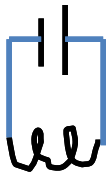
ECET 211 DC Shunt Motor Demonstration
Prof. Paul I. Lin
Wednesday, March 23, 2016
Room KT 250

Student Helpers:

- Cullan S. Magnuson and Jason Ringer – move the demo equipment
- Frank Hoffmann – help with measurement
- Emily Bendix – Lab data/notes taken by Emily Bendix

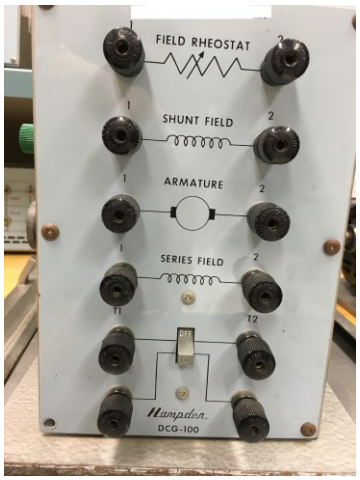
ISH calculation



254.3 Ω

DC MOTOR DEMONSTRATION

- 1/3 HP Motor, 1725 rpm
- 115V DC, 3.4 Amps
- Shunt Field Amp = 0.4 Amps
  - Rshunt = 254.3 Ohms (measured with DMM)
- $I_{SH} = \frac{115\,V}{254.3\Omega} = 0.45A$ (calculation)



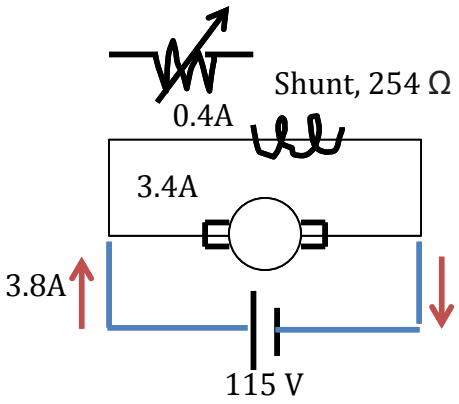
R_A = 5.4 Ω (armature resistance measurement)

Rotations (rotate the shaft 5 steps from 0°, 60°, 120°, 180°, ..):

#2	#3	#4	#5	Average
5.3 Ω	5.3 Ω	5.3 Ω	5.4 Ω	5.35 Ω

$$(R_{Ave} = \frac{R_{A1}+R_{A2}+R_{A3}\cdots}{n} = 5.4\ \Omega)$$

- Rheostat = 85Ω (adjusts, controls the amount of current provided to the shunt)
- Allow us to reduce the Ish from the rated 0.4A to Ish = 115V/(254.3 + 85) = 115V/339.3Ω = 0.34 A, to weaken the flux for extra speed control
- I_{SH} reduced (Φ, flux, reduced as well)



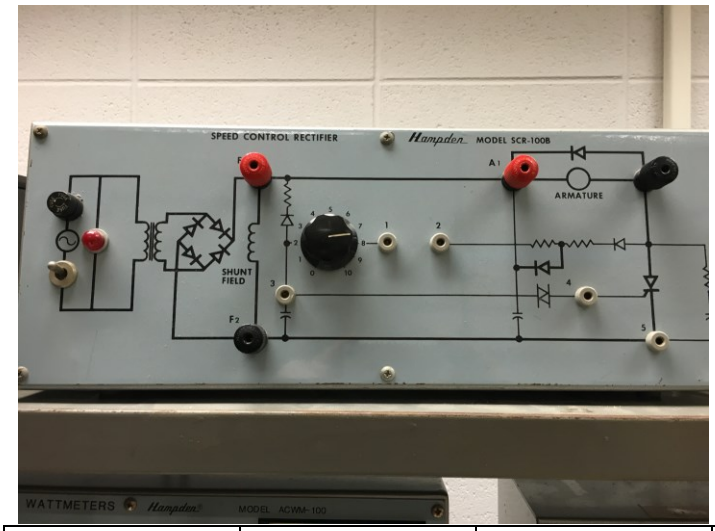
Power Supply

AC 120V

10A (estimated max)

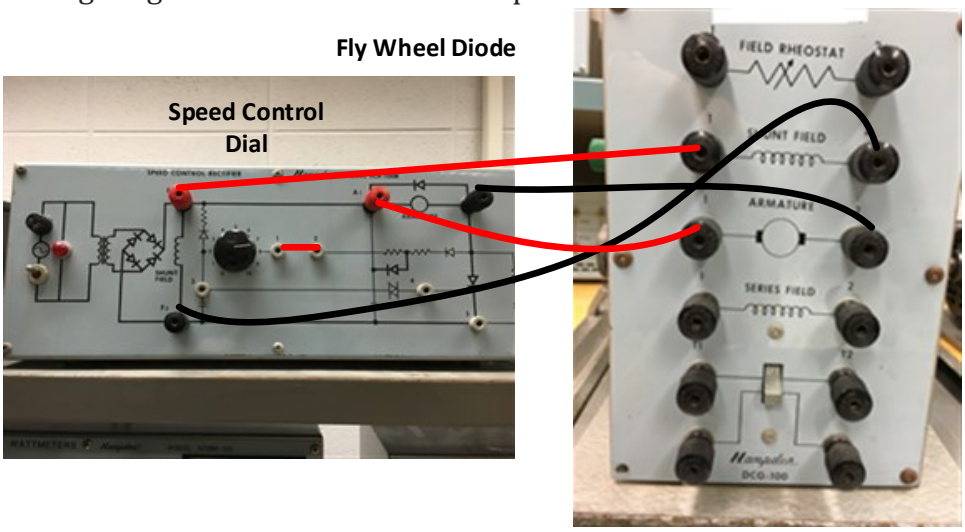
$I_T = I_{SH} + I_A$ = 3.4 + 0.4 = 3.8A

DC Motor Speed Controller (SCR-based)



Adjust dial 0,1,2,..9	100% Full-wave	75% Full-wave (triggered at)	50% Full-wave (triggered at)	25% Full-wave (triggered at)
Motor Speed	100% of rated motor speed	75% of rated motor speed	50% of rated motor speed	25% of rated motor speed

Wiring Diagram for DC Shunt Motor Speed Control



AC
Vrms = 120V
60Hz

$$e(t) = -L\frac{\Delta i}{\Delta t}$$ (L = inductance)

$$e(t) = -L\frac{Imax - Imin}{t2 - t1} = \frac{3.4 - 0}{t}$$

Full-wave bridge rectifier (pulsating DC), Vp = 169.7

DC = Vp* 0.90
DC = 152.73

- Fly wheel diode (short circuit, when power is turned off)
  - The induced voltage e(t) across the armature, will force the fly wheel to turn-on, to consume the armature stored energy
  - Protect SCR from having a high-voltage at its anode
- 120.6V (from Kill A Watt reader)
- when the motor starts, reads 119.8 ~119.9V (I = 1.59A)
- As more load is applied to the motor, the amperage increases:

1.87 A
1.94 A
2.09 A
2.40 A
2.54 A
2.70 A
2.98 A
3.0 A
3.12 A

Increase in load,

Dial 4, 1700 rpm