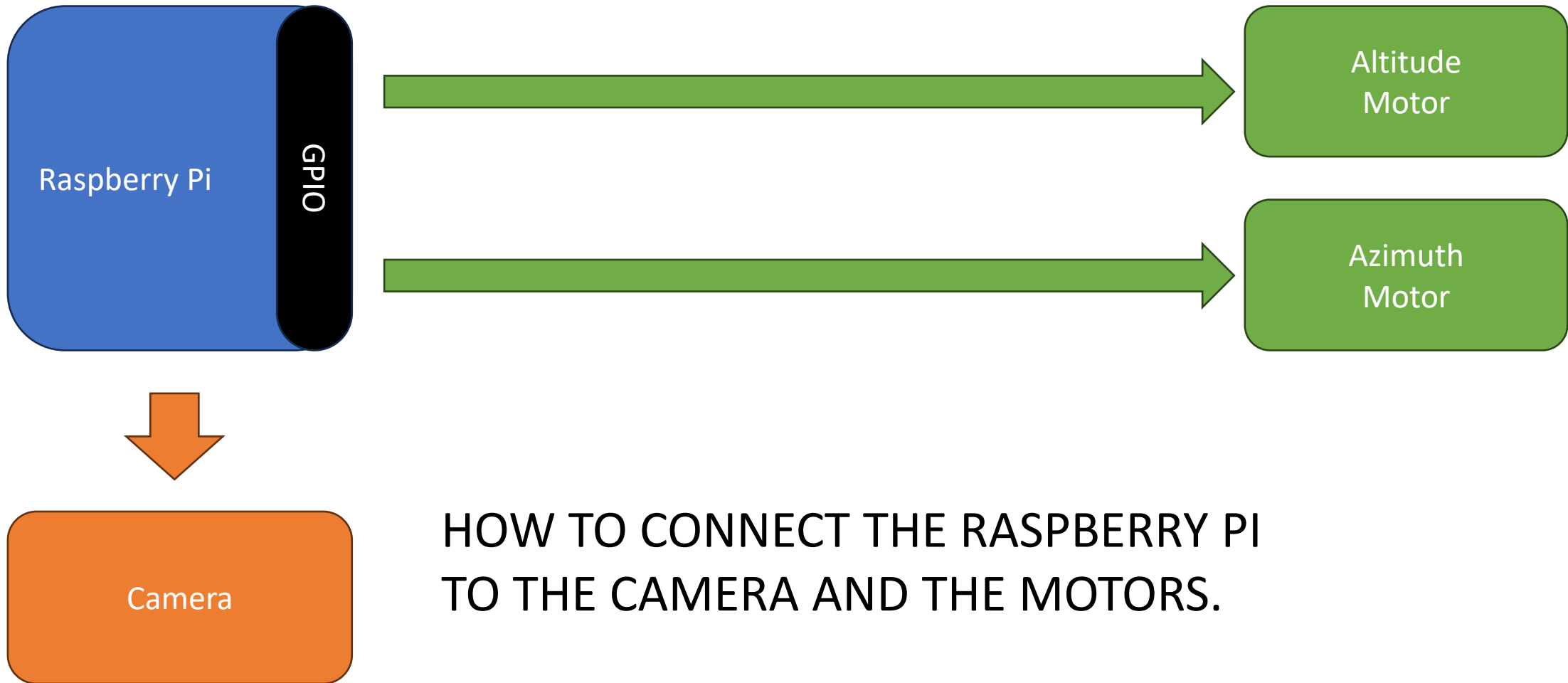
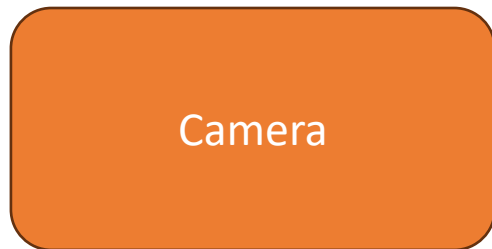
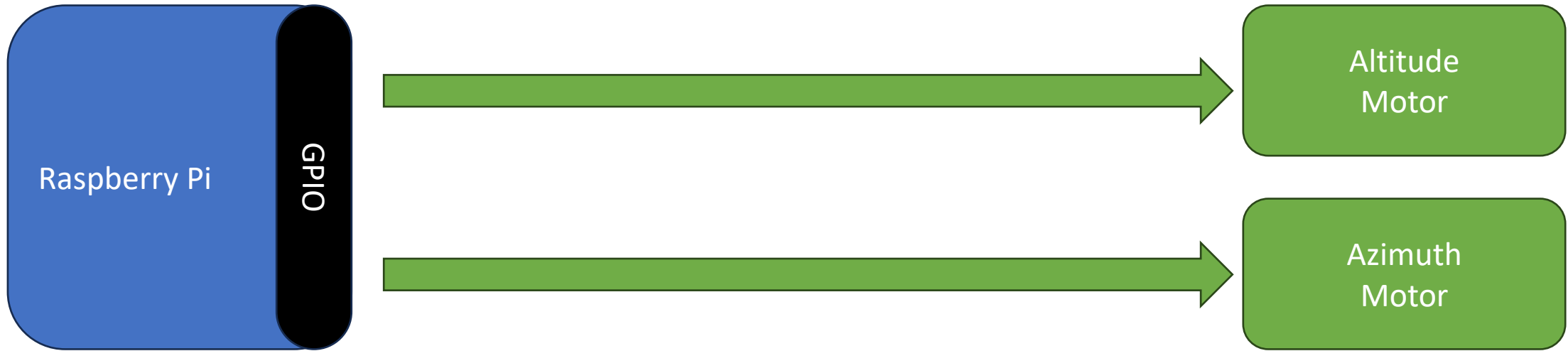


Pi-lomar construction

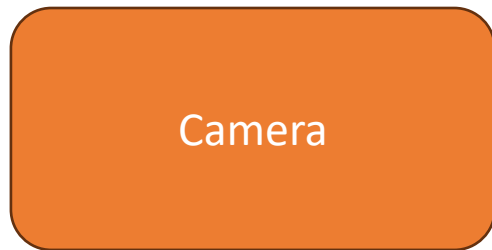
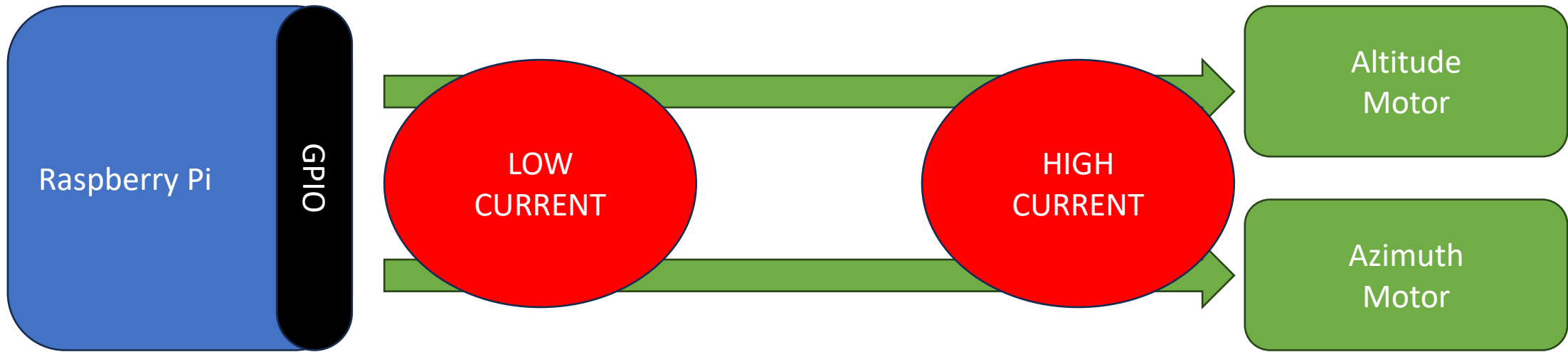
Motorcontroller wiring

DRAFT

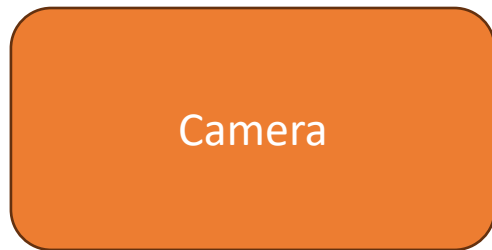
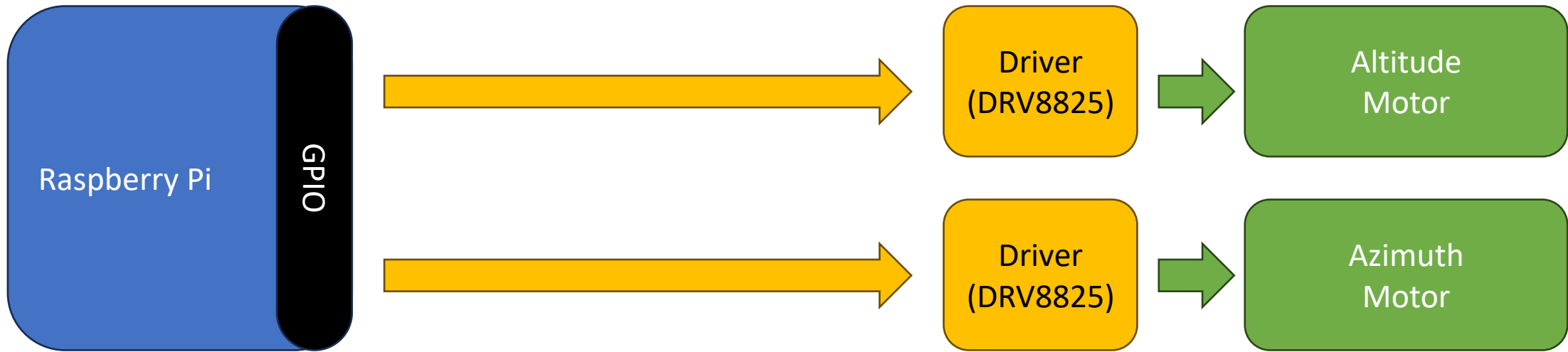




IDEALLY THE RASPBERRY PI WOULD DIRECTLY CONTROL THE STEPPER MOTORS THROUGH THE GPIO PORTS

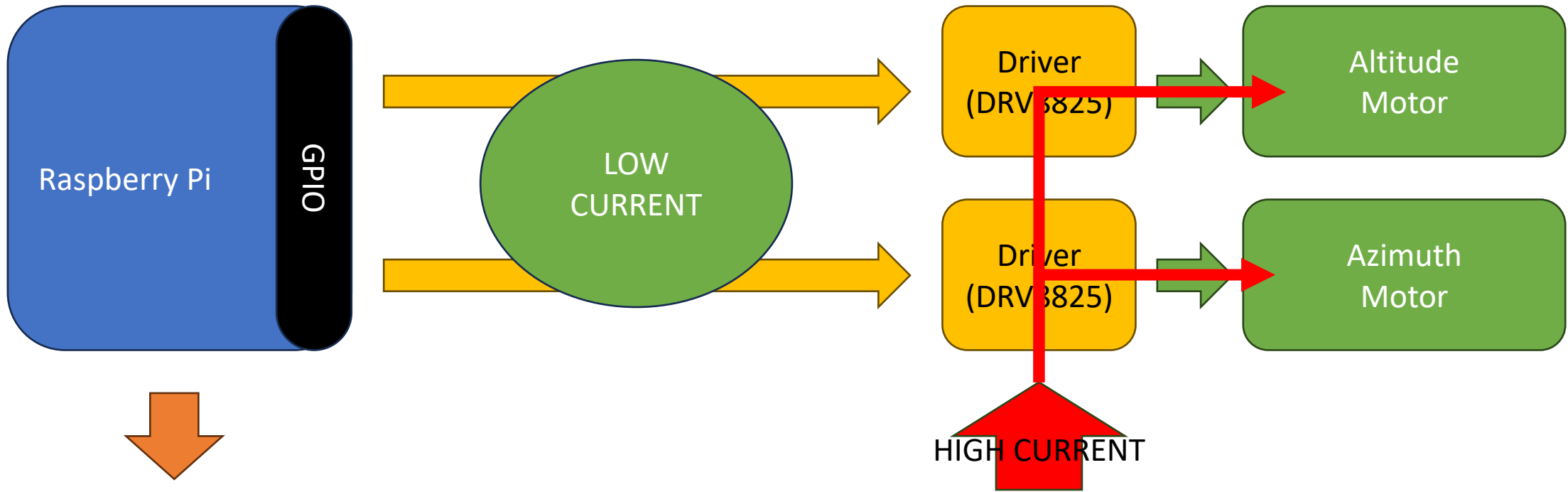


THERE IS A PROBLEM:
THE STEPPER MOTORS NEED HIGHER
CURRENTS THAN THE GPIO PORTS CAN
DELIVER.
WE WOULD BLOW UP THE RPi.

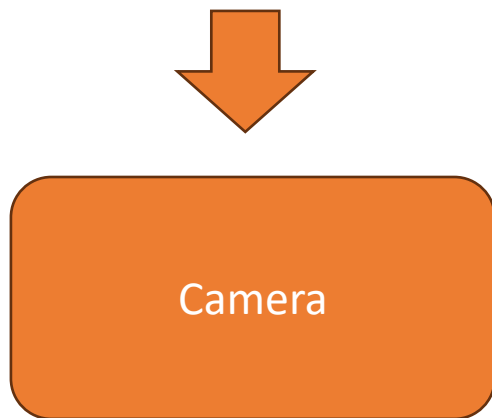
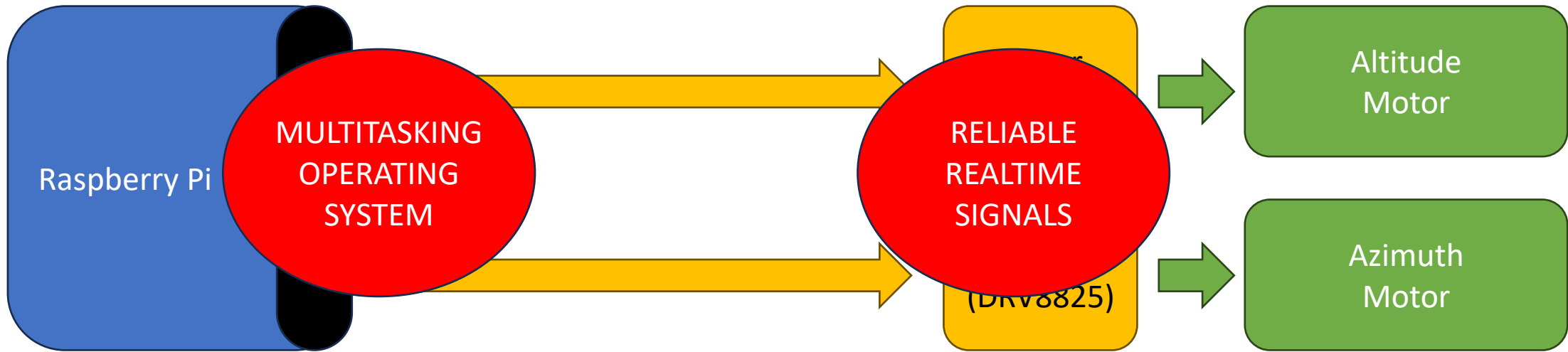


THERE IS A SOLUTION:

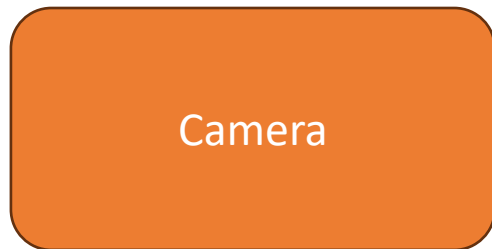
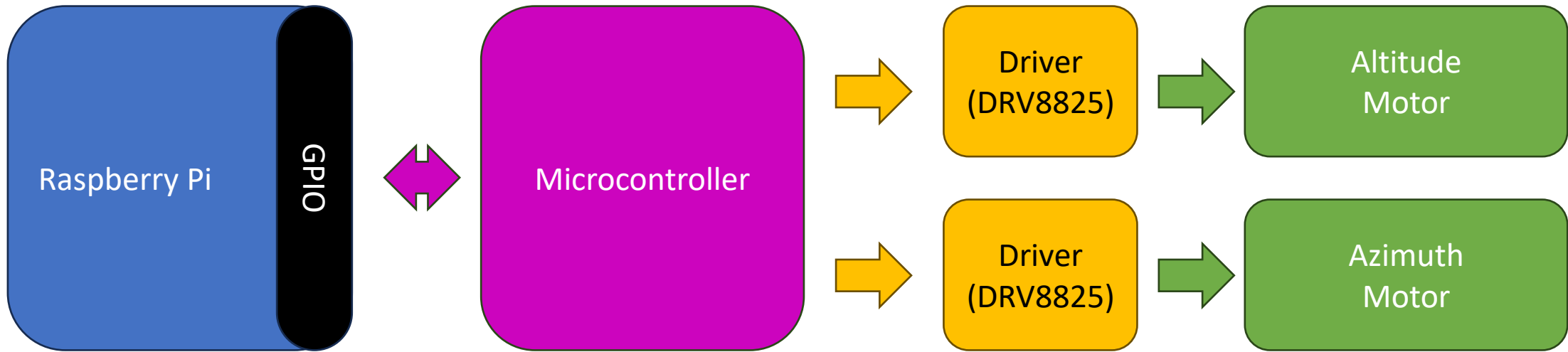
WE CAN ADD DRV8825 STEPPER MOTOR DRIVER CHIPS.



