

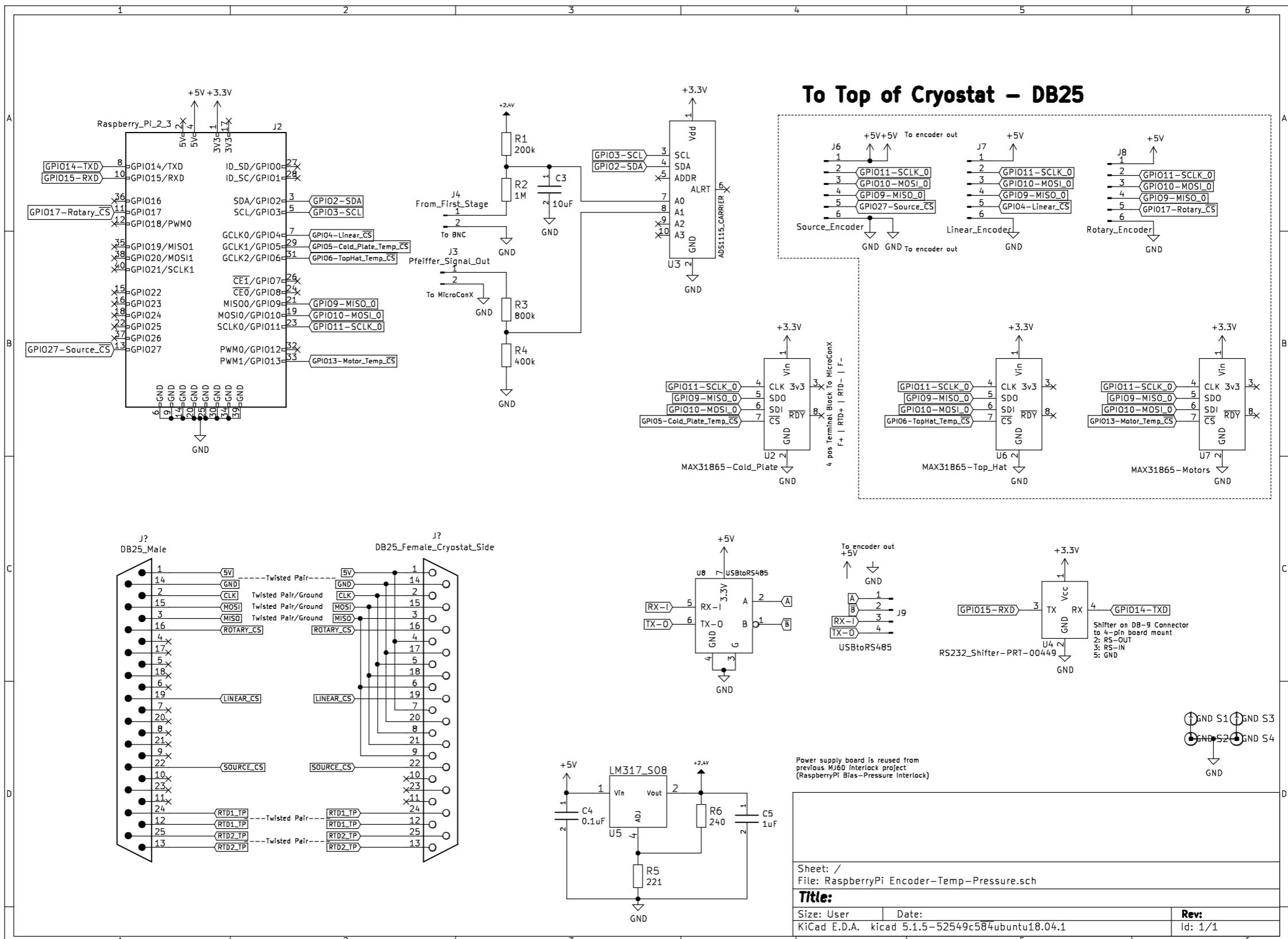
# CAGE Wiring Guide

Clint (on behalf of the CAGE group)

