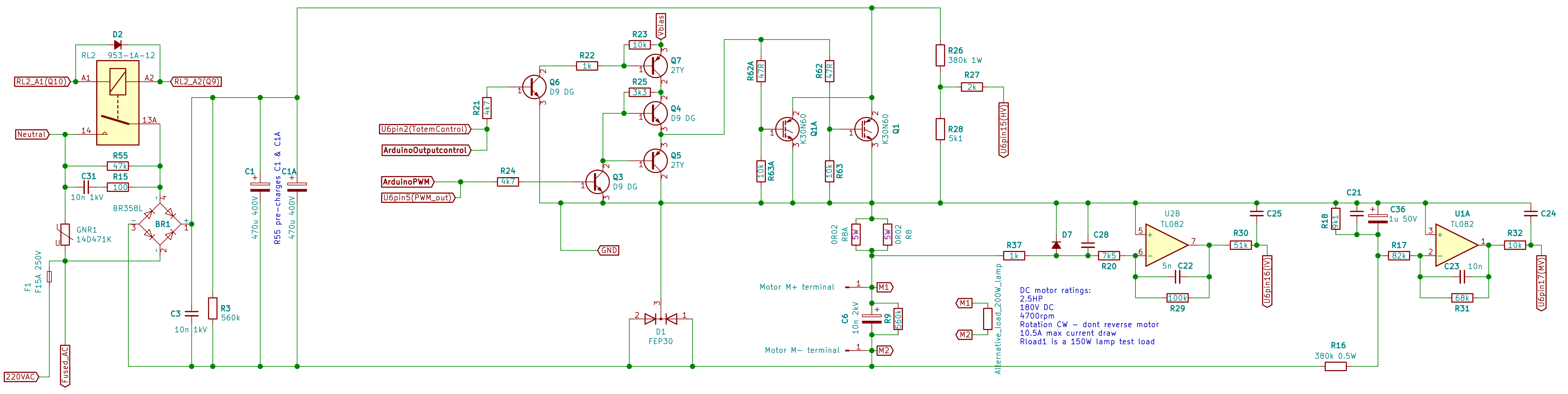


C21, C24, C25, C27, C28, C29, C30, C32, C35, C37, C44, C45, C49, C52, C53 = 100n (assumed)

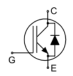
Modelling indicates motor current range of 0 to 24A
gives an output (IV) voltage range of 0 - 3.2V
(Motor rated 0-10.5A)

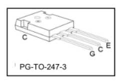
Similarly, MV ranges 0- 3.6V for
voltage range of 0 - 200V
(Motor rated for 180V)

Motor control and protection :-
Power turned on, charges caps through R55.
SMPS controller starts providing power to PIC and treadmill user control panel
HV voltage increases to 3.6V as caps charge (ie to -320V DC or caps fully charged)
PIC allows RLA2 to close through PIC pin 10
User clicks power switch which causes RLA2 to close its contacts and PIC reads this through PIC pin 9
PIC starts motor PWM based on user selected speed, measures RPM, HV, IV and MV.
If MV > 180V - trip motor (excess voltage ie speed)
if MV < 0V - trip motor as motor is generating
If HV > 3.6V - trip motor as excessive input voltage
If HV < 3.6V - trip motor as excessive current being drawn or something wrong with the incoming supply

If IV > 2V then motor overloaded as motor current > 10.5A
IV may exceed 2V to 3.2V (24A) for brief periods - say when a large user steps onto the treadmill belt so IV should have a 1s or so time delay before it trips the motor If the treadmill belt is heavily loaded the PWM duty cycle is high, then the user suddely steps off, the motor will speed up instantly, so IV suddenly falls but the RPM rises quickly

K30N60 pinout





So HV and IV are analog inputs and MV can be analog or an interrupt, likely analog for PID reasons

