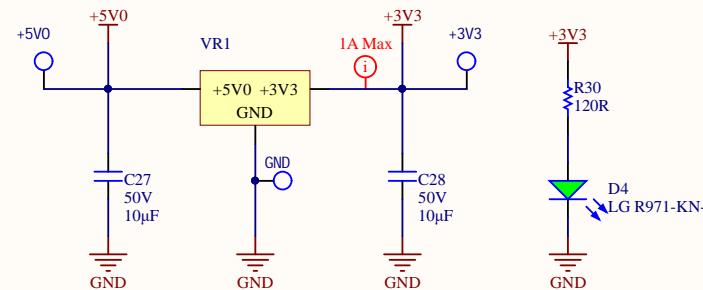
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C

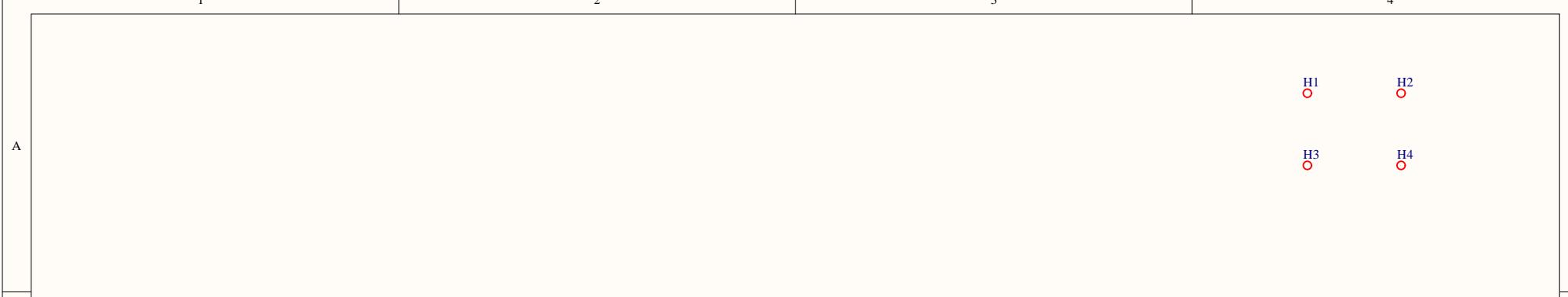
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D

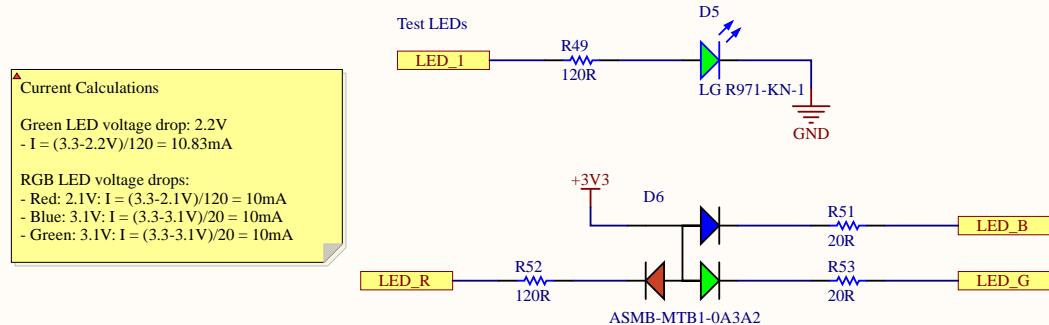
5V-3.3V LDO



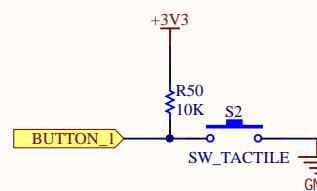
Current Calculations
Green LED voltage drop: 2.2V
- $I = (3.3-2.2)/120 = 10.83\text{mA}$