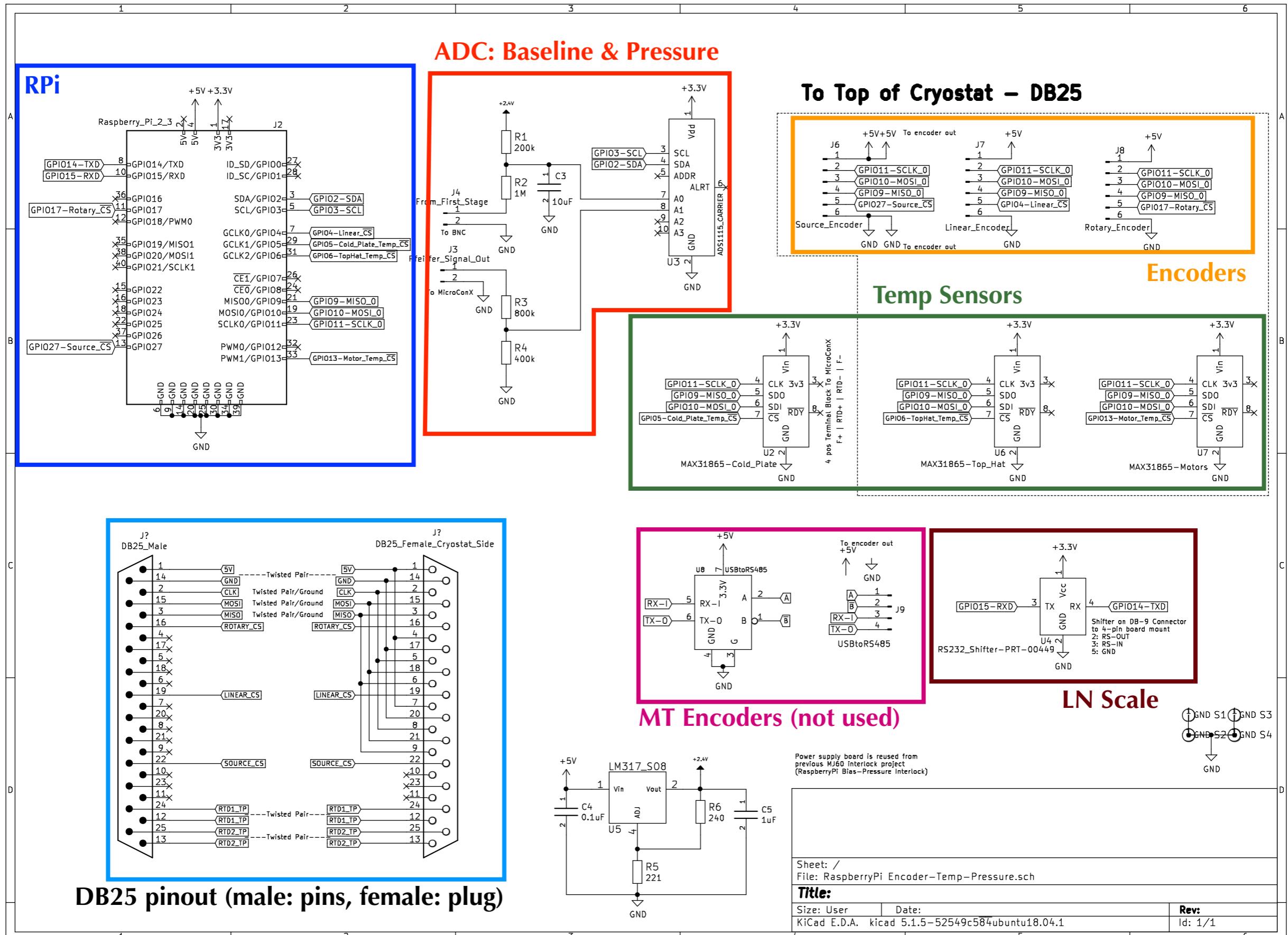
**2020.01.30**

# Master Schematic for SC box (David P, Jan. 2020)

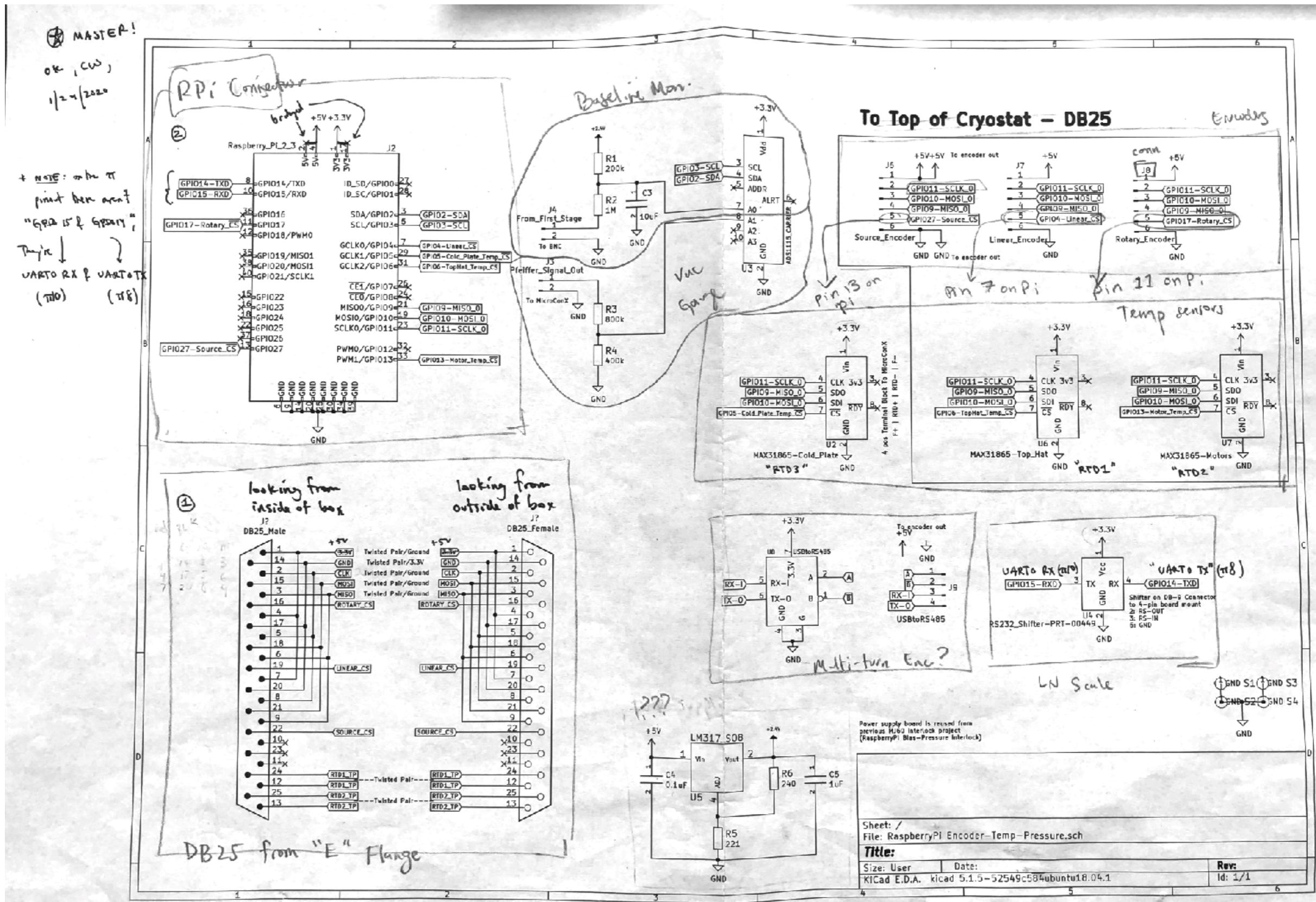
This version from David Peterson, 2020.01.27