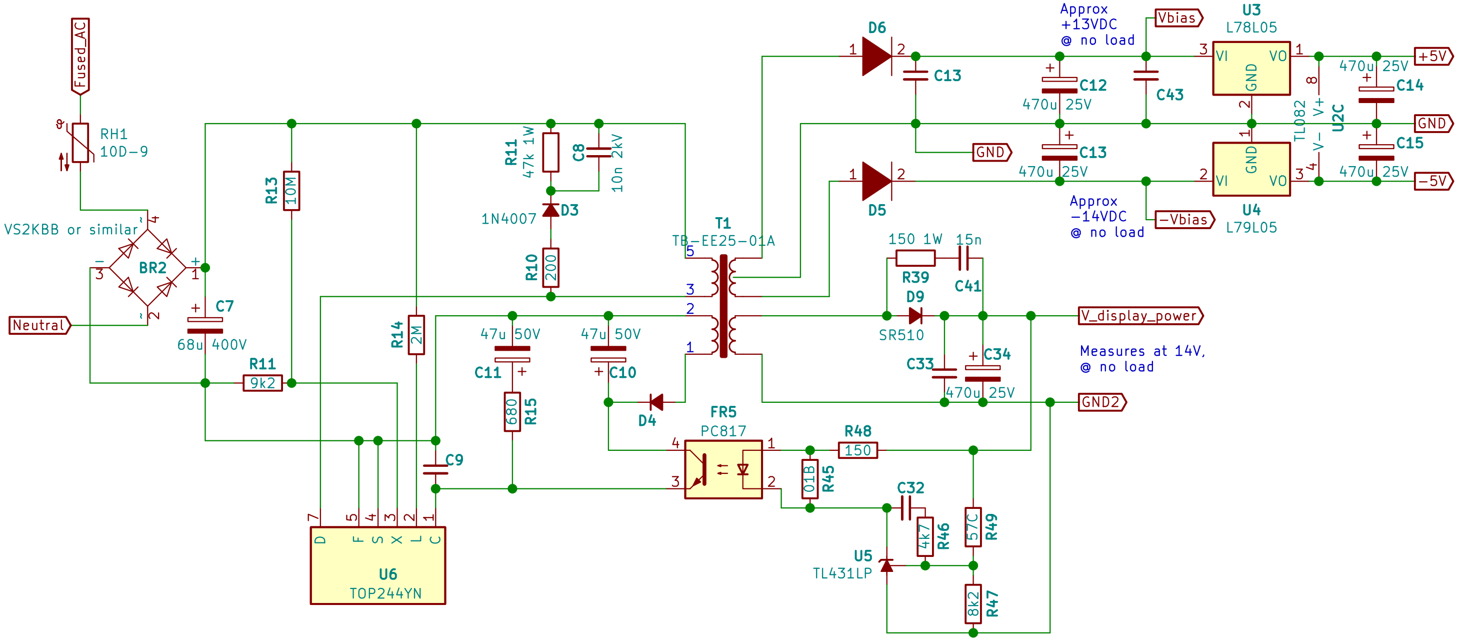
RPM is not sensed by an interrupt capable pin, so it must be polled.

LTspice model indicates (resistive load)
IV rises with rising load current - 2V @10ohm, 1.3V @ 30ohm
MV rises decreasing load current - 4.5V @ 30ohm, 2.8V @ 10ohm
HV rises with increasing load current - 4.2V @ 10ohm, 2V @ 10ohm

Note: Not guaranteed to be correct. Use at your own risk.