Test LEDs



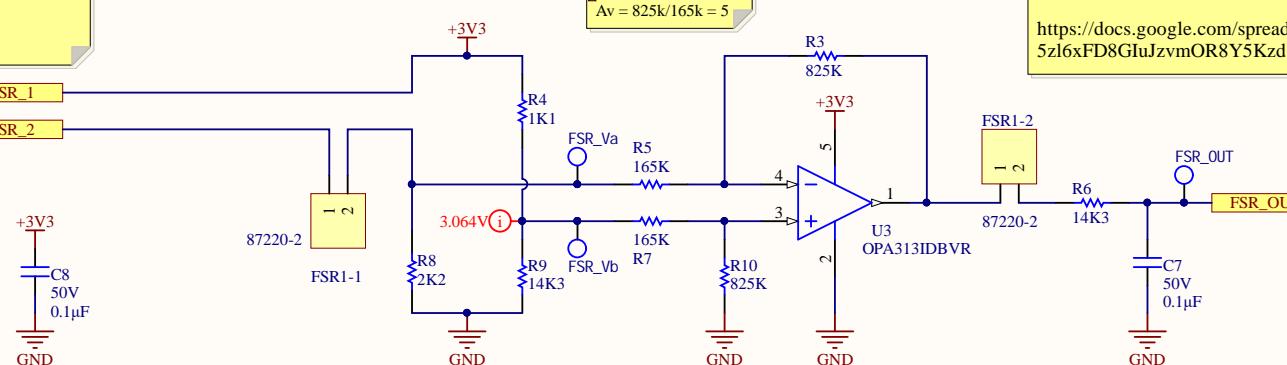
Test Button



Force Sensitive Resistor

A
 Sensor:
 Manufacturer: Interlink Electronics
 Manufacturer Part Number: 30-81794
 Supplier: Digi-Key
 Supplier Part Number: 1027-1001-ND
<https://cdn.sparkfun.com/assets/8/a/1/2/0/2010-10-26-DataSheet-FSR402-Layout2.pdf>
 Resistance at 20N = 800 ohms
 Resistance at 100N = 250 ohms

Wheatstone Bridge



Differential Amplifier

Differential amplifier gain:
 $A_v = 825k/165k = 5$

Wheatstone bridge voltage output values:
 At 20N, $V_{out} = 3.2V$
 At 100N, $V_{out} = 0.5V$

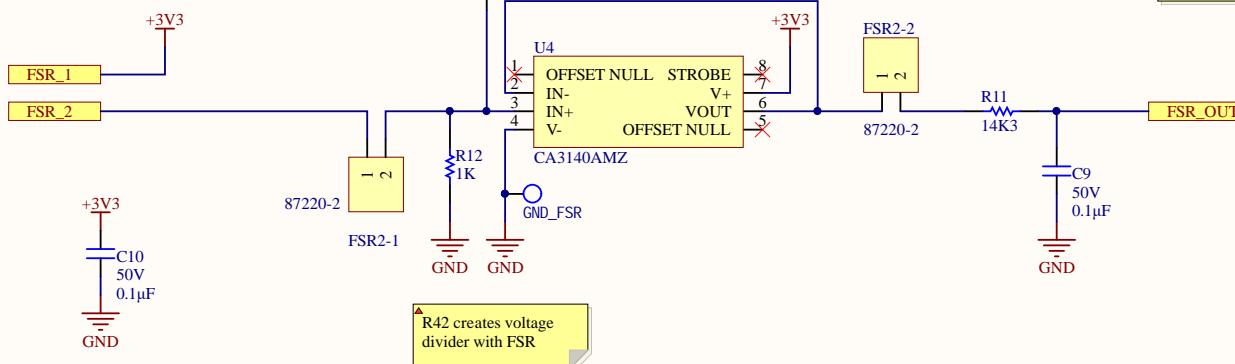
Low pass filter cutoff frequency:
 $f_c = 1/(2\pi R_6 C_7) = 111.30 \text{ Hz}$

Links to differential amplifier calculations and documentation

<https://docs.google.com/spreadsheets/d/1JzRwpCH-aMdlyAMP5zl6xFD8GluJzvmOR8Y5Kzd1RN0/edit#gid=0>