# SC box master schematic (annotated)

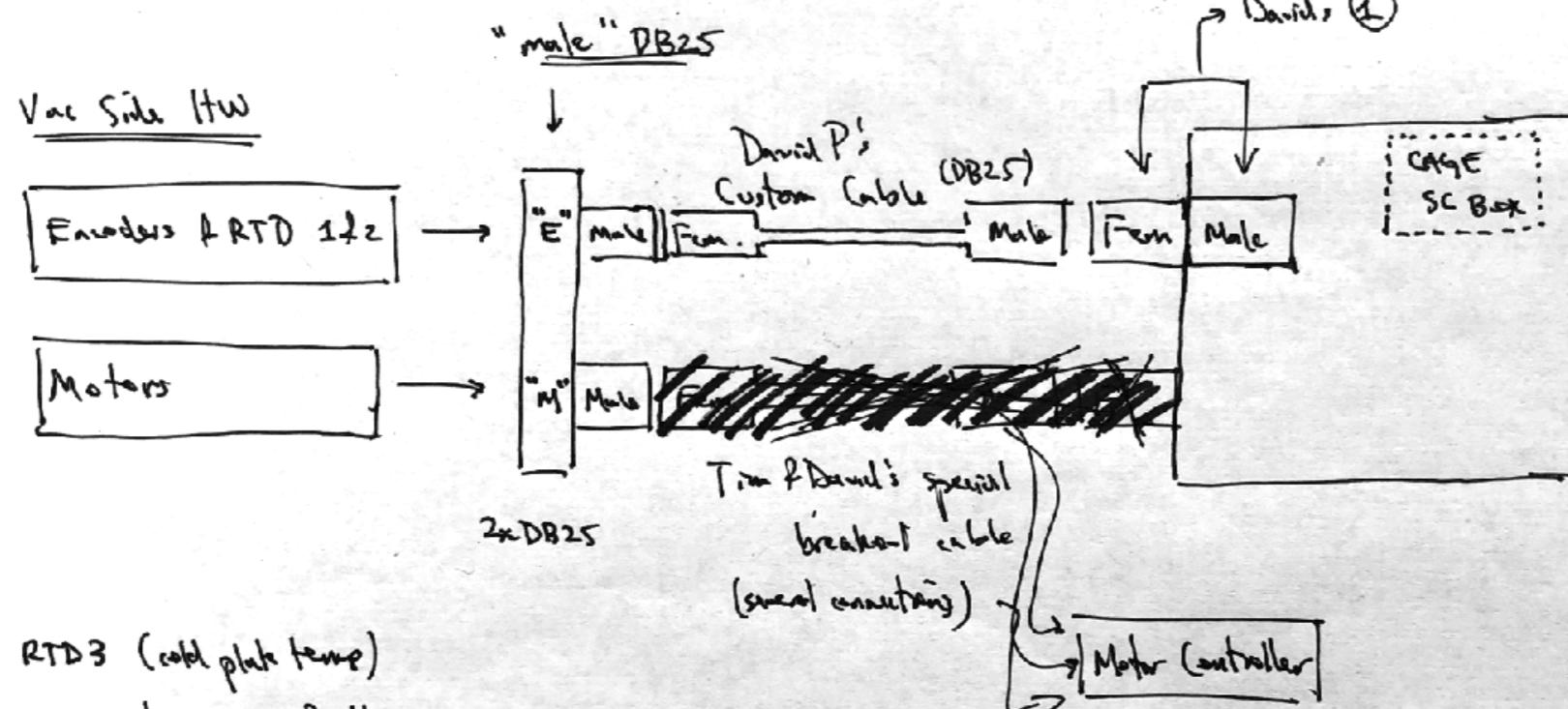


# Annotated SC box diagram (Clint, Jan. 2020)

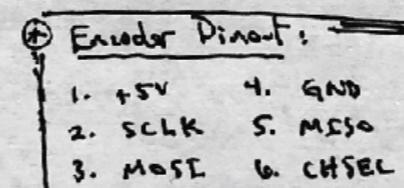
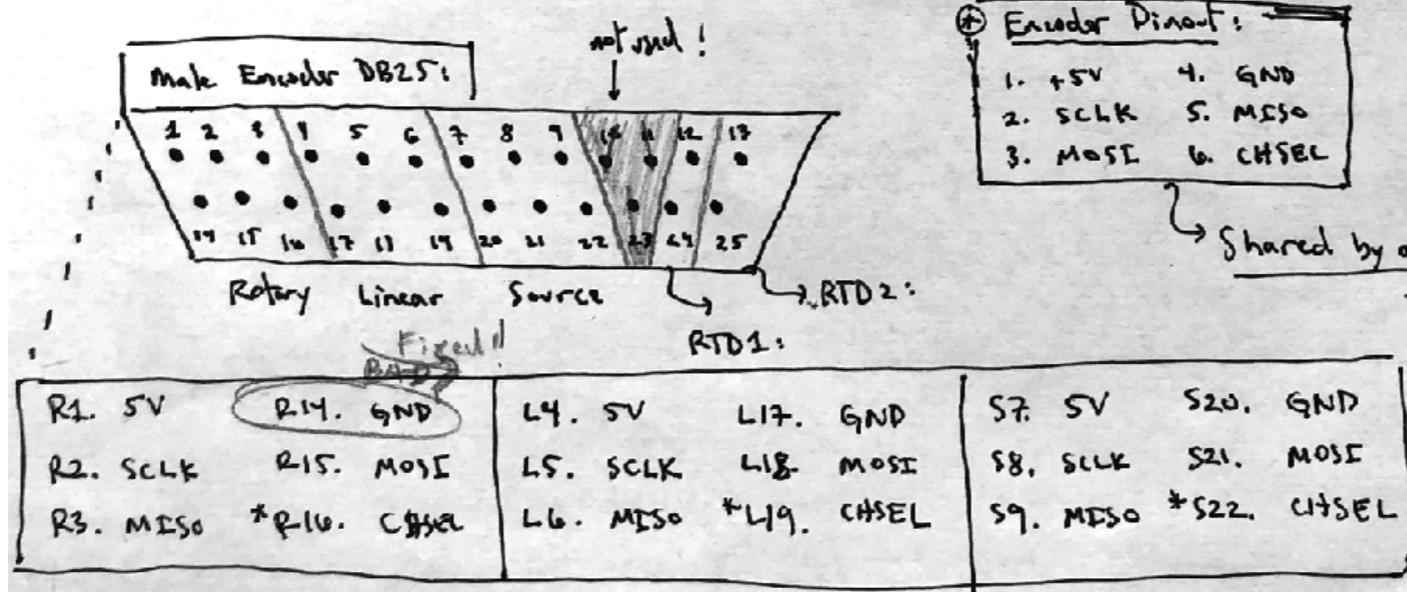


# Notes on Encoder DB25 (Clint, Jan. 2020)

Clint's SC Box Decoder Ring



④ RTD3 (cold plate temp)  
comes out @ STC feedthrough



NOTE: R: Rotary Encoder  
L: Linear Encoder  
S: Source Encoder

Shared by all: GND, SCLK, MOSI, MISO, 5V

→ Not shared: CHSEL !

④

3 RTD's :

④ U2 : cold plate (STC feedthrough)

U6 : Top Hat (RTD1)

U7: Motors (RTD2)

4 Encoder DB25

# Notes on Encoder DB25, and other RPi pins (Clint, Jan. 2020)

Encoder DB25 → RPi Pinout (including shared connection) (π)

**+SV**: RL, L4, S7 → π2 (+SV)

**SCLK**: R2, L5, S8 → π23 (SPI<sub>0</sub> SCLK GPIO 11)  
"CLK"

**MISO**: R3, L6, S9 → π21 (SPI<sub>0</sub> MISO GPIO 9)

**GND**: R14, L17, S20 → π9, 25, 39, 6, 20, 30, 34  
(all grounds are bridged together)  
(as shown in ②)

**MOSI**: R15, L18, S21 → π19 (SPI<sub>0</sub> MOSI GPIO 10)

**CHSEL**: R16 → π11 (GPIO 17)

L19 → π7 (GPIO 4)

S22 → π13 (GPIO 27)

Ok!: Bot + David's Encoder cable .