DRV8825 TAKES LOW POWER SIGNALS FROM PROCESSORS TO CONTROL HIGHER CURRENT/VOLTAGE POWER DIRECTLY TO THE STEPPER MOTORS.

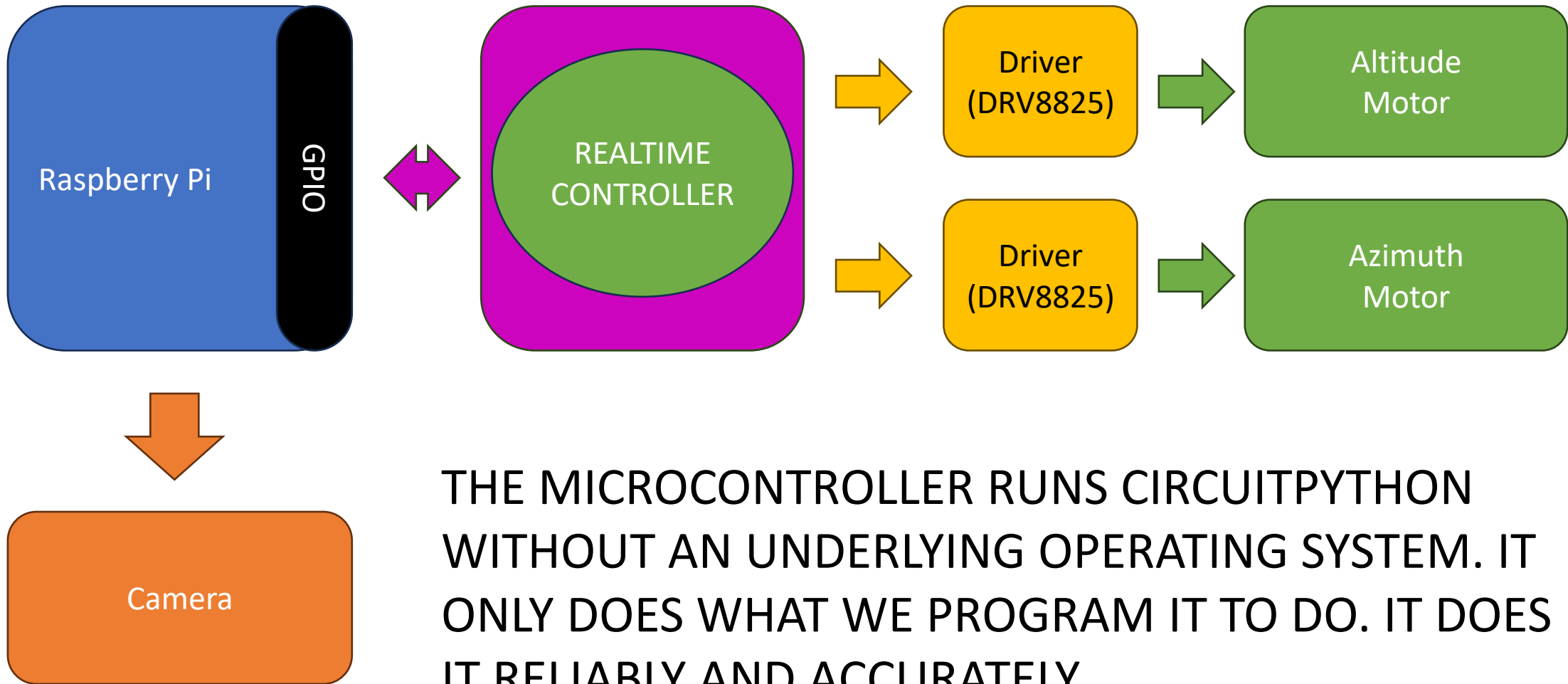


THERE IS ANOTHER PROBLEM:
THE MOTORS MUST MOVE TO VERY PRECISE
TIMING. THE RPi IS A LINUX MULTITASKING
OPERATING SYSTEM. SOMETIMES IT IS BUSY DOING
OTHER THINGS. THE MOTORS WILL NOT BE
SMOOTH.

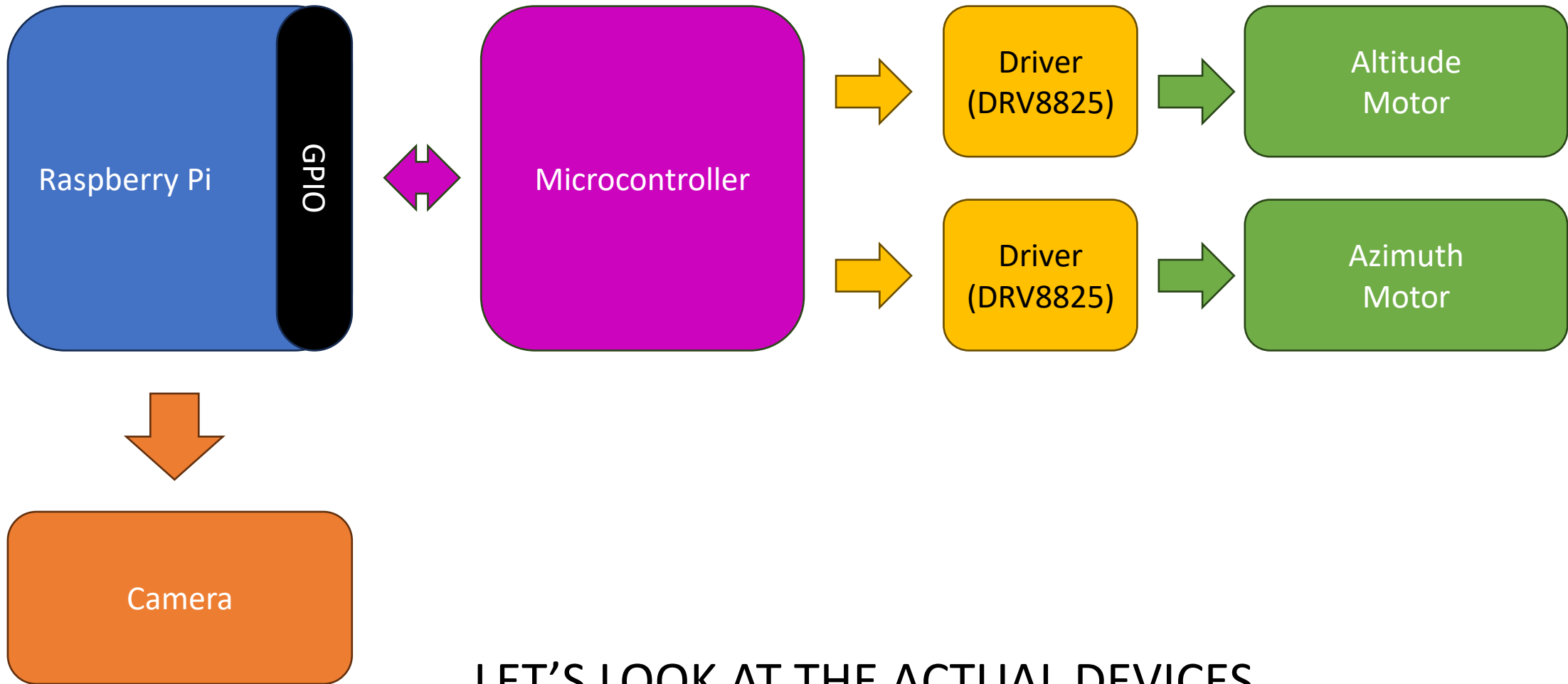


THERE IS A SOLUTION:

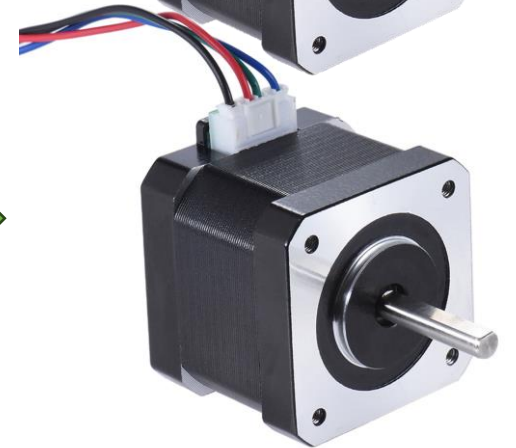
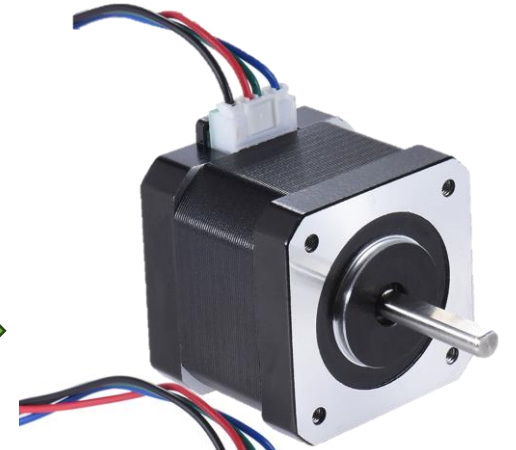
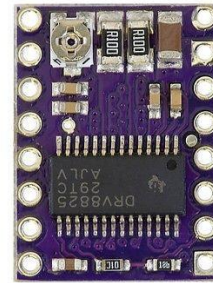
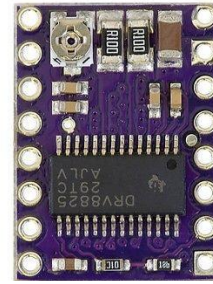
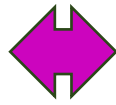
INSERT A MICROCONTROLLER WHICH CAN PROVIDE RELIABLE SIGNALS TO THE MOTORS. EVEN IF THE RPi IS BUSY!



THE MICROCONTROLLER RUNS CIRCUITPYTHON WITHOUT AN UNDERLYING OPERATING SYSTEM. IT ONLY DOES WHAT WE PROGRAM IT TO DO. IT DOES IT RELIABLY AND ACCURATELY.

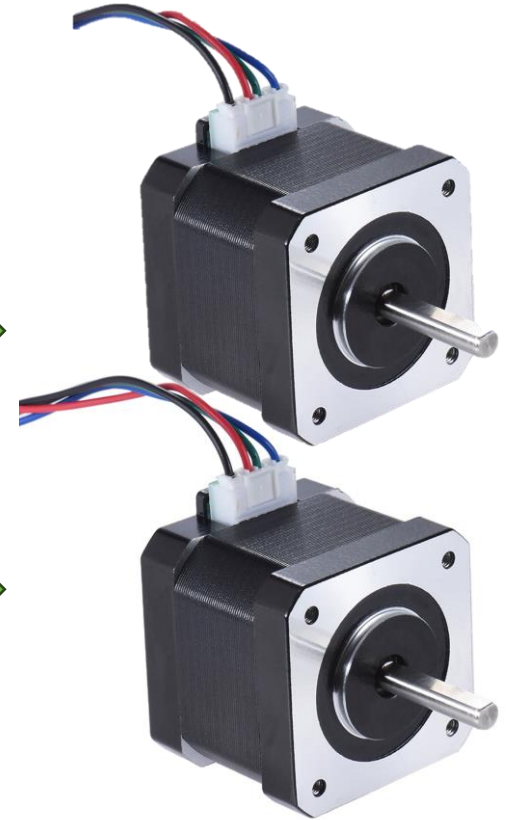
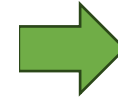
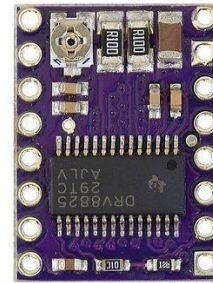
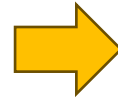
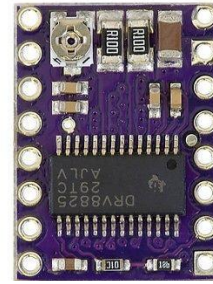


LET'S LOOK AT THE ACTUAL DEVICES...

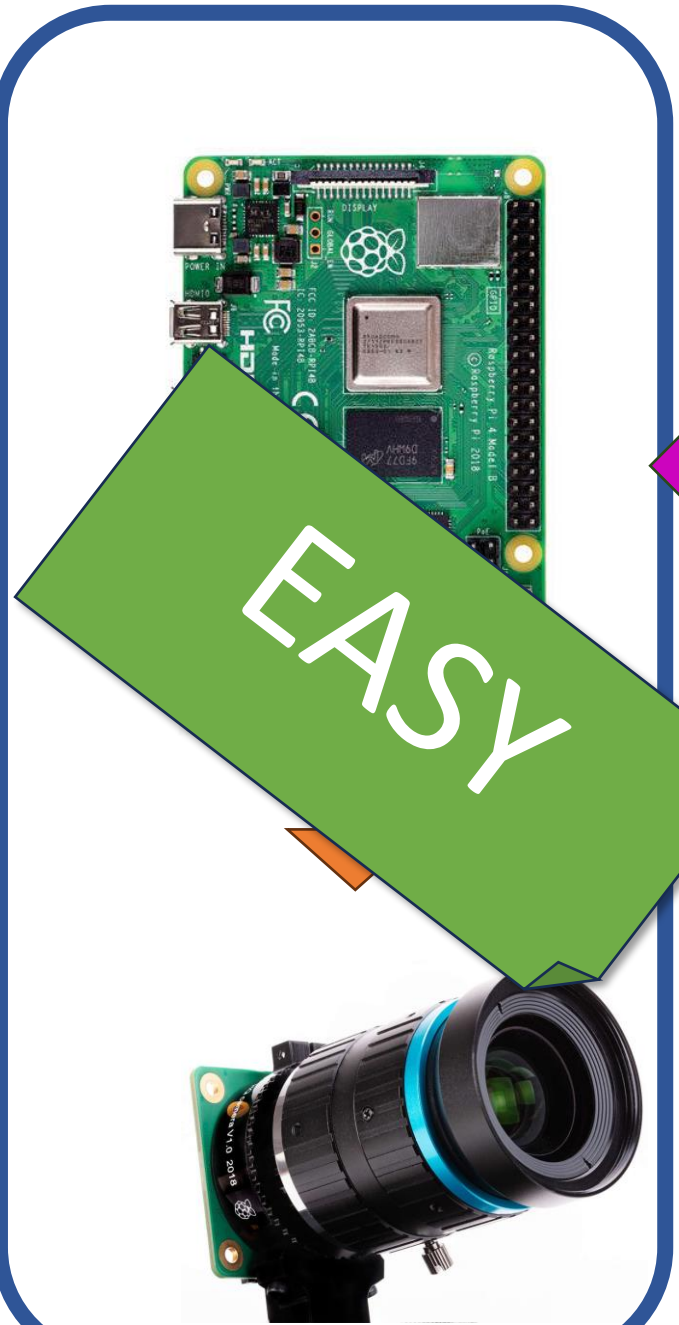


THE DEVICES LOOK LIKE THIS IN REALITY.

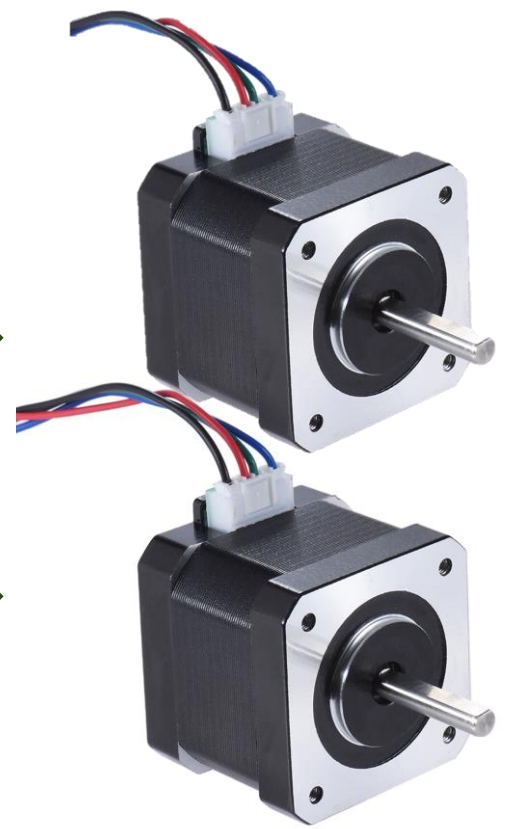
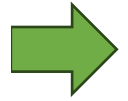
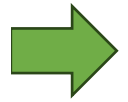
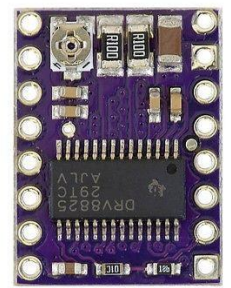
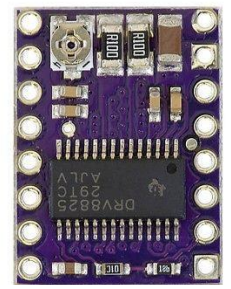
WE HAVE TO CONSTRUCT A CIRCUIT TO LINK THESE TOGETHER.