PF906 DC Motor driver schematic reproduced by Happymacer

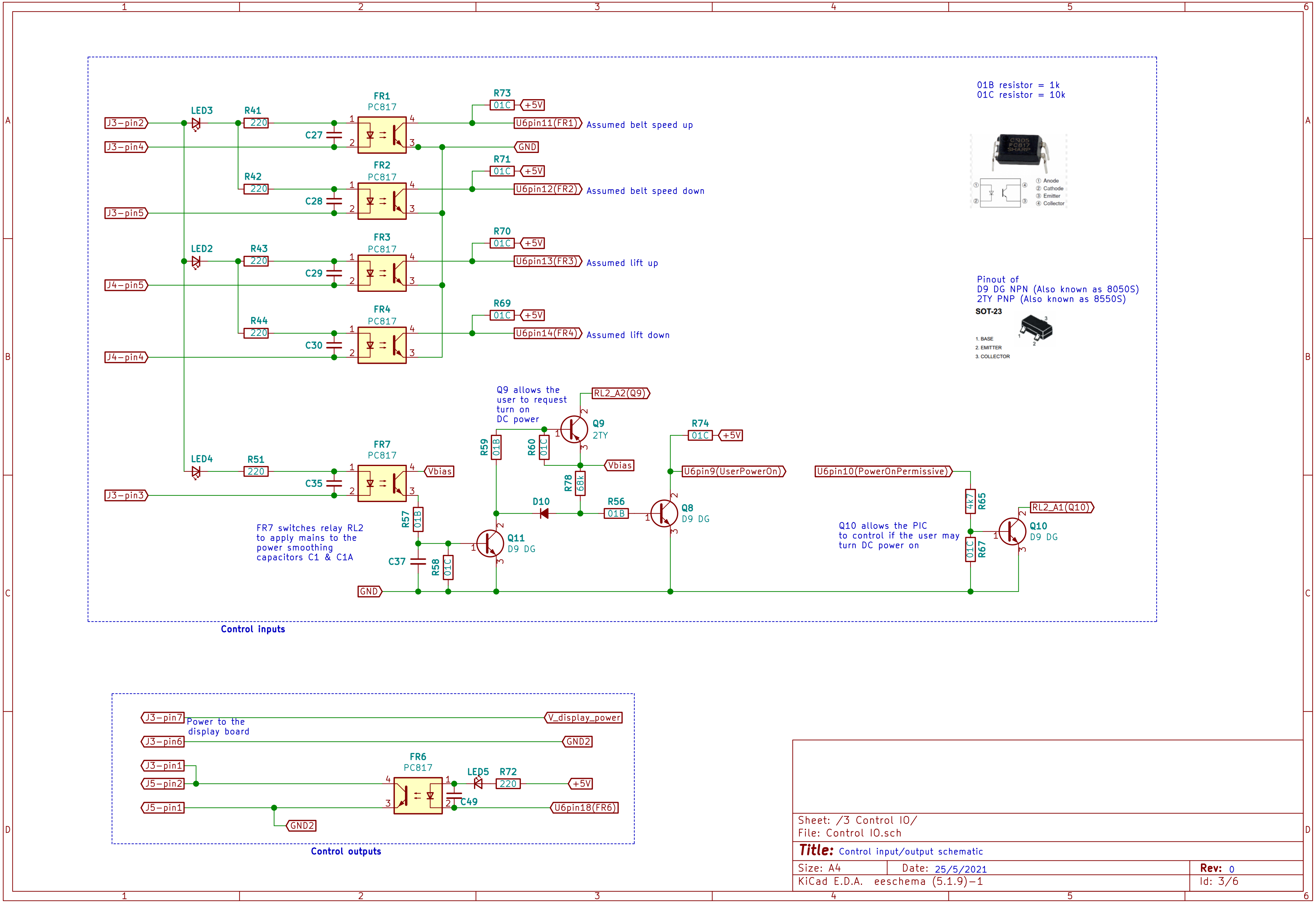
Sheet: /	
File: copy redrawn pf906 dc motor driver board.sch	
Title: PF906 treadmill DC Power schematic	
Size: A3 Date: 23/5/2021	**Rev:** 1
KiCad E.D.A. eeschema (5.1.9)-1	Id: 1/6