B
 $+3V_3$
 C8 50V 0.1 μ F
 GND

Buffer

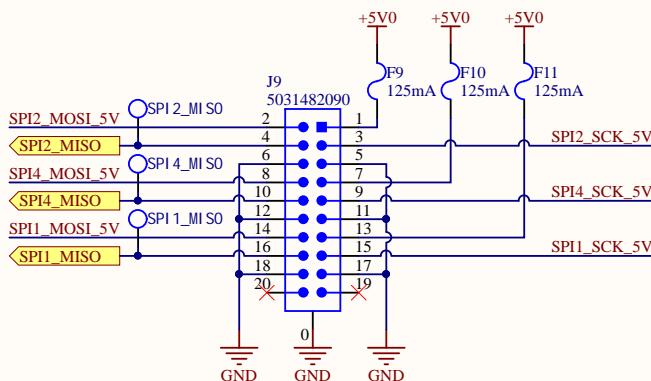


$LSB = 3.3V/(2^{12}-1)$
 $= 805.86 \mu V$

C
 $+3V_3$
 C10 50V 0.1 μ F
 GND

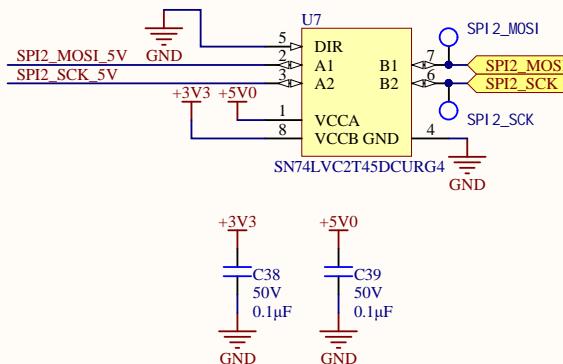
A

SPI Encoders

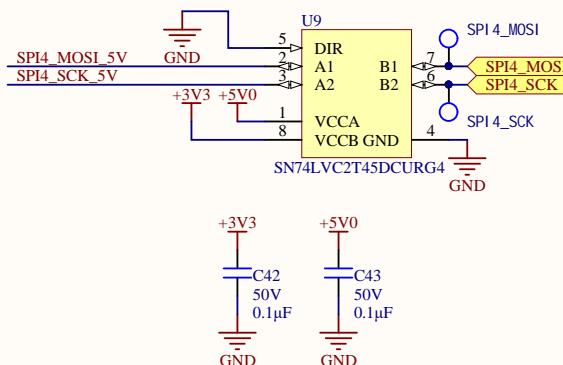
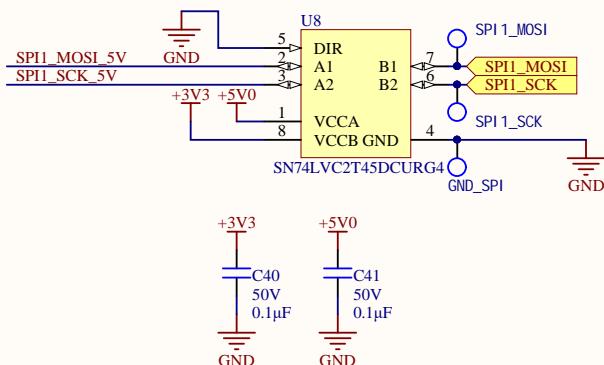


Encoder manufacturer: Broadcom
Encoder part number: AEAT-6012-A06
Did not level shift MISO signals since the STM32 SPI peripheral is 5V tolerant

B



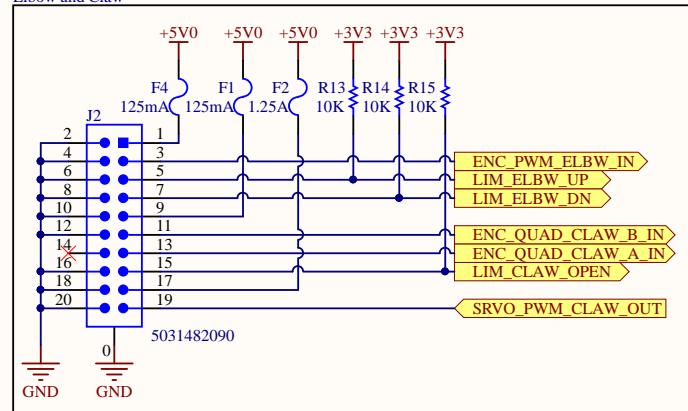
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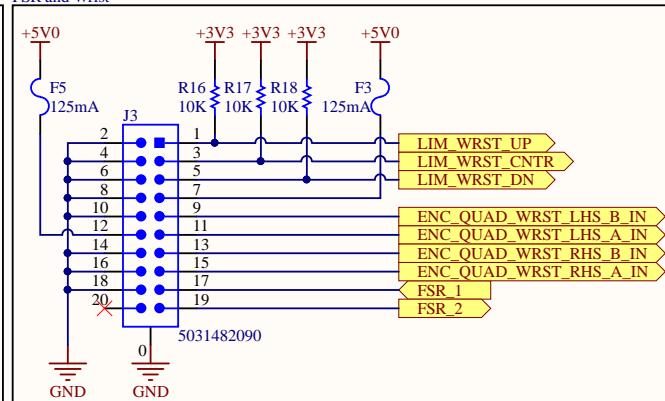
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Consolidated Connectors