MAX31865 Scale: RS232 shifter (V4 on board)  
232 plug →

→ 3.3V supply,

Note: Multi-turn encoders are optional, we want exten.

- Power supply?

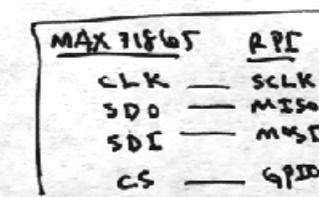
--  OK ←  
should check this w/ a mm.

②

Other Used π pins:

Encoder

Temp Sensors:  
(MAX31865) →



Top Hat: RTD1	V6
Motors: RTD2	V7
Cold Plate: RTD3	V2

} shared



~~Temp Sensors, Shared Connection~~

π23 CLK/SCLK → GPIO 11 → SCLK → "SPI<sub>0</sub> SCLK GPIO 11"  
π21 SDO/MISO → GPIO 9 → MISO → "SPI<sub>0</sub> MISO GPIO 9"  
π19 SDI/MOSI → GPIO 10 → MOSI → "SPI<sub>0</sub> MOSI GPIO 10"

Top Hat Chsel / GPIO  
GPIO 6 π21

Motors GPIO 13 π33

Cold Plate GPIO 5 π29

③ Note: Temp sensors AND encoders SHARE SCLK, MISO, MOSI

Baseline monitor & Vac Gauge (ADS1115 ADC chip)

SCL → GPIO 3 → "I<sub>2</sub>C SCL GPIO 3"

SDA → GPIO 2 → "I<sub>2</sub>C SDA GPIO 2"

A0 → Input from 1st stage. BNC → J4 connector

A1 → Input from vac gauge. Custom plug → J3 connector

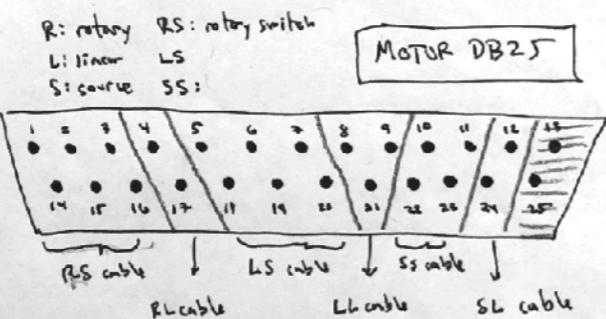
# Notes on Motor DB25, and Rotary Angle Convention (Clint, Jan. 2020)

Tim's note: diag 90 : Don't use Axis Z (or C in the code)

"continues to send some sort of signal after move is finished"

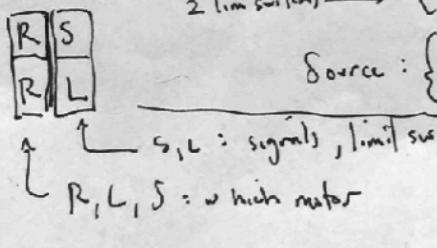
Motors are connected to A, B, D.

$SL \rightarrow X$  signals  
 $RS \rightarrow T$  motor  
 $RL \rightarrow T$  signal  
 $LL \rightarrow Y$  signal  
 $LS \rightarrow Y$  motor  
 $SS \rightarrow X$  motor  
 manual cable check



Rotary:  $\begin{cases} RS \rightarrow T \text{ motor} \rightarrow \text{Axis D} \\ RL \rightarrow T \text{ signal} \rightarrow -LFD(\text{line 173}), \text{Axis D} \end{cases}$

Conventions:



Linear:  $\begin{cases} LS \rightarrow Y \text{ motor} \rightarrow \text{Axis B} \\ LL \rightarrow Y \text{ signal} \rightarrow \text{Axis B. Fwd: Rev:} \end{cases}$

Source:  $\begin{cases} SS \rightarrow X \text{ motor} \rightarrow \text{Axis A} \\ SL \rightarrow X \text{ signal} \rightarrow -LFA(\text{line 170}), \text{Axis A} \end{cases}$

Motor DB25, vacuum side of top of flange side ⚡ male-to-male is same on both sides. (4)

$R1.$  Black       $R4.$  Green  
 $R2.$  Red       $R5.$  Blue  
 $R3.$  Yellow       $R6.$  White

RS cable

$R7.$  switch-hot  
 $R17.$  switch-ground

Rotary (Axis D)

$L5.$  Black       $L18.$  Green  
 $L6.$  Red       $L19.$  Blue  
 $L7.$  Yellow       $L20.$  White

LS cable

$L8.$  switch-red  
 $L9.$  switch-black  
 $L21.$  switch-green

Linear (Axis B)

⚡ note: fwd & rev switches on the linear stage!