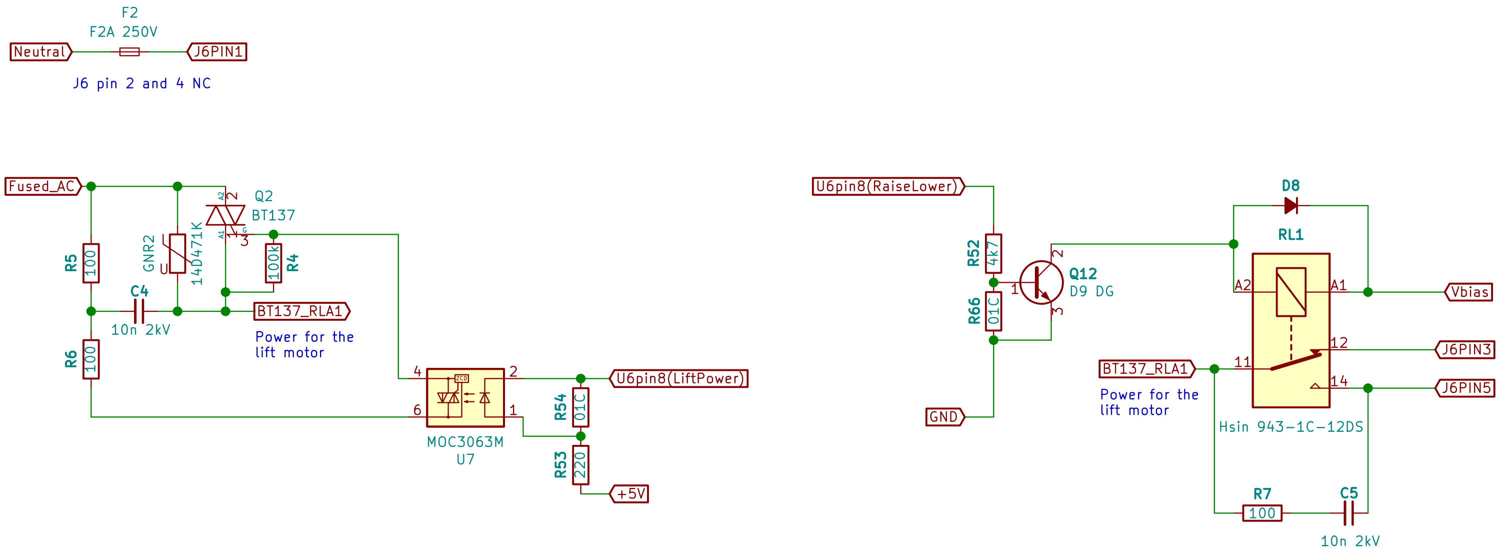


Sheet: /2 Aux power/
File: Aux power.sch

Title: Auxiliary power schematic

Size: A4	Date: 25/5/2021	Rev: 0
KiCad E.D.A. eeschema (5.1.9)-1		Id: 2/6


01B resistor = 1k
01C resistor = 10k
Pinout of
D9 DG NPN (Also known as 8050S)
2TY PNP (Also known as 8550S)
SOT-23
1. BASE
2. EMITTER
3. COLLECTOR
① Anode
② Cathode
③ Emitter
④ Collector
J3−pin2
J3−pin4
J3−pin5
J4−pin5
J4−pin4
J3−pin3
LED3
LED2
LED4
R41 220
R42 220
R43 220
R44 220
R51 220
C27
C28
C29
C30
C35
FR1 PC817
FR2 PC817
FR3 PC817
FR4 PC817
FR7 PC817
R73 01C
R71 01C
R70 01C
R69 01C
+5V
GND
U6pin11(FR1) Assumed belt speed up
U6pin12(FR2) Assumed belt speed down
U6pin13(FR3) Assumed lift up
U6pin14(FR4) Assumed lift down
Vbias
Q9 allows the user to request turn on DC power
RL2_A2(Q9)
Q9 2TY
R59 01B
R60 01C
R78 68k
D10
R56 01B
R74 01C
U6pin9(UserPowerOn)
Q8 D9 DG
U6pin10(PowerOnPermissive)
R65 4k7
R67 01C
RL2_A1(Q10)
Q10 D9 DG
Q10 allows the PIC to control if the user may turn DC power on
FR7 switches relay RL2 to apply mains to the power smoothing capacitors C1 & C1A
R57 01B
C37
R58 01C
Q11 D9 DG
Control inputs
J3−pin7
Power to the display board
V_display_power
J3−pin6
GND2
J3−pin1
J5−pin2
J5−pin1
FR6 PC817
LED5
R72 220
C49
U6pin18(FR6)
Control outputs
Sheet: /3 Control IO/
File: Control IO.sch
Title: Control input/output schematic
Size: A4
Date: 25/5/2021
Rev: 0
KiCad E.D.A. eeschema (5.1.9)−1
Id: 3/6