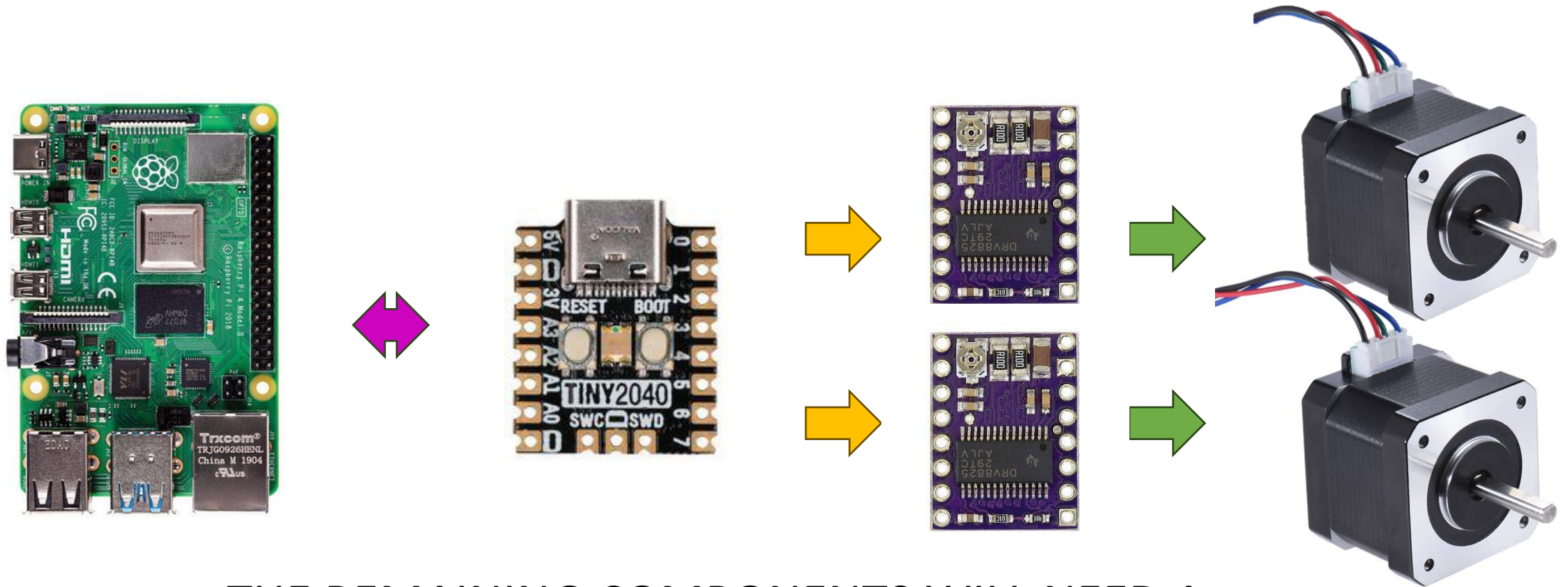
CONNECTING THE CAMERA IS WELL DOCUMENTED ONLINE.



EASY

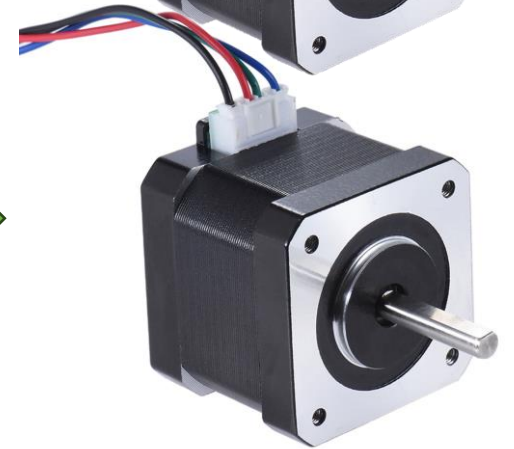
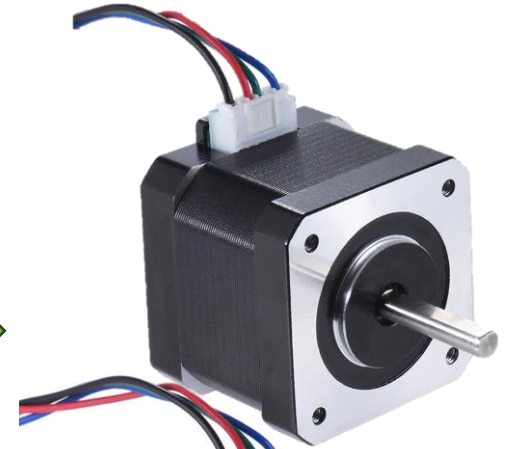
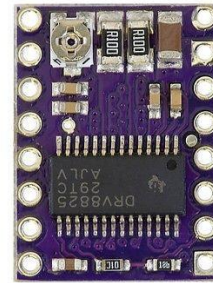
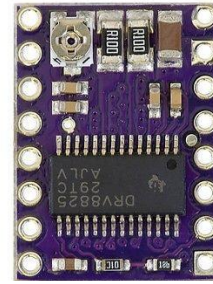
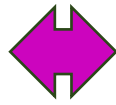
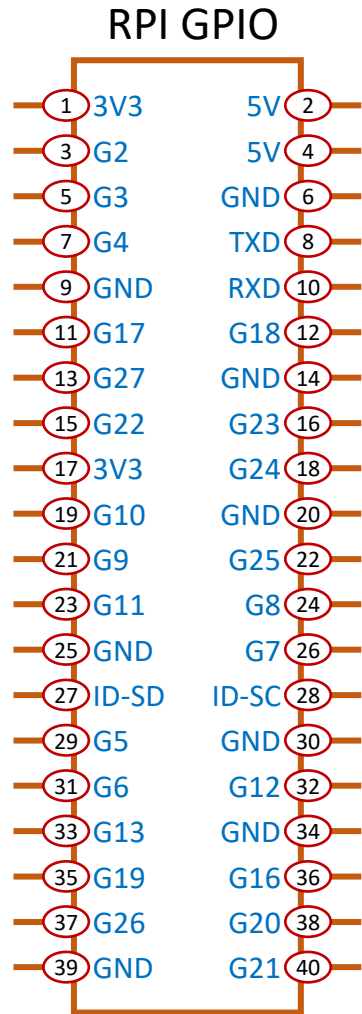


WE DON'T NEED TO DO ANYTHING SPECIAL WITH THE CAMERA. JUST CONNECT IT AS EXPECTED.



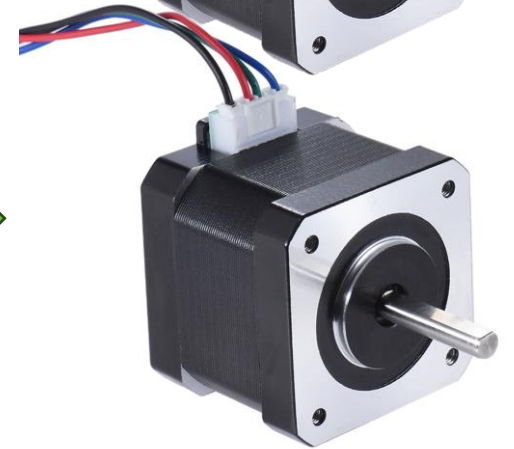
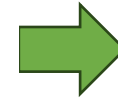
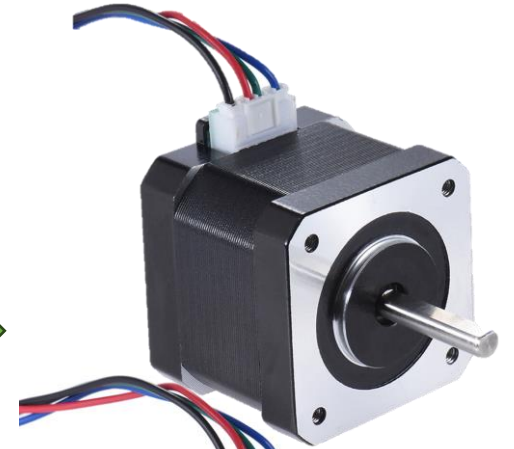
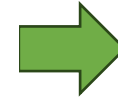
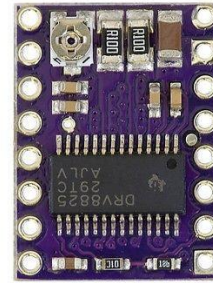
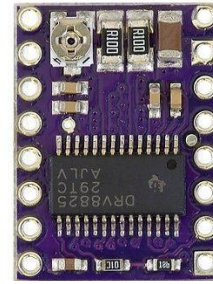
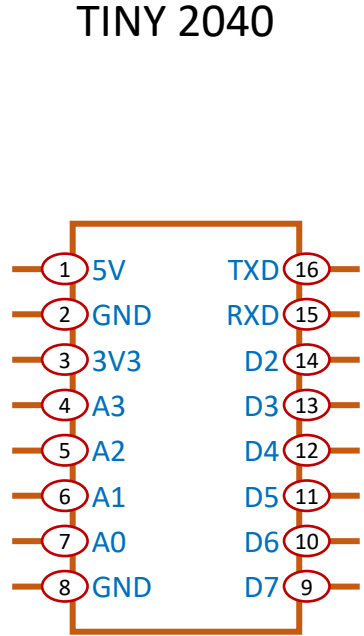
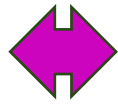
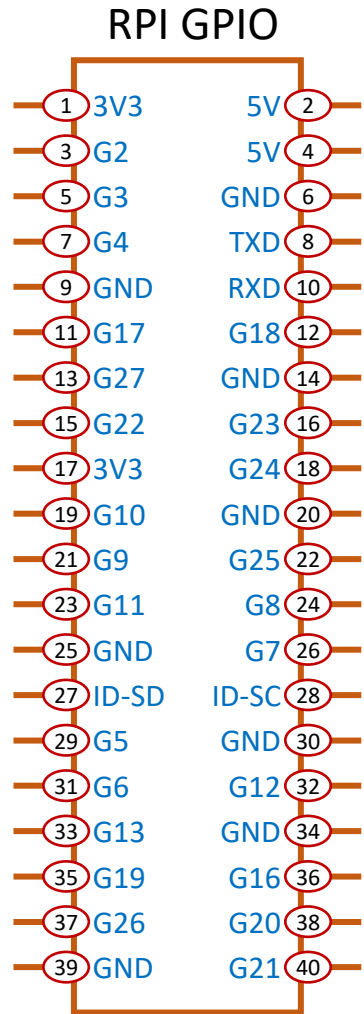
THE REMAINING COMPONENTS WILL NEED A CIRCUIT BOARD OF SOME SORT.

THIS WILL CONNECT THE VARIOUS I/O PINS IN ORDER TO CREATE A WORKING MOTOR CONTROL SYSTEM.

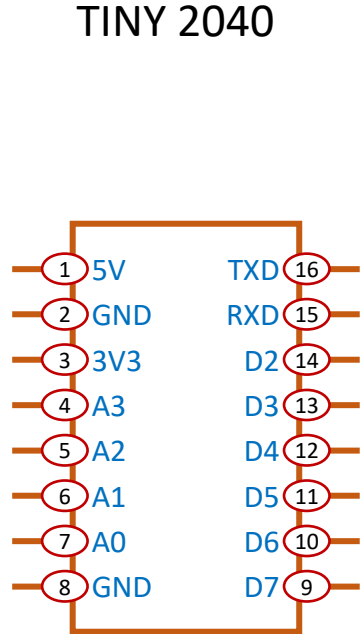
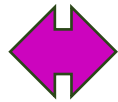
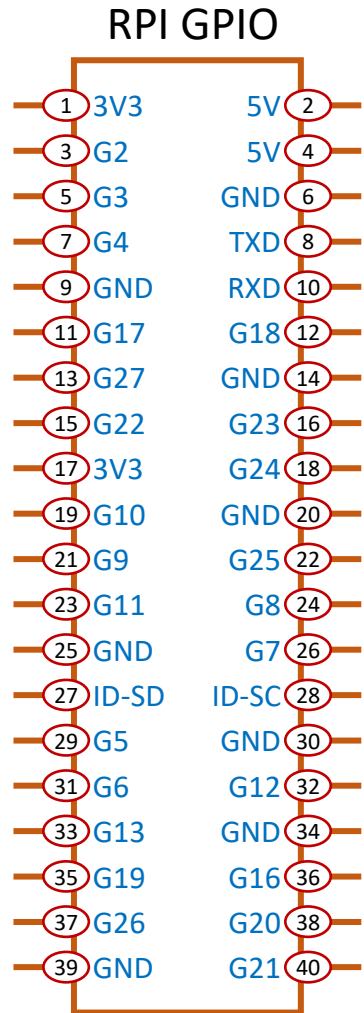


WE WILL CONNECT TO THE RASPBERRY PI GPIO HEADER.

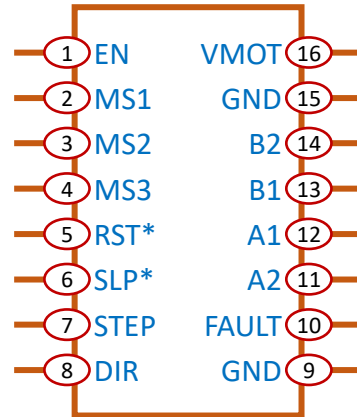
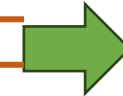
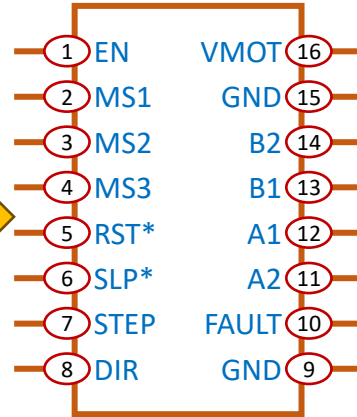
THE RPi REMAINS IN OVERALL CONTROL.



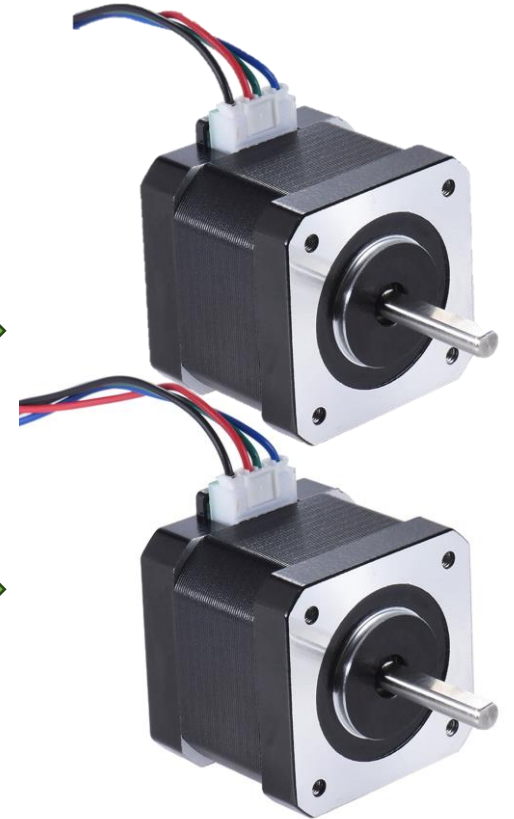
THE PIMORONI TINY 2040 MICROCONTROLLER WILL TALK BETWEEN THE RPi AND THE DRV8825 CHIPS. THERE IS ONE DRV8825 CHIP FOR EACH MOTOR THAT WE CONTROL.



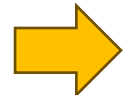
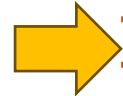
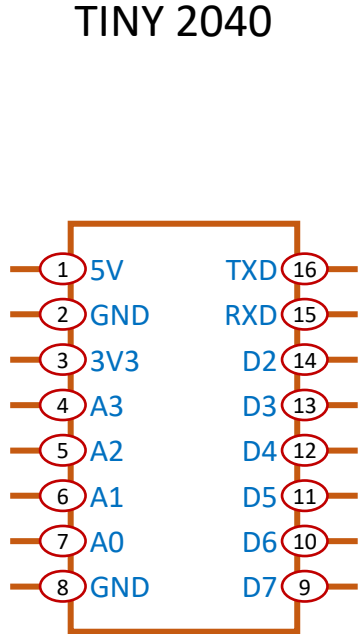
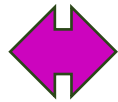
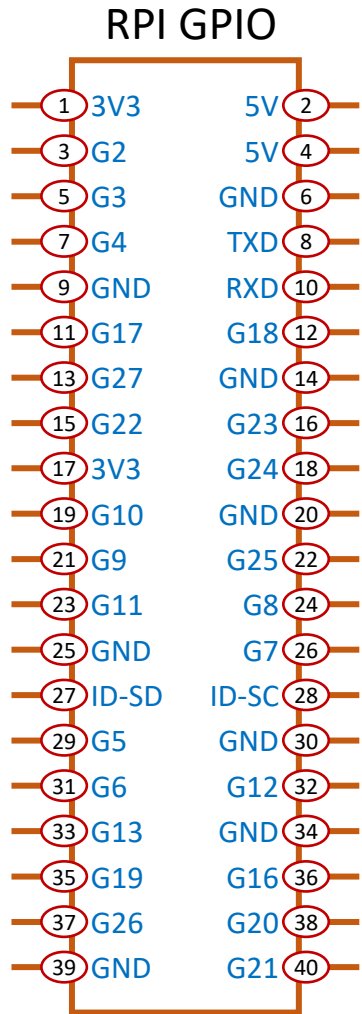
DRV8825 (ALTITUDE)



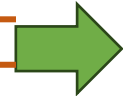
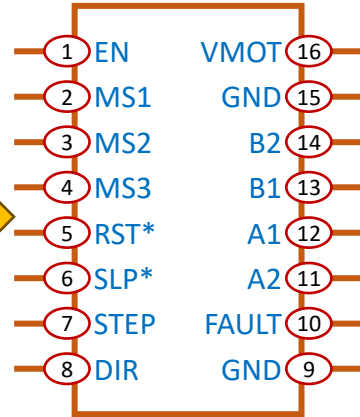
DRV8825 (AZIMUTH)



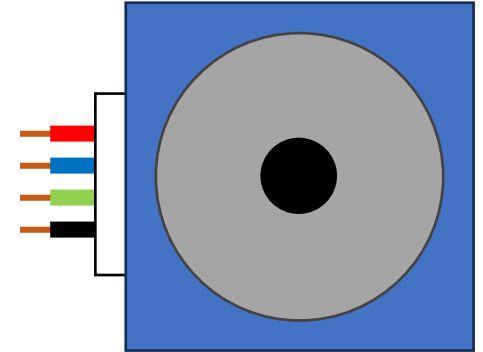
THE DRV8825 CHIPS
COME ON AN EASILY
CONNECTED BOARD.