$S10.$  Green       $S22.$  Black  
 $S11.$  Blue       $S23.$  Red

SS cable

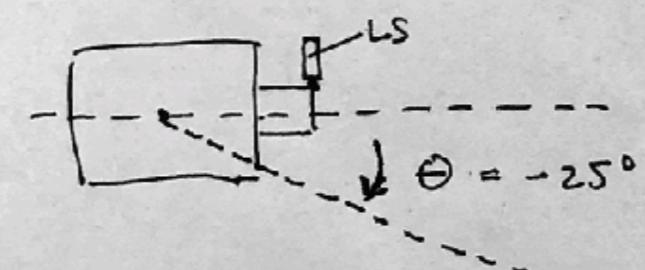
$S12.$  Ground-switch  
 $S24.$  switch-hot

Source (Axis A)

NOTE: Need to find Network print to explain color codes on vacuum side

NOTE: slightly inconsistent labeling here.

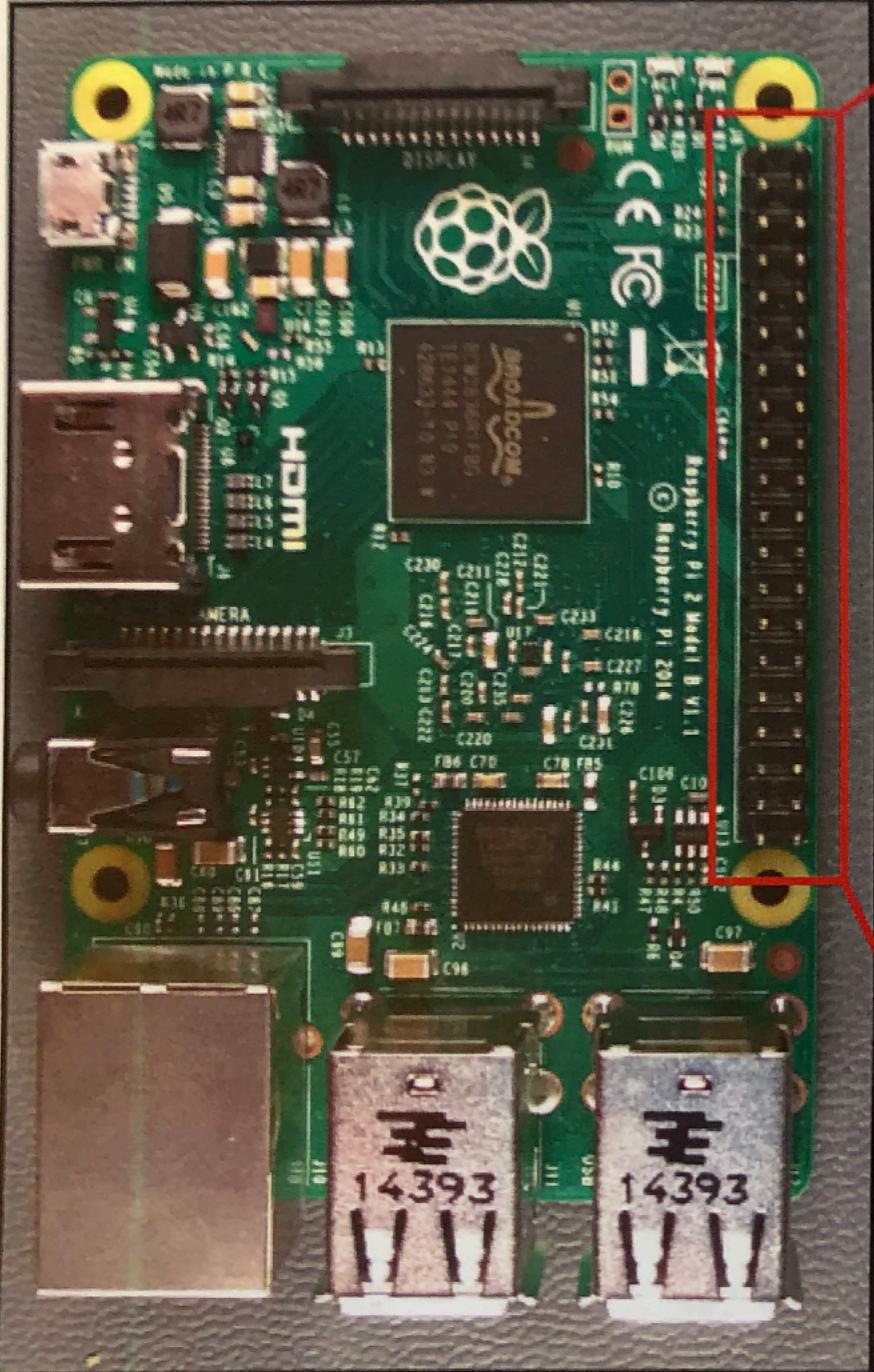
Rotary:



NOTE: Negative angles rotate away from limit switch.