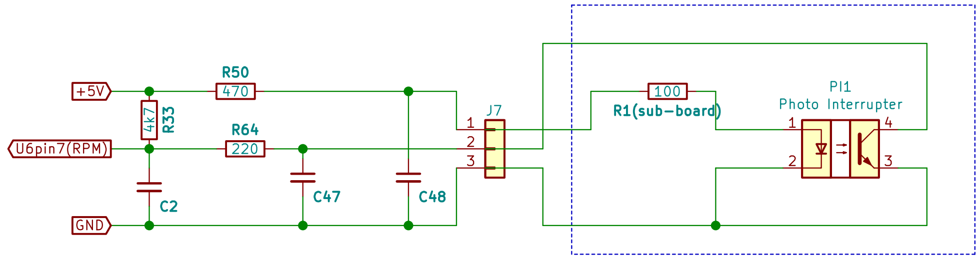


Sheet: /4 Lift Motor Control/
File: Lift Motor Control.sch

Title: Lift motor power schematic

Size: A4	Date: 25/5/2021	**Rev:** 0
KiCad E.D.A. eeschema (5.1.9)-1		Id: 4/6

RPM sensor



Daughter board mounted on motor across a disk mounted on the motor shaft.
The disk has 36 slots and same number of spaces between slots.

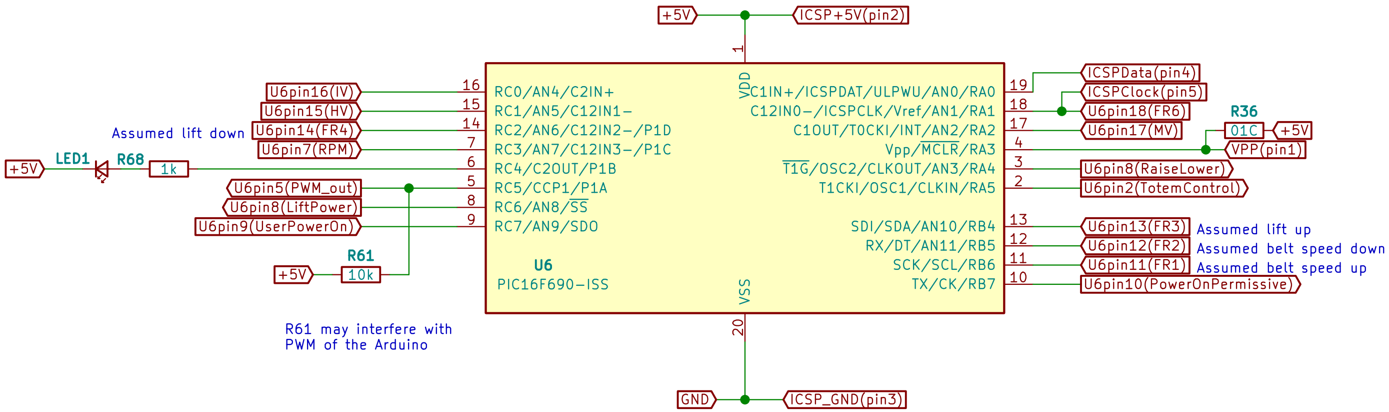
Max motor speed is 4700RPM so max pulse rate is 4700*36/60 = 2820Hz

RPM is not sensed by an interrupt capable pin, however it does connect to the inverting input of either Comparator 1 or Comparator 2 of the PIC chip. Either comparator can generate an internal interrupt.

Consider that when a hole in the disk moves to expose the LED. As the hole approaches the light level increases, reaches a peak then drops again. Much like a a typical day, where the sun rises at dawn and sets at dusk but its niot an abrupt light level change. Pushing the light signal through a compartor therefore makes sense to square off the wave and trigger on the rising or falling edges of the wave.

Counting the pulses from this wave is thus simplified by uising a comparator in the PIC.

Sheet: /5 RPM /		
File: RPM.sch		
Title: Motor RPM sensor		
Size: A4	Date: 25/5/2021	**Rev:** 0
KiCad E.D.A. eeschema (5.1.9)-1		Id: 5/6



Sheet: /PIC 16F690 Controller/
File: PIC 16F690 Controller.sch

Title: PIC 16F690 controller schematic

Size: A4	Date: 23/5/21	**Rev:** 0
KiCad E.D.A. eeschema (5.1.9)-1		Id: 6/6