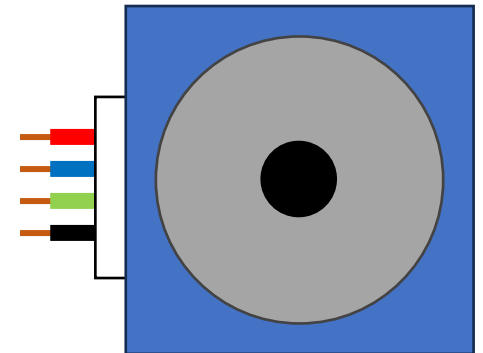
DRV8825
(ALTITUDE)



ALTITUDE

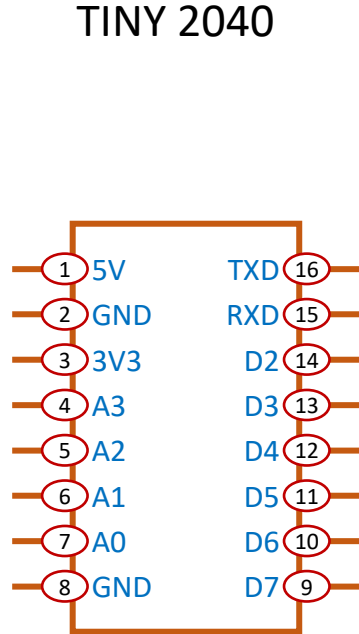
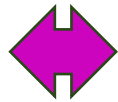
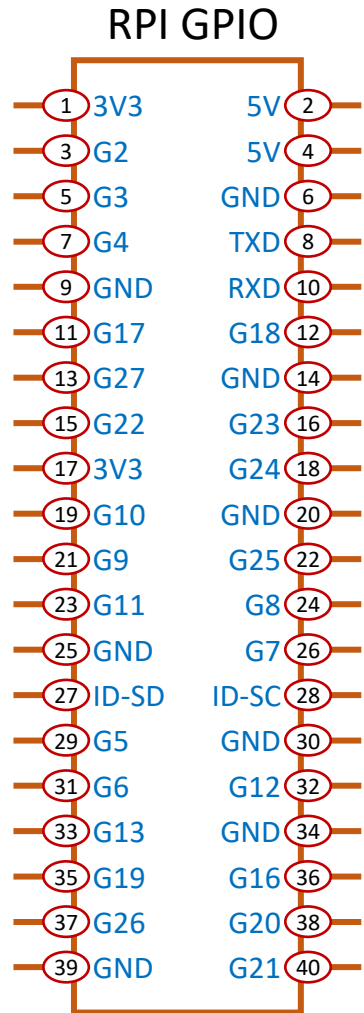


AZIMUTH

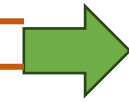
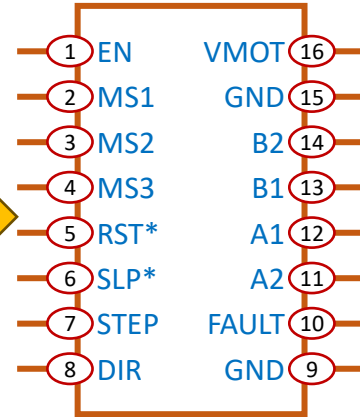


THE NEMA 17 STEPPER MOTORS HAVE 4 COLORED CABLES TO CONNECT TO THE DRV8825 CHIPS.

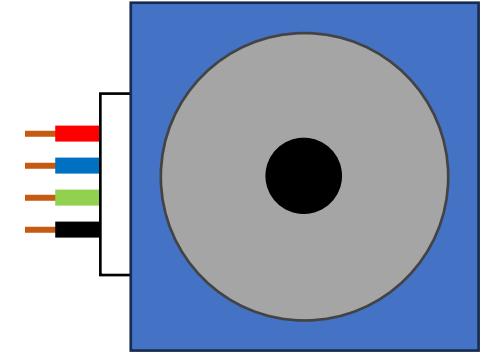
DRV8825
(AZIMUTH)



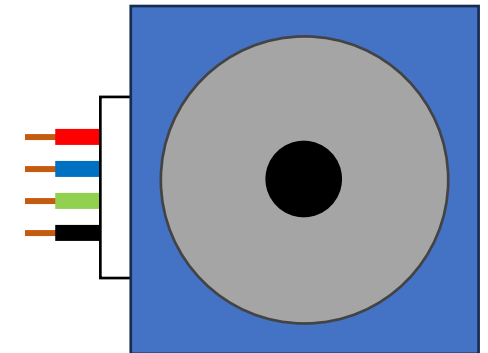
DRV8825 (ALTITUDE)



ALTITUDE

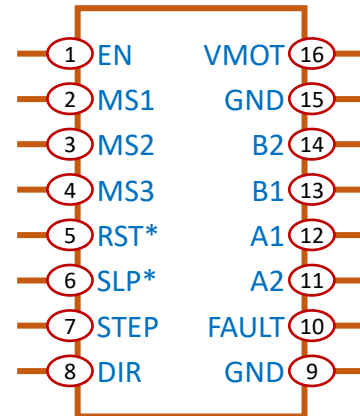


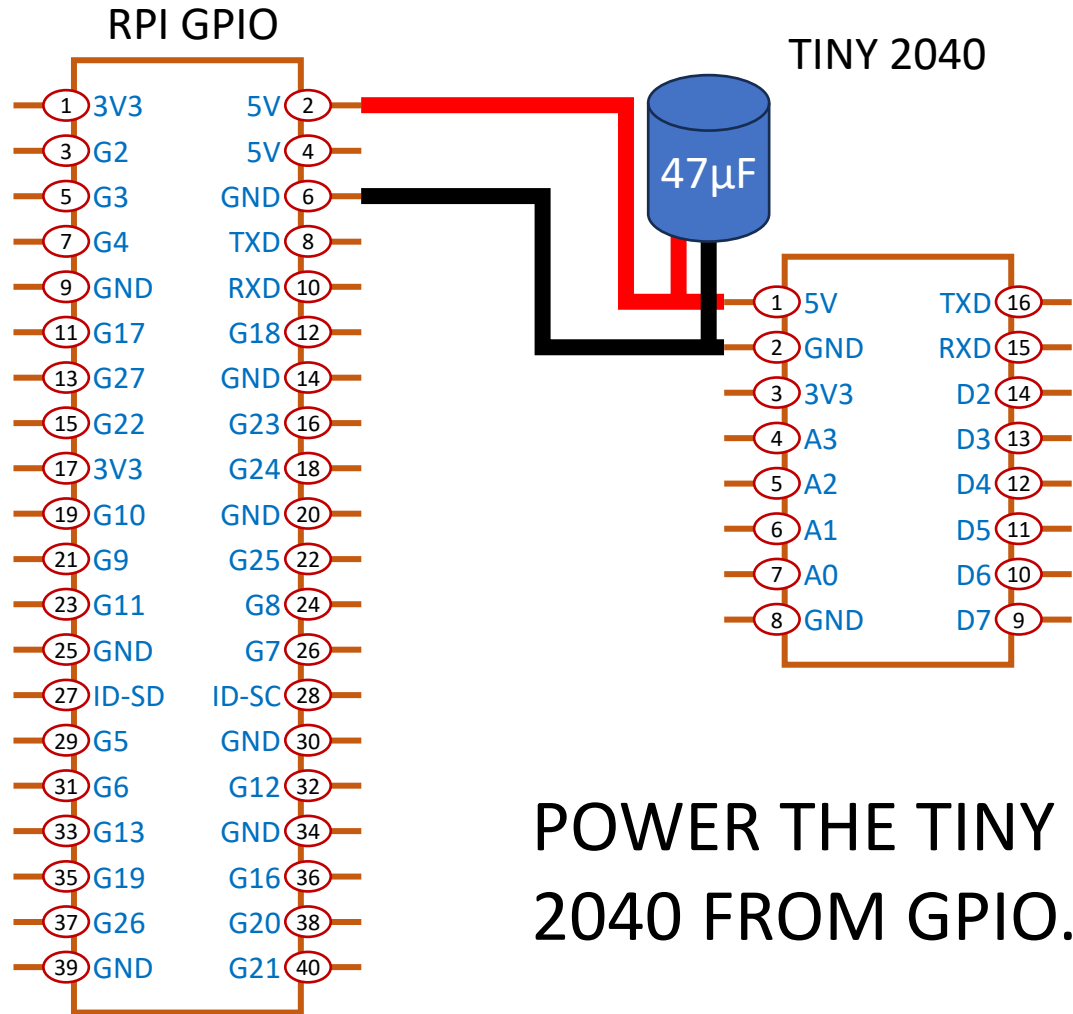
AZIMUTH



WE CAN WORK THROUGH
THE VARIOUS
CONNECTIONS IN TURN.

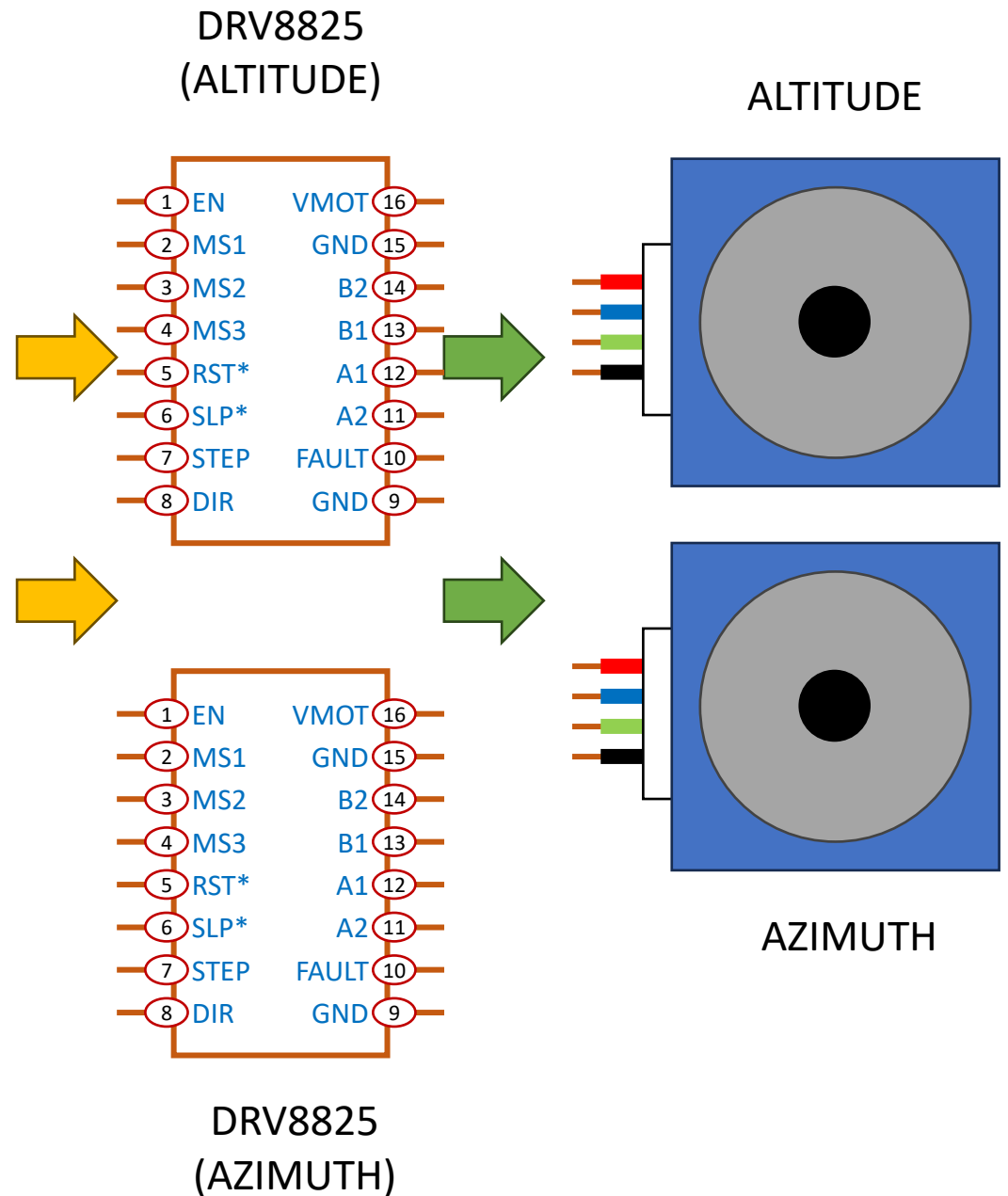
DRV8825 (AZIMUTH)

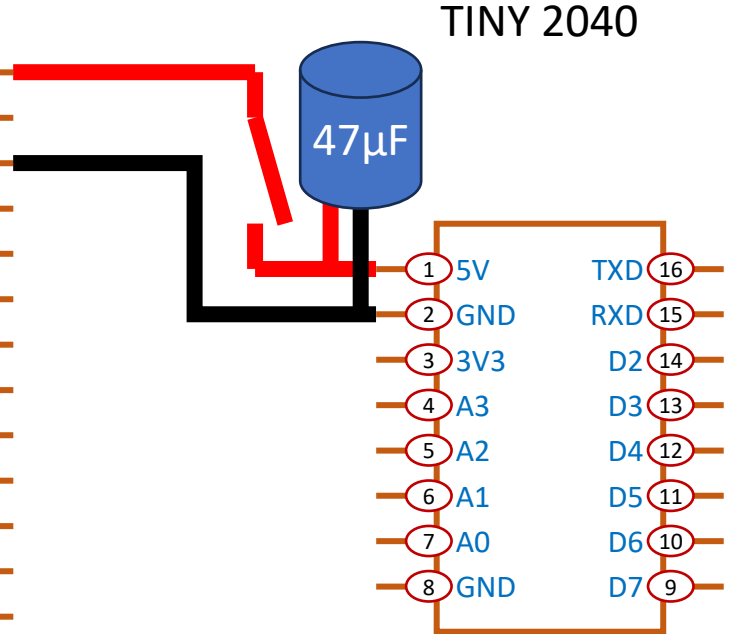
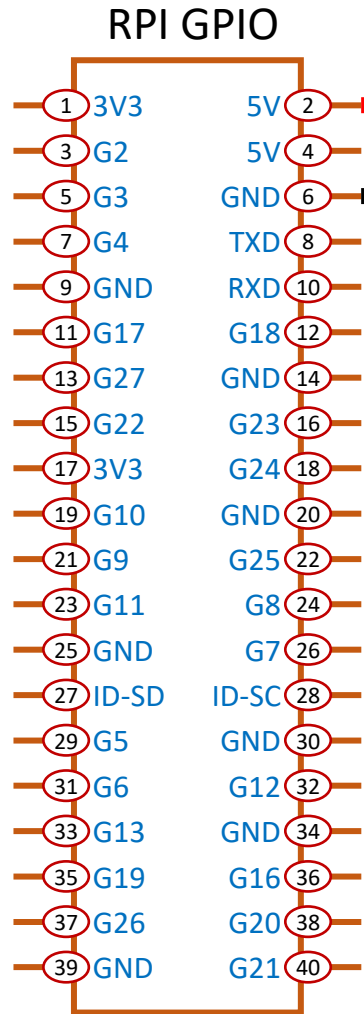




POWER THE TINY 2040 FROM GPIO.

PROBLEM: NO ABILITY TO RESET!