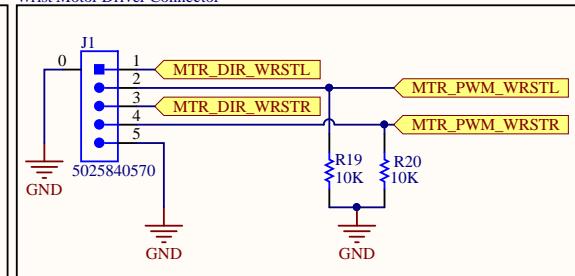
Elbow and Claw



FSR and Wrist



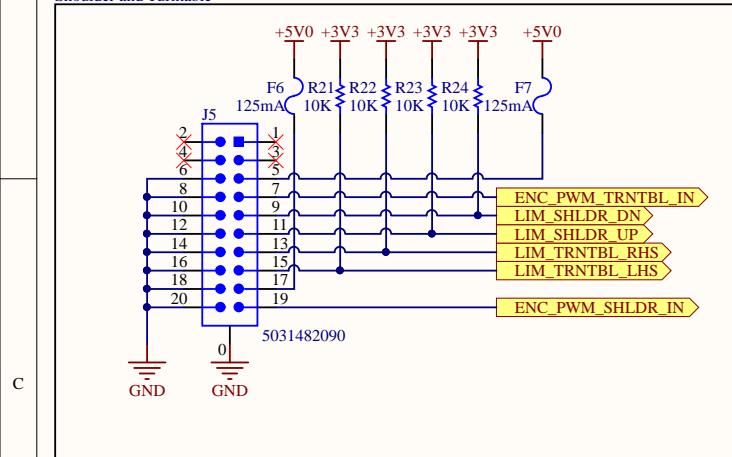
Wrist Motor Driver Connector



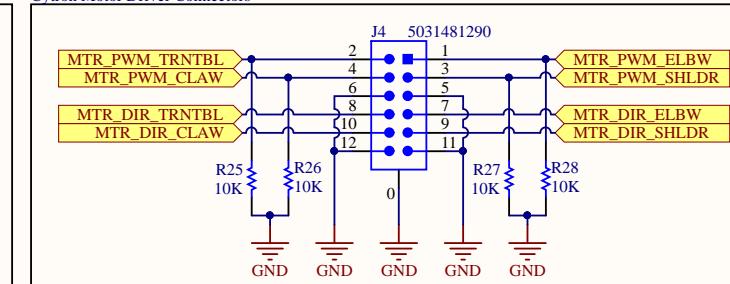
A

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Shoulder and Turntable



Cytron Motor Driver Connectors

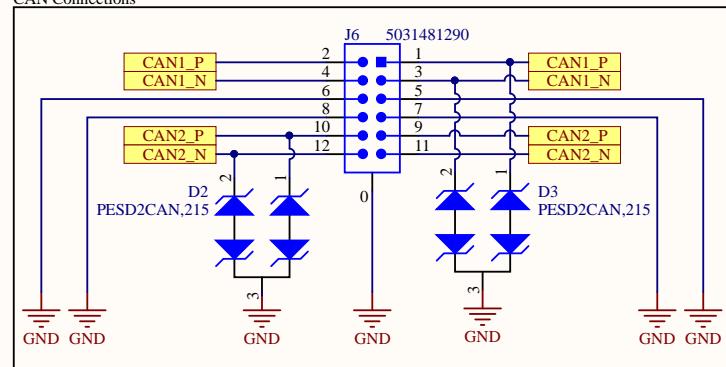


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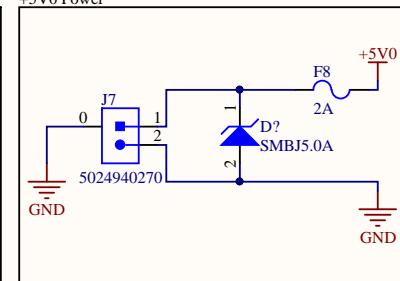
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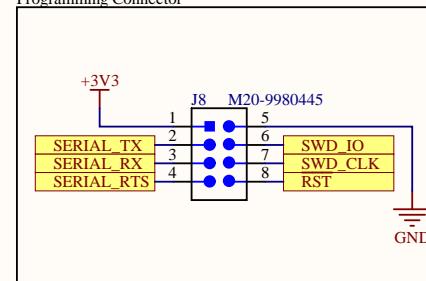
CAN Connections