→ Note 2: Rotary motion code needs a serious overhaul (it can't get past any of the while loops.)

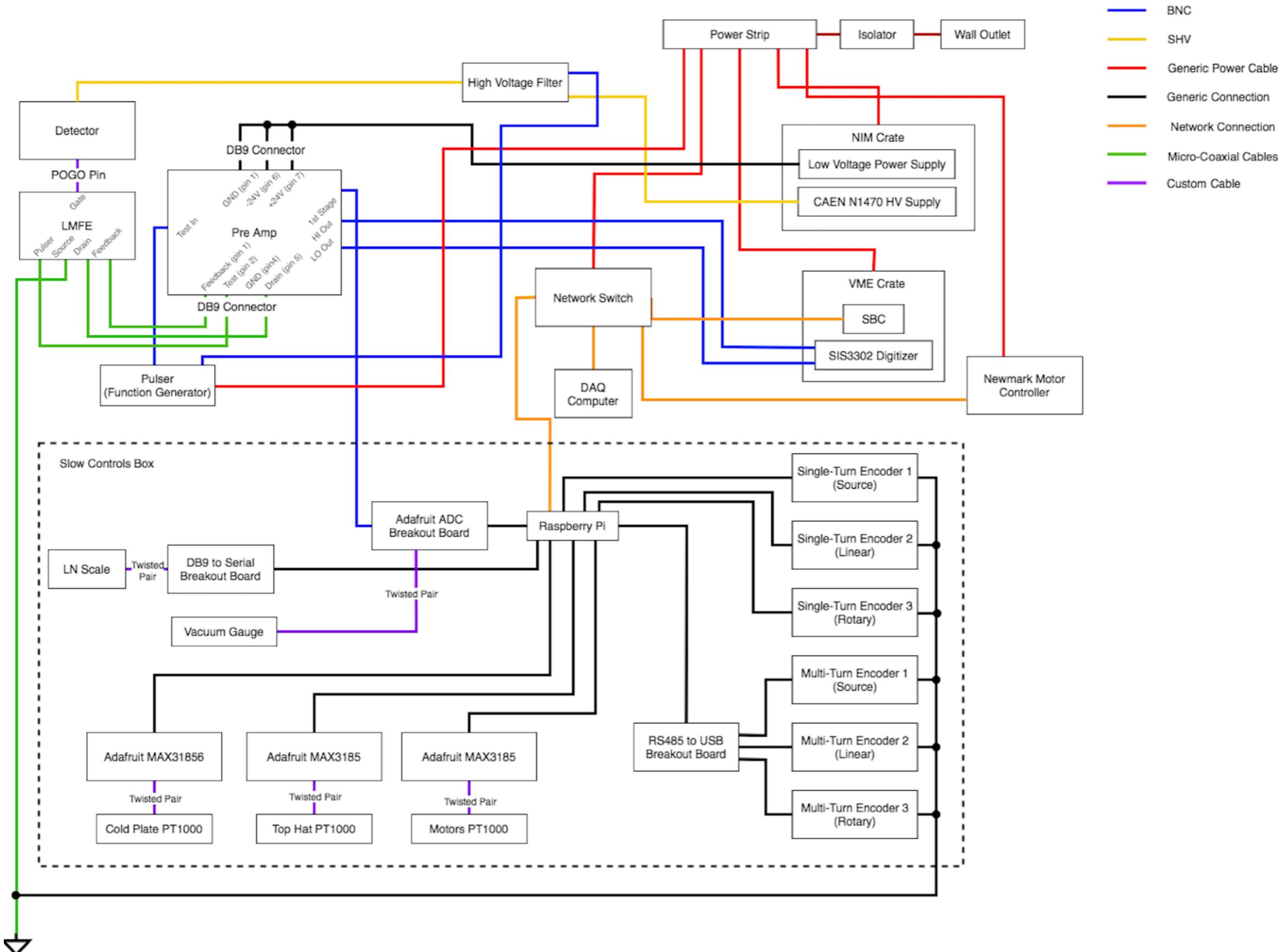
# Currently used RPi pins (Clint, Jan. 2020)