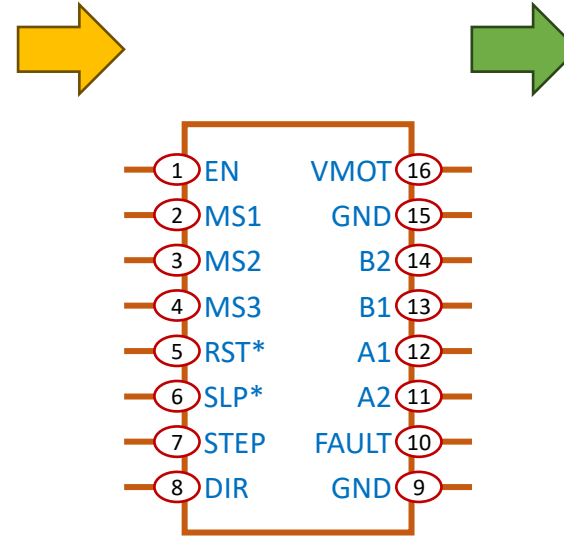
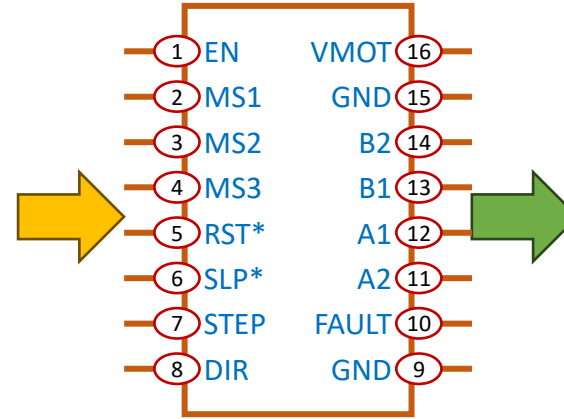




POWER THE TINY 2040 FROM GPIO.

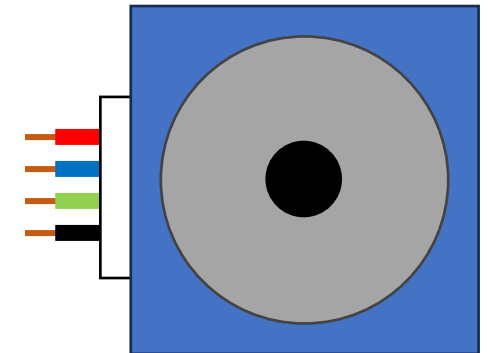
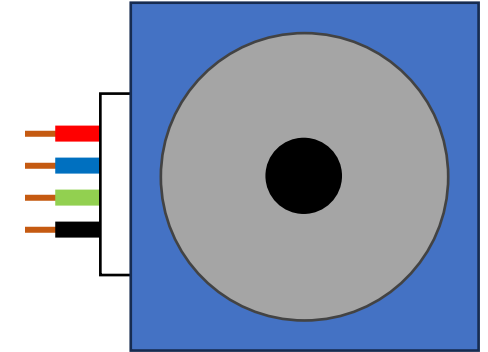
WE NEED A SWITCH

DRV8825
(ALTITUDE)

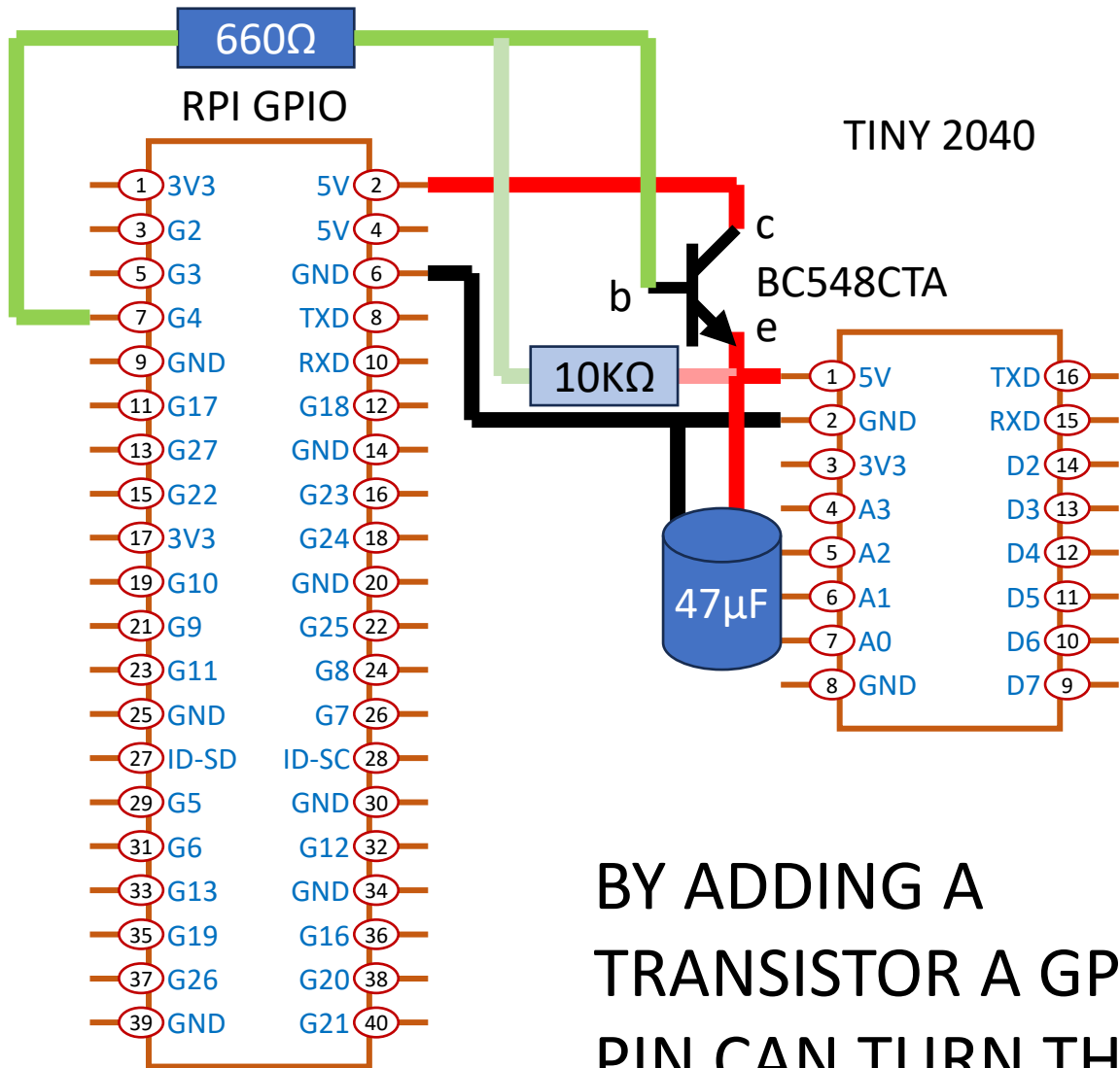


DRV8825
(AZIMUTH)

ALTITUDE

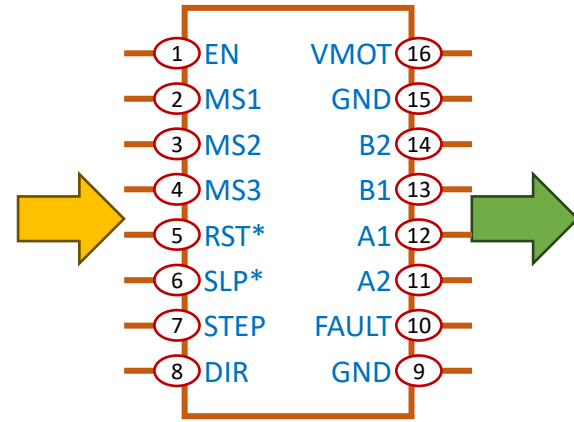


AZIMUTH

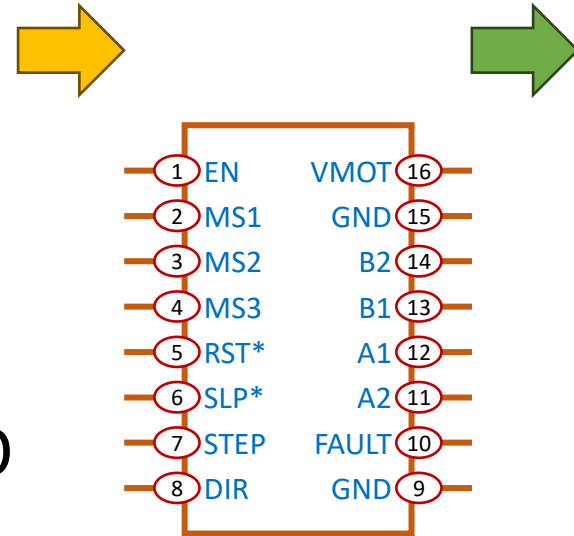
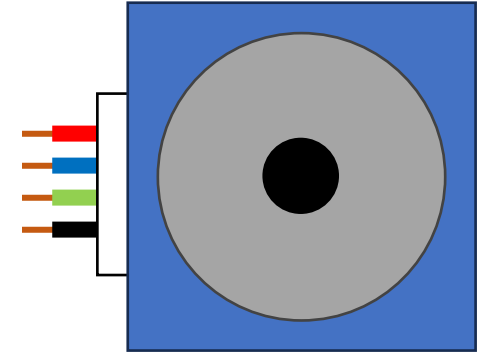


BY ADDING A TRANSISTOR A GPIO PIN CAN TURN THE TINY 2040 ON/OFF.

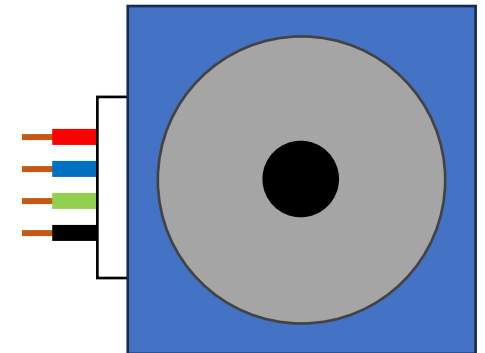
DRV8825 (ALTITUDE)



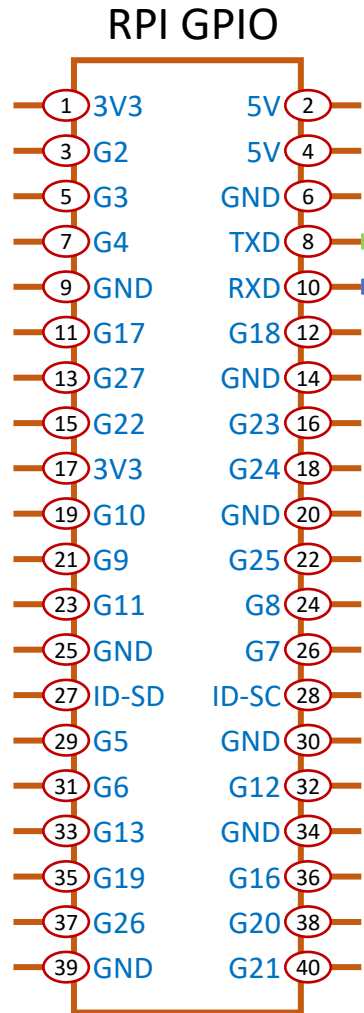
ALTITUDE



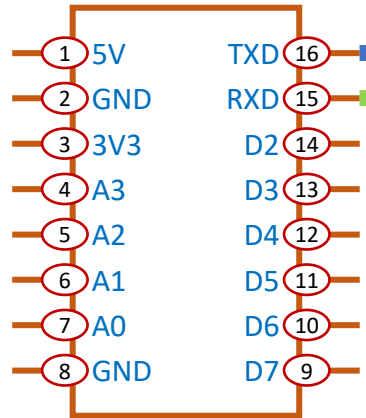
AZIMUTH



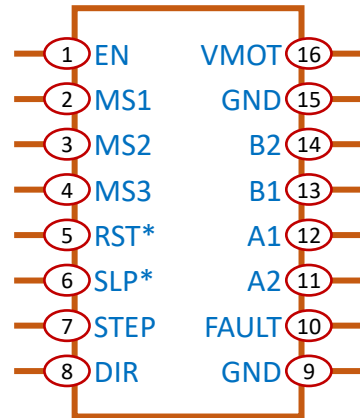
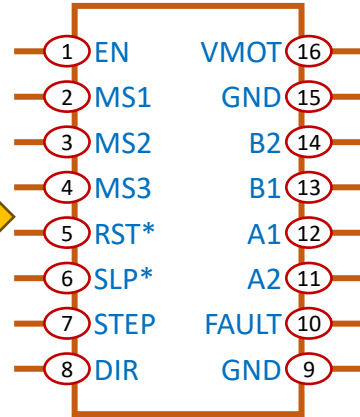
DRV8825 (AZIMUTH)



TINY 2040

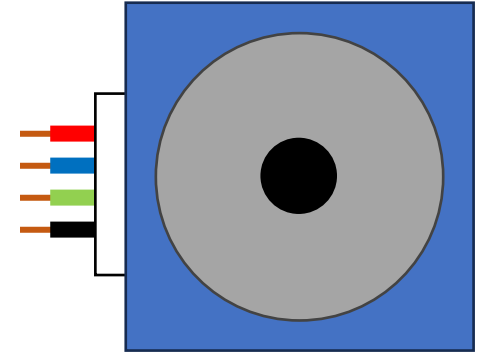


**DRV8825
(ALTITUDE)**

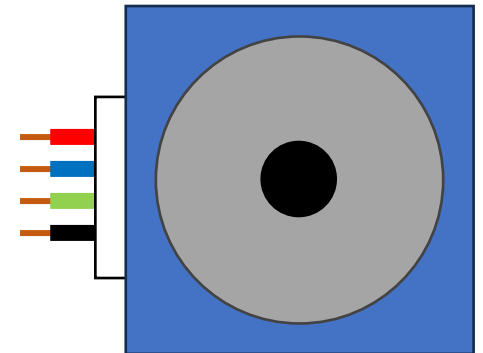


**DRV8825
(AZIMUTH)**

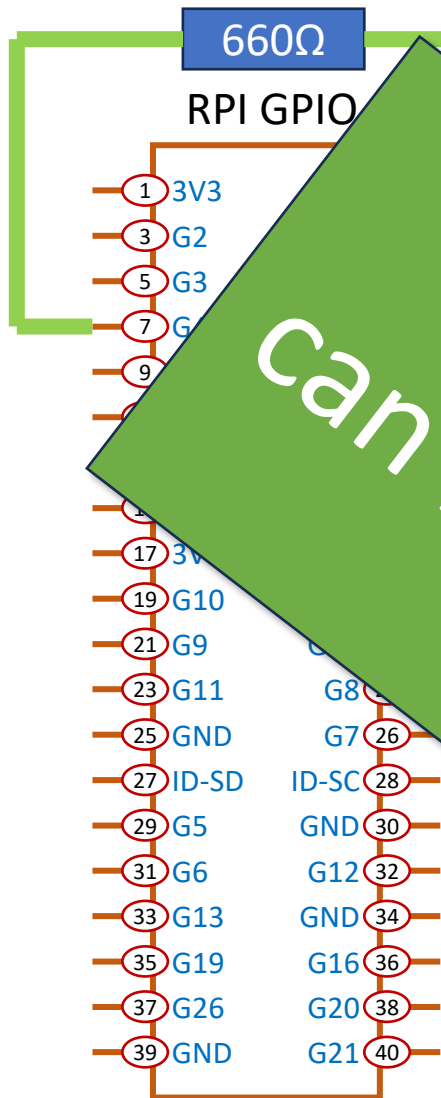
ALTITUDE



AZIMUTH



**CONNECT UART
(GPIO) TXD -> RXD (TINY)
(GPIO) RXD -> TXD (TINY)**

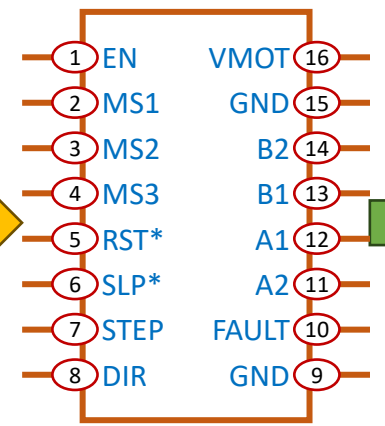


660Ω
RPI GPIO

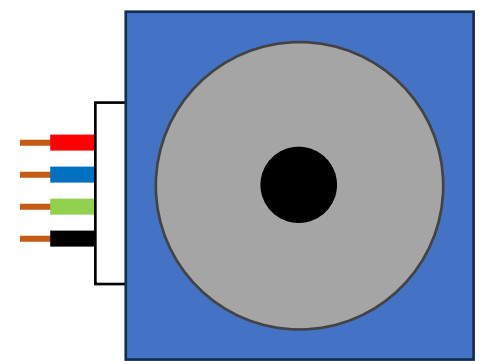
TINY 2040

BC548CTA

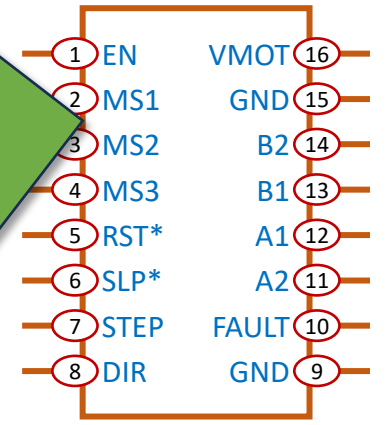
DRV8825
(ALTITUDE)