+5V0 Power



Programming Connector



Acronyms Explained
 FSR: Force Sensitive Resistor
 CLAW: Claw
 WRST: Wrist
 SHLDR: Shoulder
 ELBW: Elbow
 TRNTBL: Turntable
 DIR: Direction for motors

D

D

Title: *

Size: Letter

Drawn By: *

Date: 2020-06-02

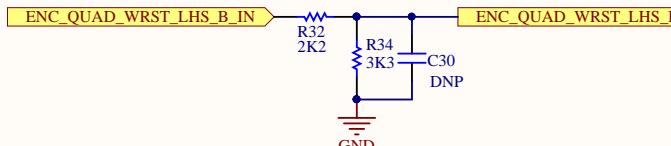
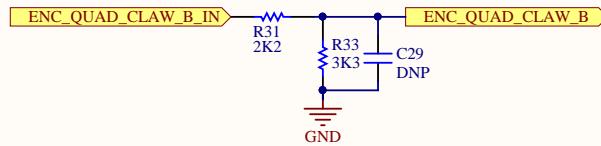
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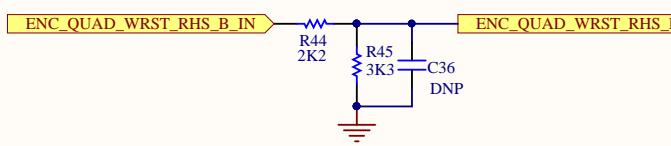
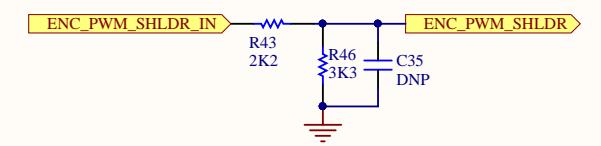
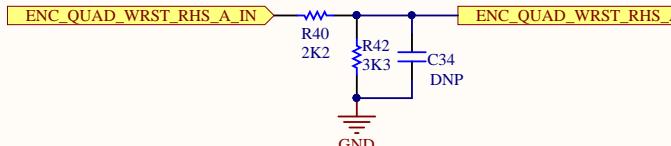
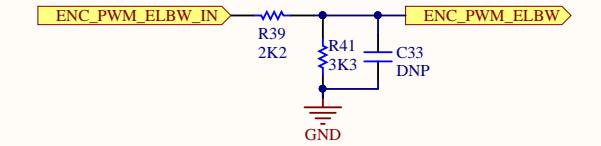
Servo motor and PWM Encoders

A

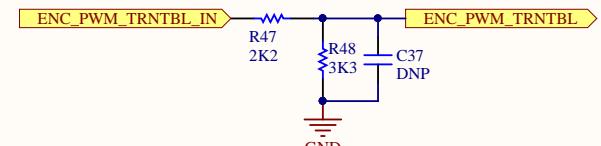
Encoder RC filter & Voltage divider



B



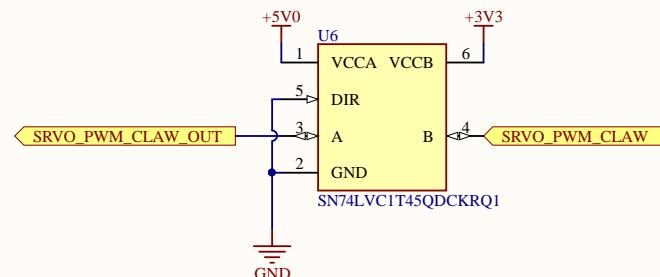
C



▲ Low pass filter cut-off frequency:
 $f_c = 1/(2\pi \cdot 3.3k \cdot ?) = ? \text{ Hz}$

Voltage divider:
 $V_{out} = 5(3.3k / (2.2k + 3.3k)) = 3V$

Servo level shifter



▲ To do:
 Spec RC filter capacitor for encoder outputs and redo calculation
 Add filter to level shifter io?

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Date: 2020-06-02	Sheet* of *	*
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