Alternate Function		Used? ✓	Alternate Function
3.3V PWR	1	✓	2 5V PWR
I2C1 SDA	3	✓	4 5V PWR
I2C1 SCL	5	✓	6 GND
GPIO 4	7	✓	8 UART0 TX
GND	9	✓	10 UART0 RX
GPIO 17	11	✓	12 GPIO 18
GPIO 27	13	✓	14 GND
GPIO 22	15	✓	16 GPIO 23
3.3V PWR	17	✓	18 GPIO 24
SPI0 MOSI	GPIO 10	19	20 GND
SPI0 MISO	GPIO 9	21	22 GPIO 25
SPI0 SCLK	GPIO 11	23	24 GPIO 8 SPI0 CS0
GND	25	✓	26 GPIO 7 SPI0 CS1
Reserved	27	✓	28 Reserved
GPIO 5	29	✓	30 GND
GPIO 6	31	✓	32 GPIO 12
GPIO 13	33	✓	34 GND
SPI1 MISO	GPIO 19	35	36 GPIO 16 SPI1 CS0
GPIO 26	GPIO 20	37	38 GPIO 20 SPI1 MOSI
GND	39	✓	40 GPIO 21 SPI1 SCLK

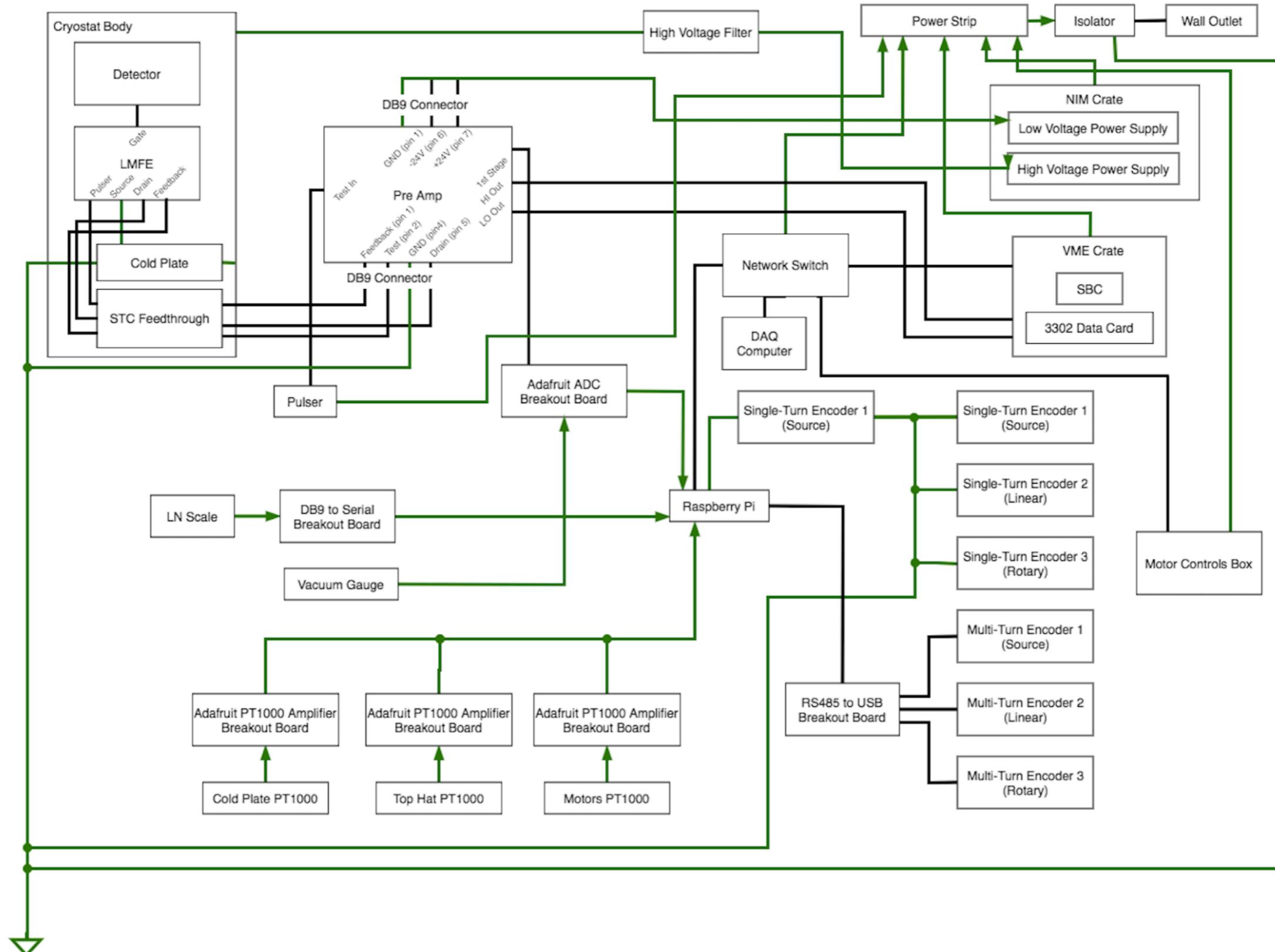
# Top-Level Electronics block diagram (Keira, Fall 2019)

NOTE: may need to check this against the most current version (Slide 2)



# Alternate diagram, showing cryostat grounding (Keira, Fall 2019)

NOTE: may need to check this against the most current version (Slide 2)



# Slow Controls —> RPi Pinout (Keira, Fall 2019)

NOTE: may need to check this against the most current version (Slide 2)