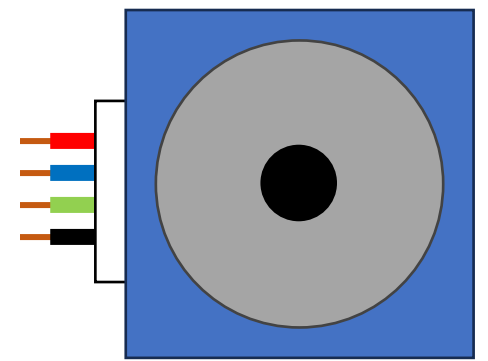
ALTITUDE



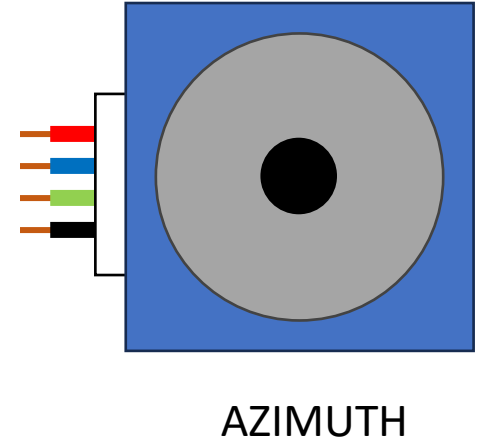
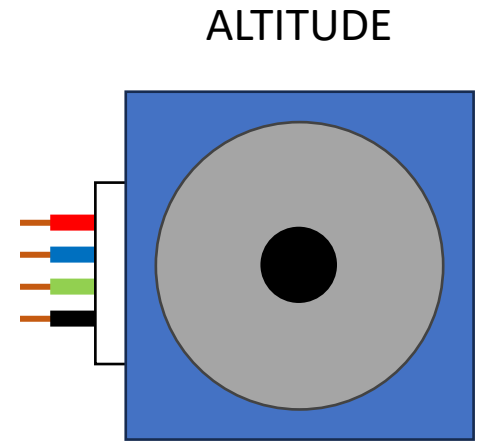
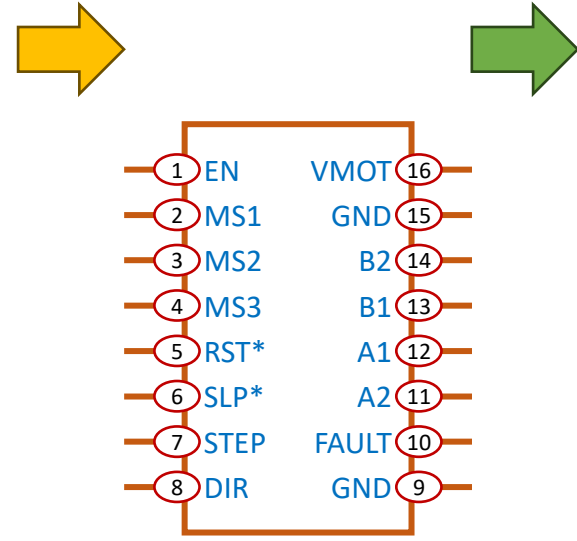
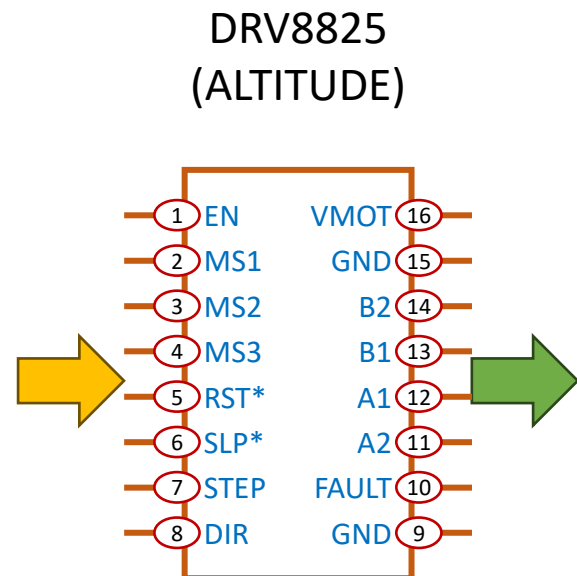
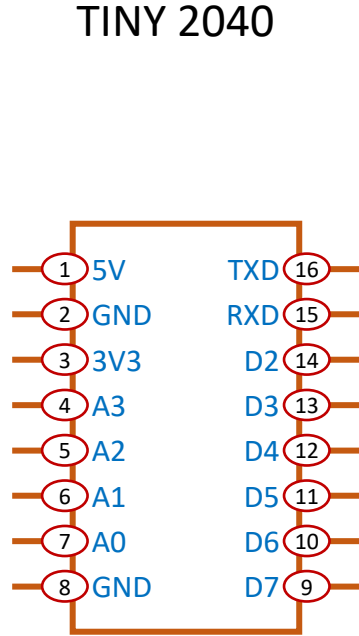
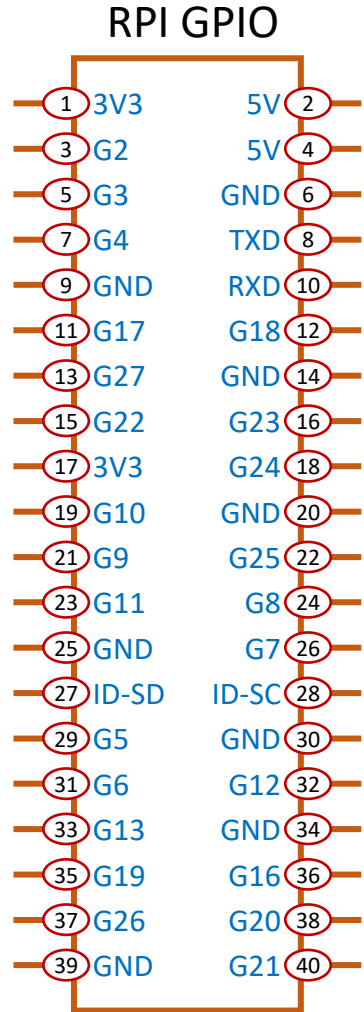
DRV8825
(AZIMUTH)



AZIMUTH

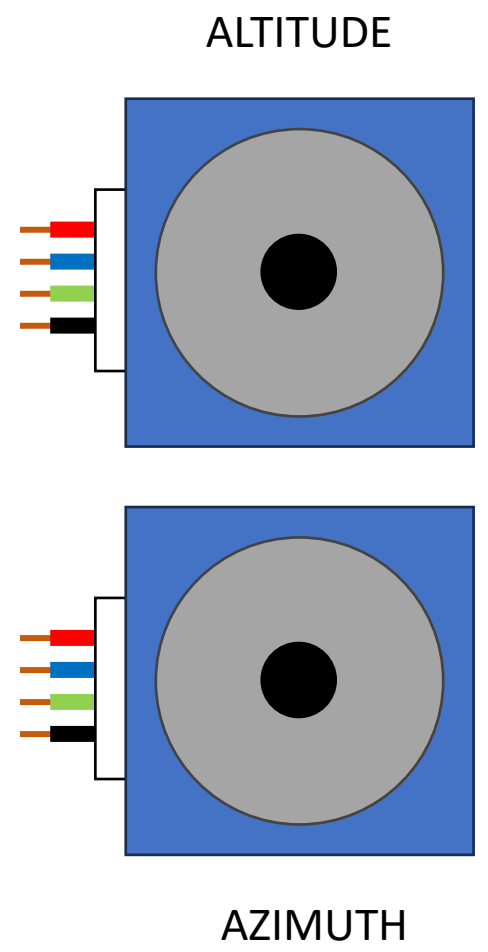
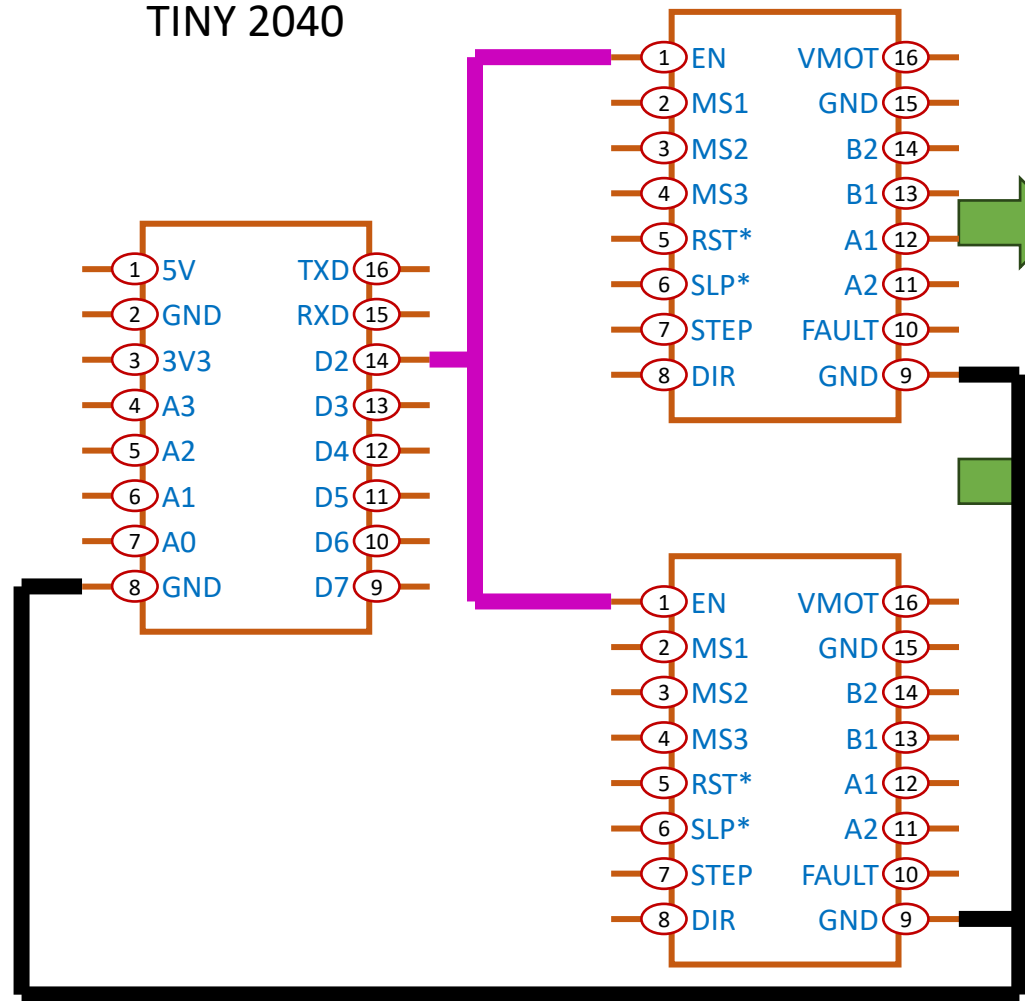
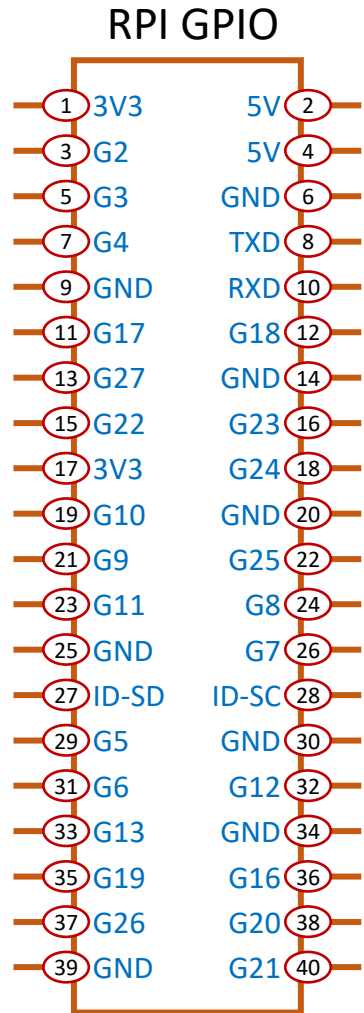


RPi Pi-lomar
can be tested now!

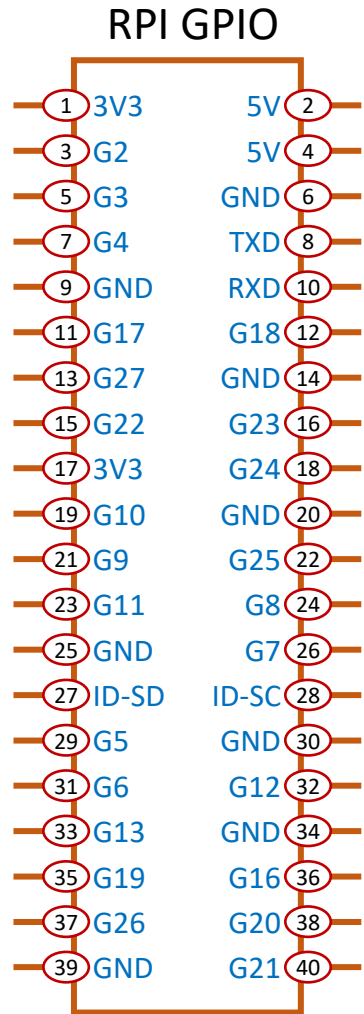


CONNECTING THE DRV8825 CHIPS

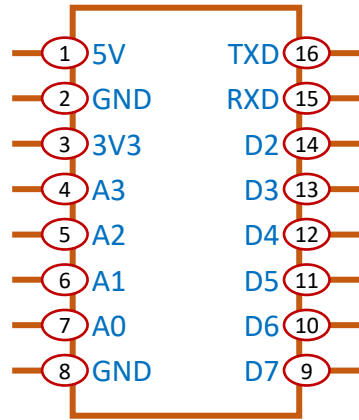
DRV8825 (AZIMUTH)



TINY 2040 D2 -> ENABLE
 GND - GND



TINY 2040



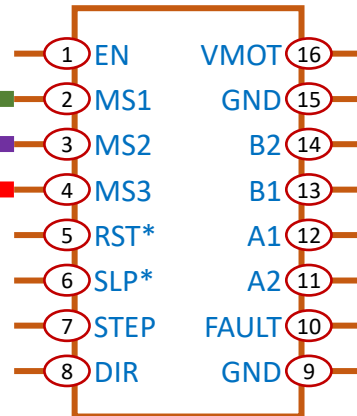
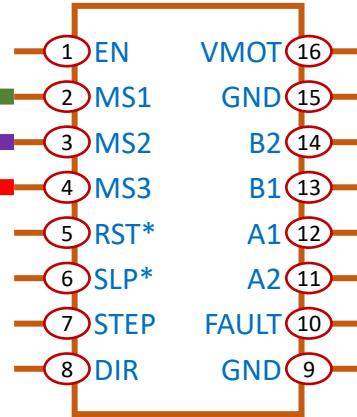
STEPPER MODE

TINY 2040 D3 -> M1

TINY 2040 D4 -> M2

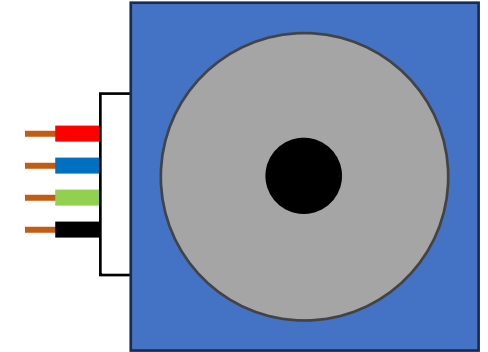
TINY 2040 D5 -> M3

DRV8825
(ALTITUDE)

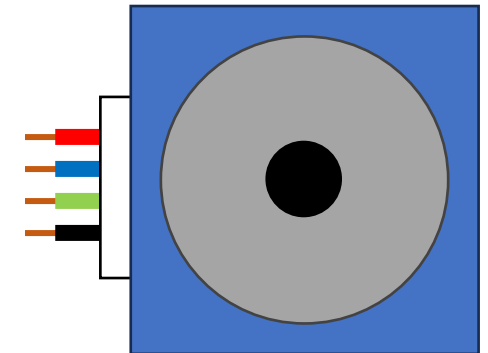


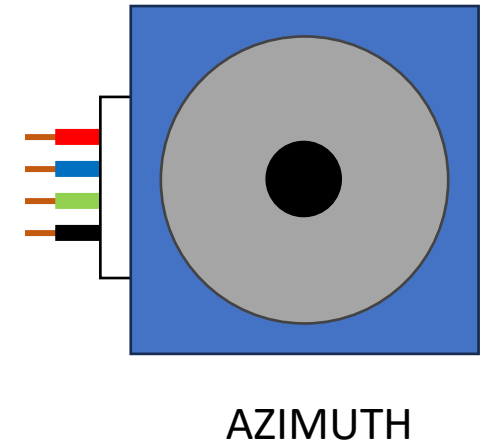
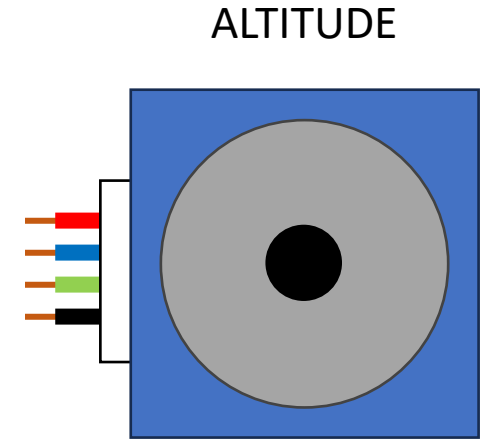
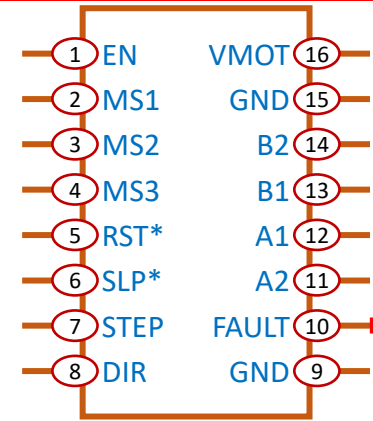
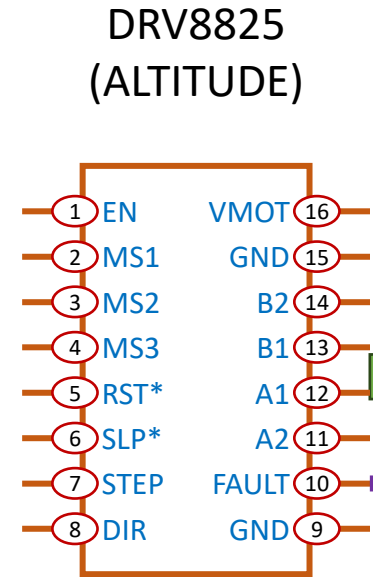
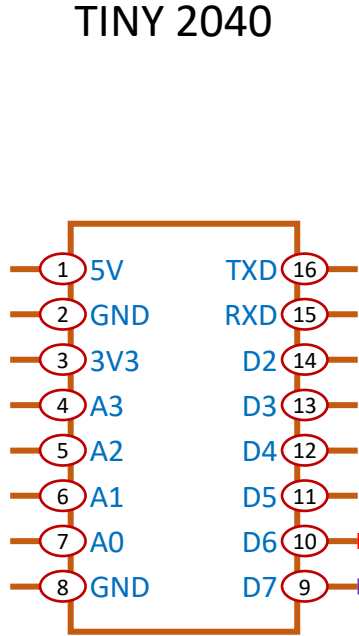
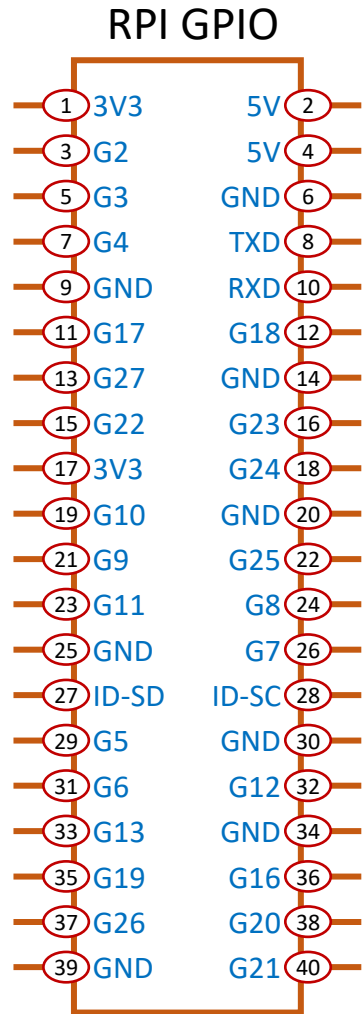
DRV8825
(AZIMUTH)

ALTITUDE



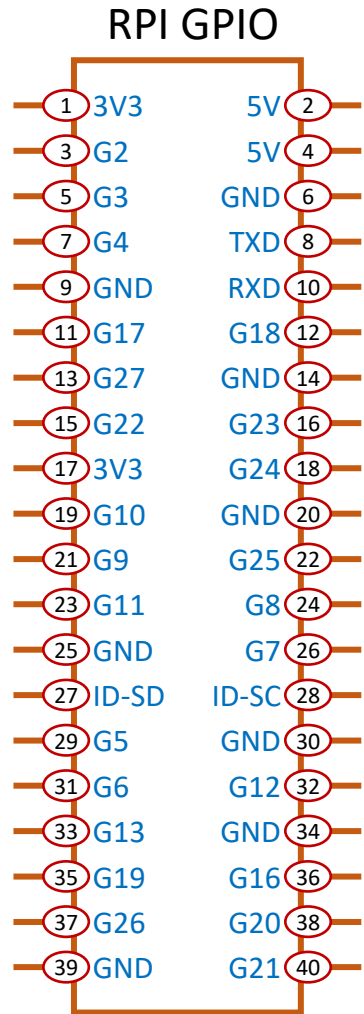
AZIMUTH



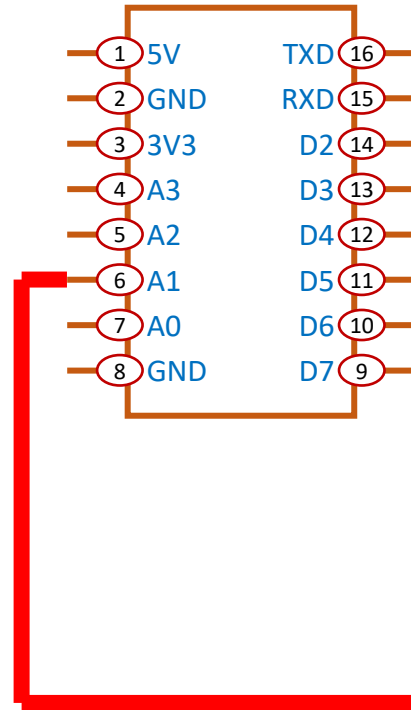


DETECT DRIVER FAULTS

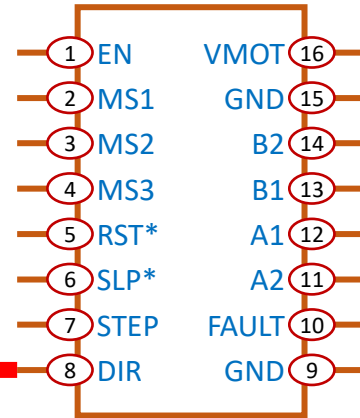
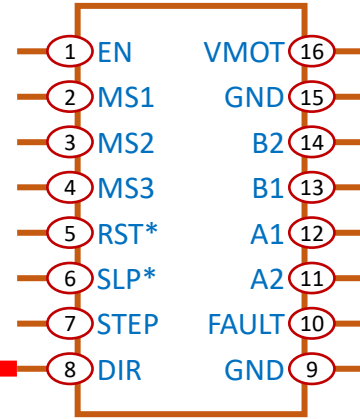
DRV8825 (AZIMUTH)



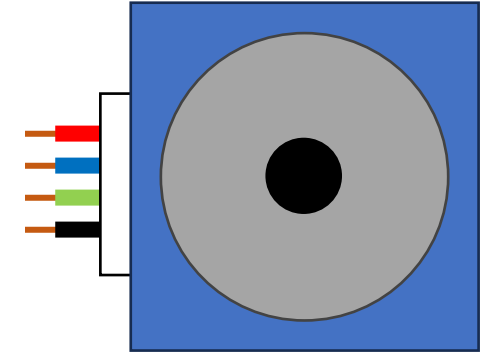
TINY 2040



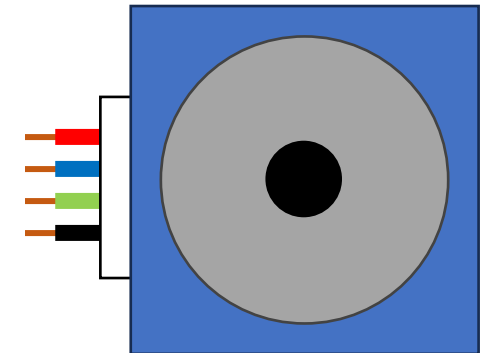
DRV8825
(ALTITUDE)



ALTITUDE

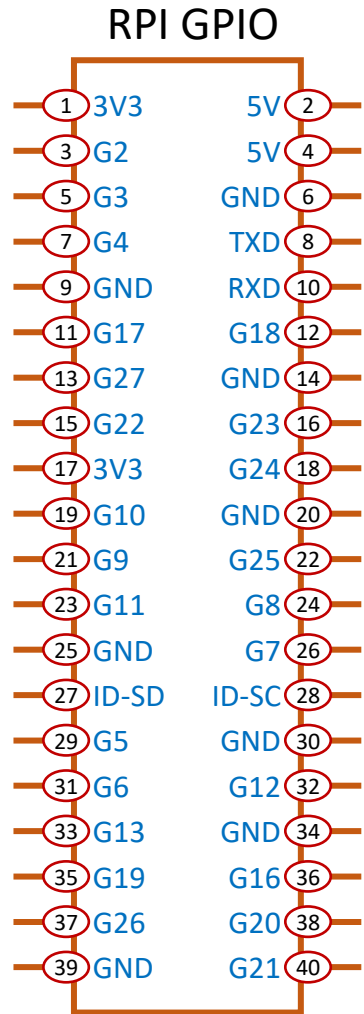


AZIMUTH

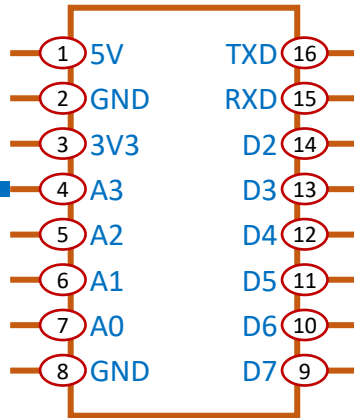


CONTROL MOTOR
DIRECTION

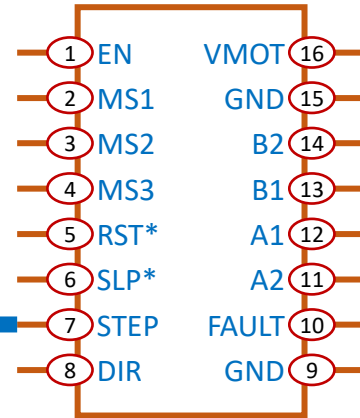
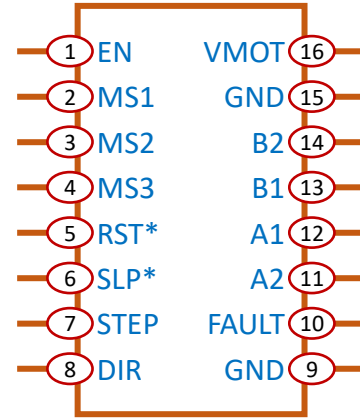
DRV8825
(AZIMUTH)



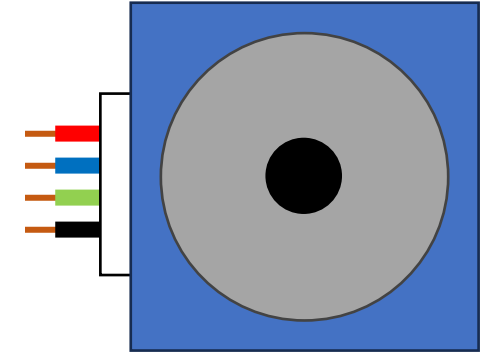
TINY 2040



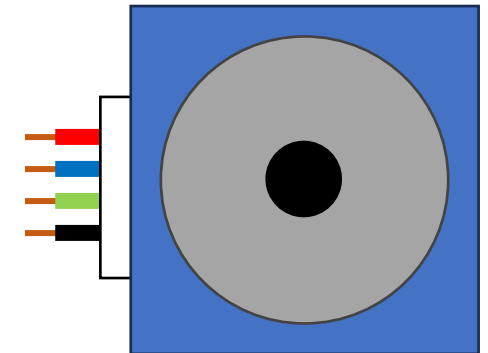
DRV8825
(ALTITUDE)



ALTITUDE

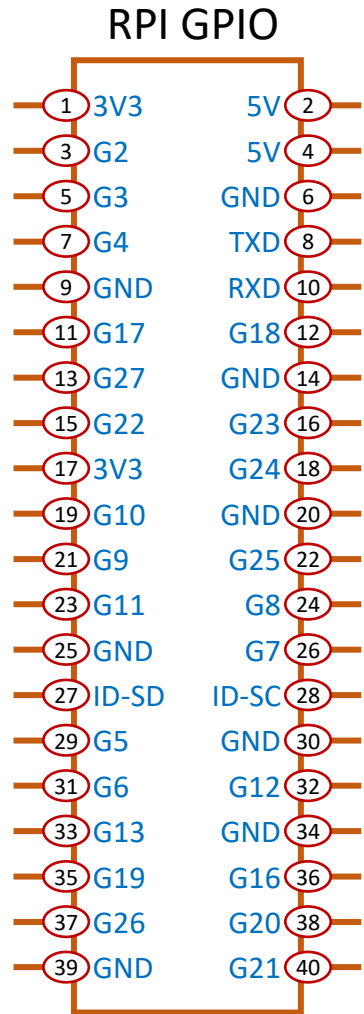


AZIMUTH

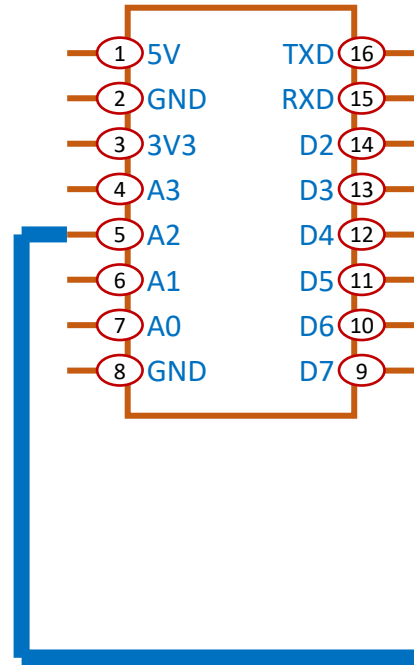


MOTOR MOVE SIGNAL
(STEP)

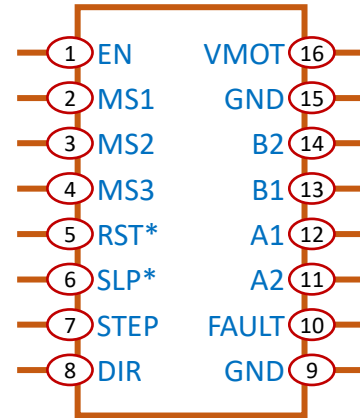
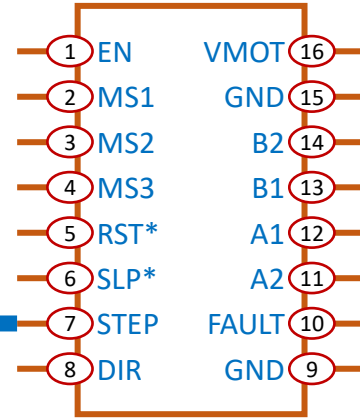
DRV8825
(AZIMUTH)



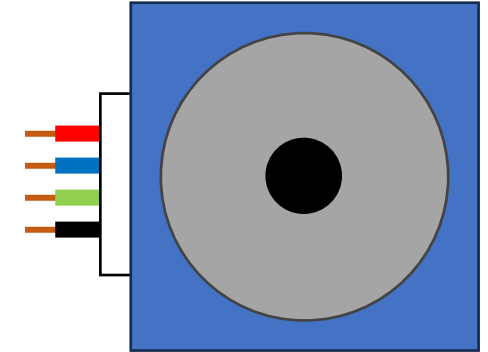
TINY 2040



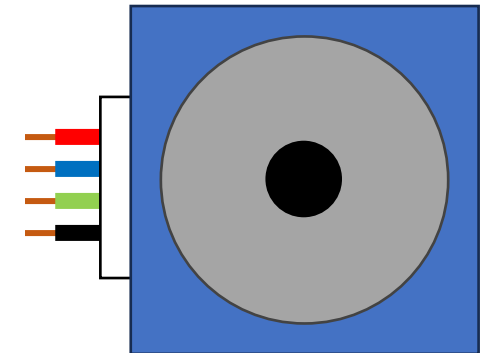
DRV8825
(ALTITUDE)



ALTITUDE

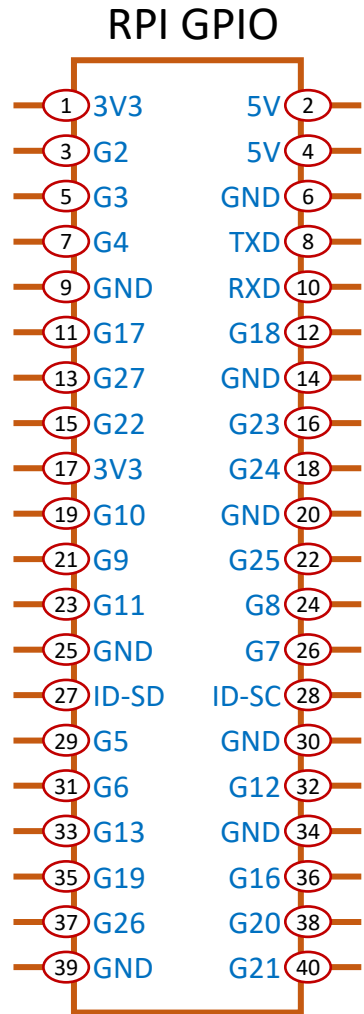


AZIMUTH

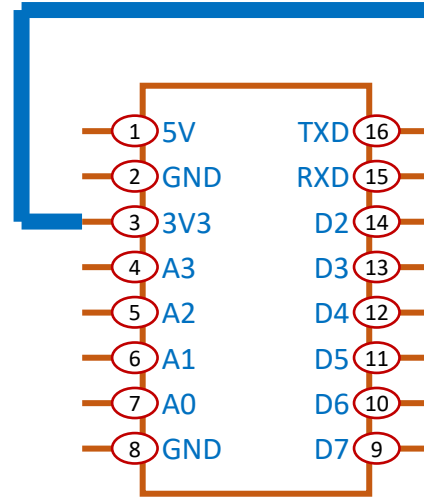


MOTOR MOVE SIGNAL
(STEP)

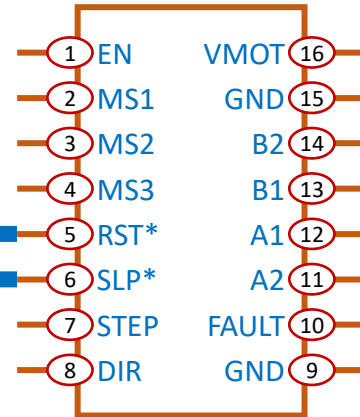
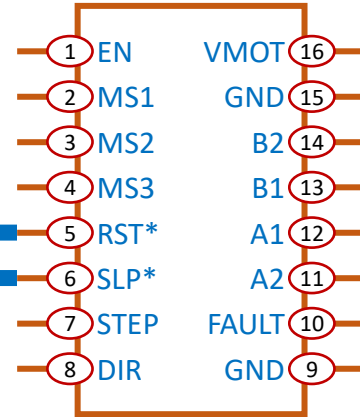
DRV8825
(AZIMUTH)



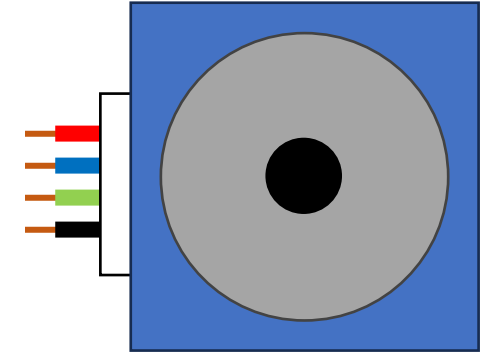
TINY 2040



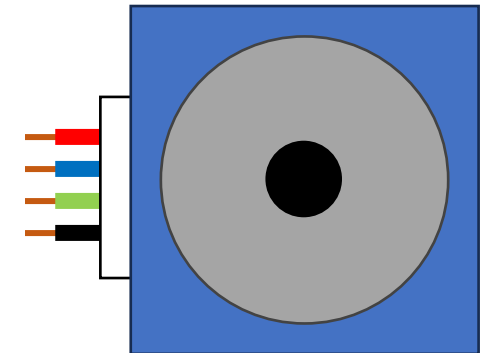
DRV8825
(ALTITUDE)



ALTITUDE

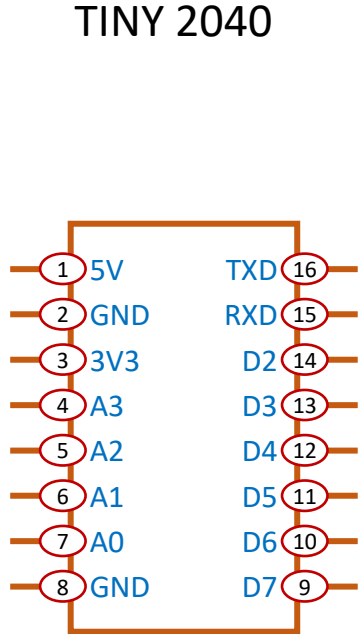
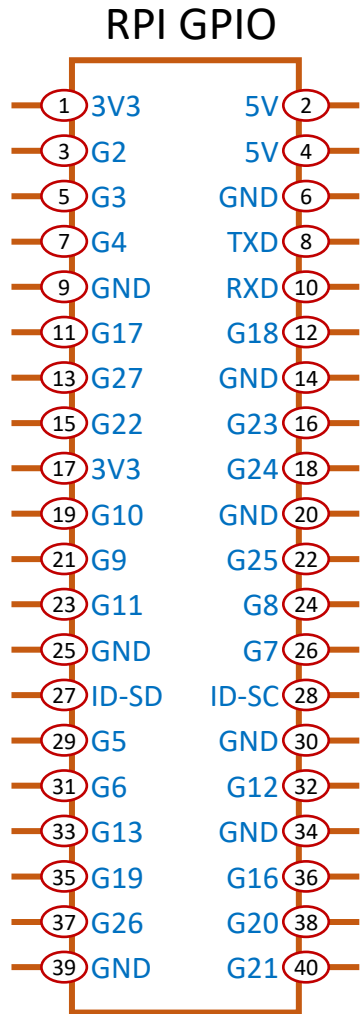


AZIMUTH

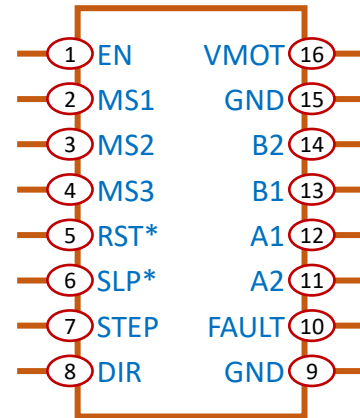
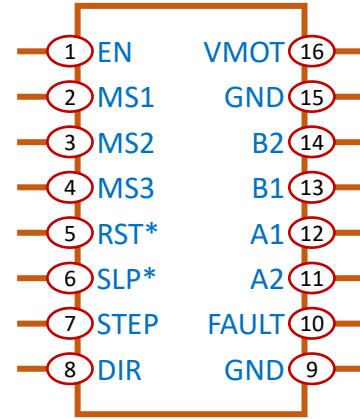


RESET and SLEEP
(Not used)

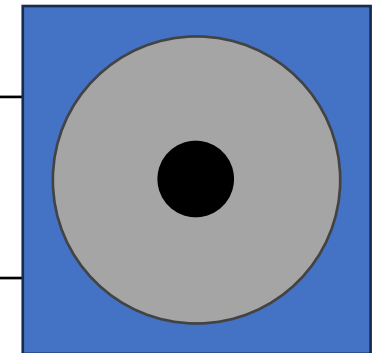
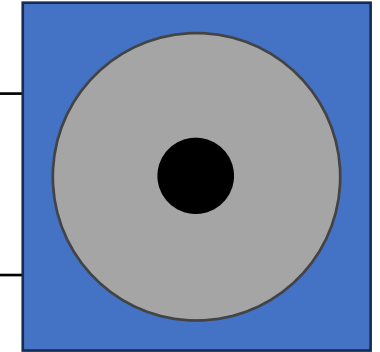
DRV8825
(AZIMUTH)



DRV8825 (ALTITUDE)



ALTITUDE

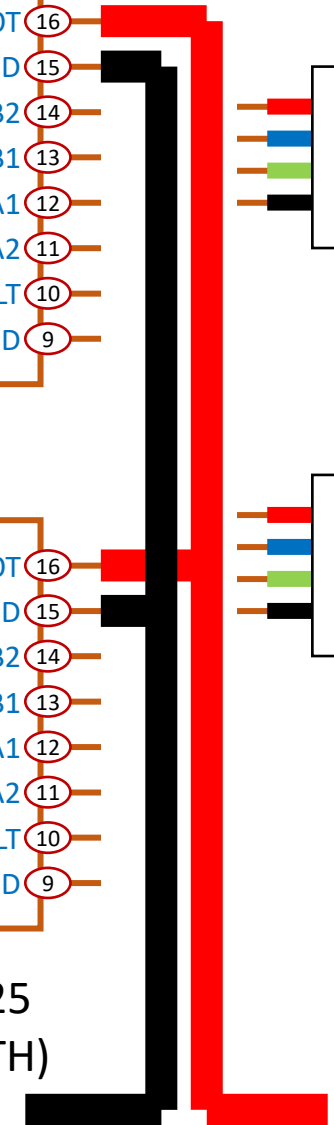


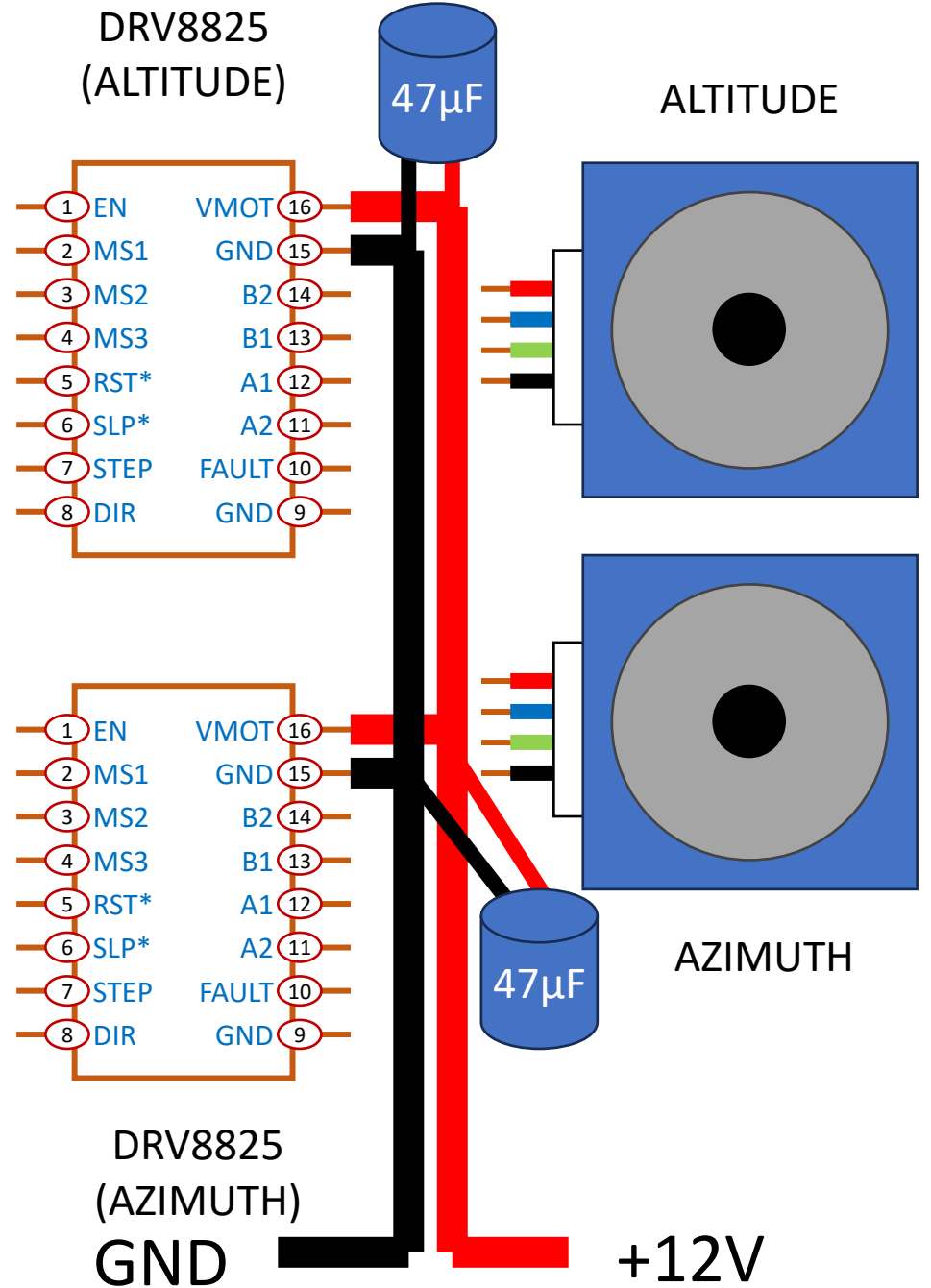
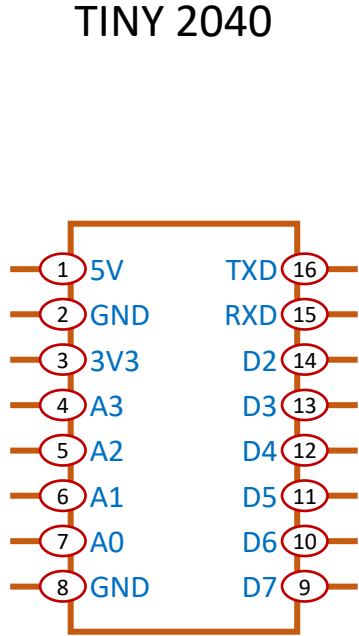
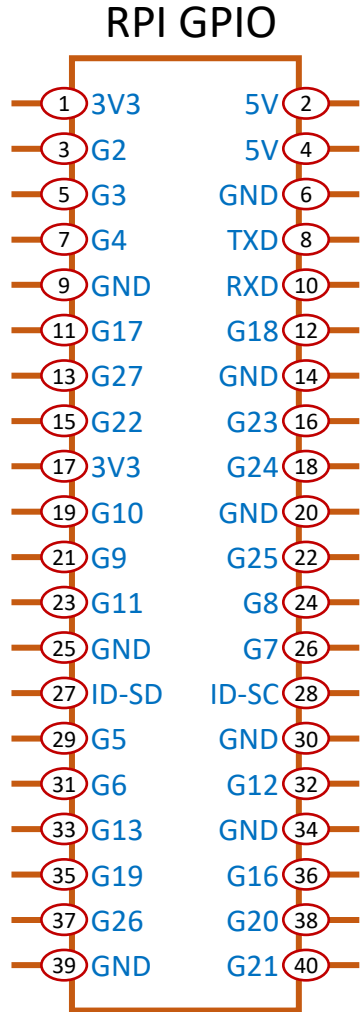
AZIMUTH

12V POWER TO THE MOTORS

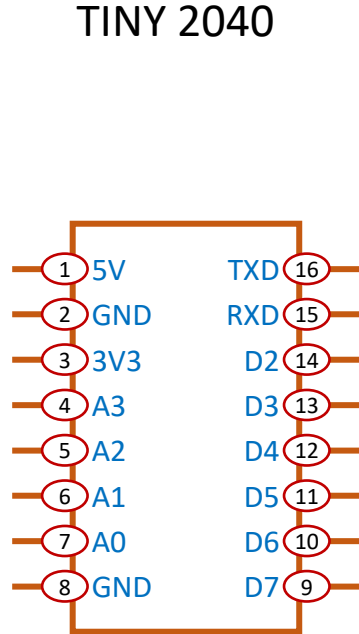
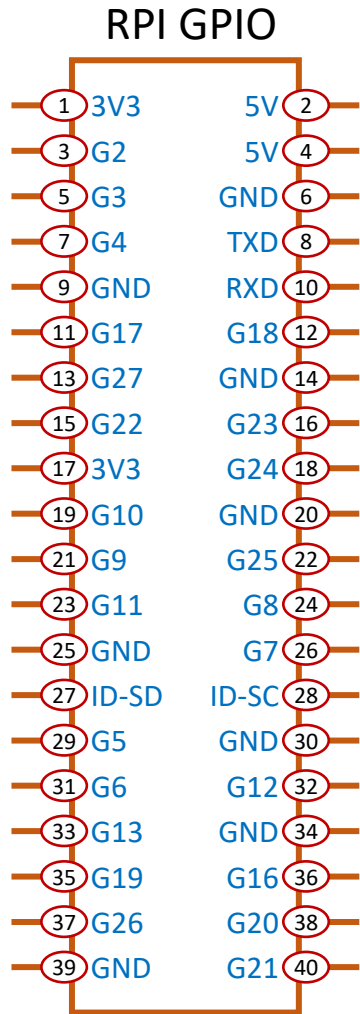
DRV8825 (AZIMUTH) GND

+12V

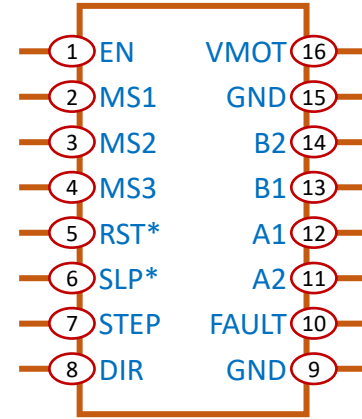




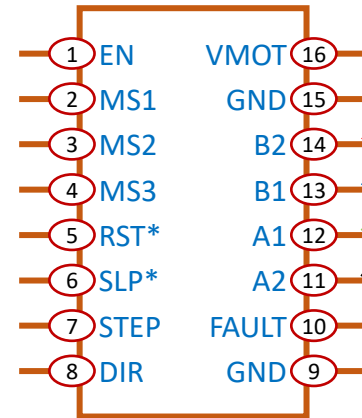
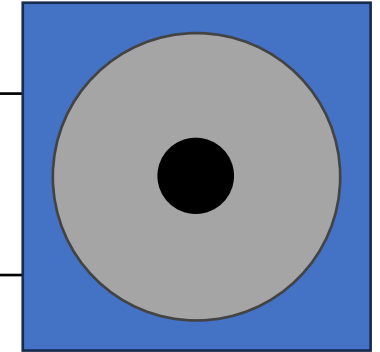
ADD SMOOTHING CAPACITORS



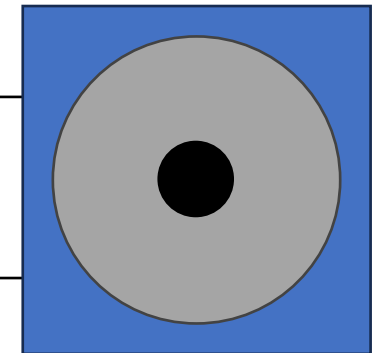
DRV8825 (ALTITUDE)



ALTITUDE



AZIMUTH



CONNECT THE MOTORS

DRV8825 (AZIMUTH)

