Prelab 1A F → μF

Tutorial Thursday 2:30

Lab 1A now posted.

As per outline → Lowest grade in prelab will be dropped.

Electrical Safety (Continued)

Microshock vs. Macroshock > 1 mA → dangerous

↑ current spreads out through the skin (small amount goes through heart)

↑ Current goes through the heart b/c of intercardiac cathodes

μA → dangerous

! Macroshock → ground fault

→ goes through body

3rd prong

→ current goes through chassis in case of fault

Classes of Equipment

Class I, Class II, Class III (on the slides)

SELV

↑

Safety Extra Low Voltage

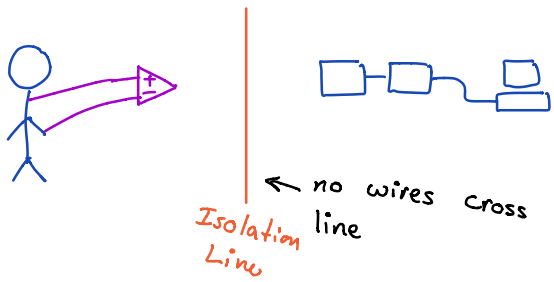
Electrical Safety Test

- A sample of devices sent to labs
- Samples are tested against a # of tests

Isolation

- Isolation amplifiers

Electrical Isolation



Isolation Technologies

- magnetic
- optical
- Transformers
- opto isolator

Examples on Slide 1.28 + Sample test Qs on other pages.

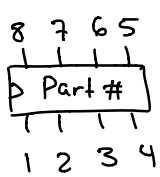
☆ We will use <u>optocouplers</u> in this course.

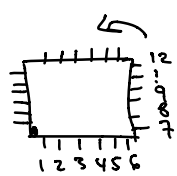
Reading Spec Sheets

Contains info on the features, compliance, pin outs, etc.

↳ Look at compliance to determine tests passed.

<u>Pinout Ex</u>





(not used in this course)

↳ Also, check abs. max ratings.

(gives great insight into which part to pick)

Opto-isolator

Diode

Mech analogy

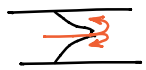
Valve → one way flow

mitral valve

P_{heart} 125 mmHg

$P_{arterial}$ 120 mmHg

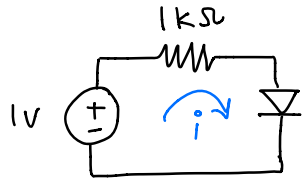
Stenosis



160 mmHg

one way flow drops by $\simeq 0.7\,V$ as current crosses diode.

Ex.



$V_D = 0.7\,V$

$+1V - iR - V_D = 0$

$i = 300\,\mu A$

Light Emitting Diode (LED)

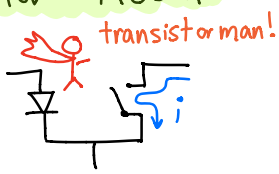
Power from $(V_D) \times i$ emitted as light
- visible
- infrared

V_D = 1.5 V IR

2.5 V visible

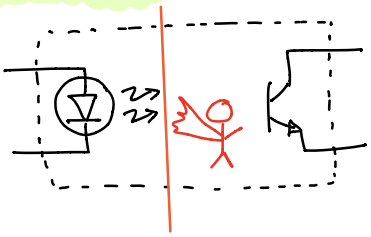
Simple Transistor Model

≡



If diode ON, transistorman closes the switch. (if i flow through diode)

Opto-transistor

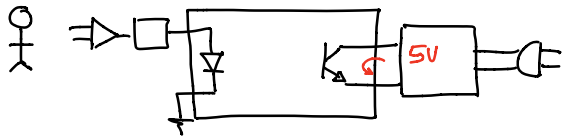


Electrical isolation

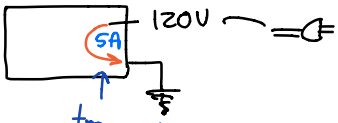
If sees light, closes switch.

Optoisolator ≡ optotransistor

Ex. Normal



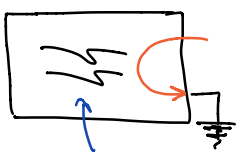
Case 1 Coffee spill (120V)



transistor burns out

Patient ok

Case 2 Lightning (1 MV)



1 MV

Current jumps gap

Patient Shocked

Switches

usually 3 pins

NO → Normally open

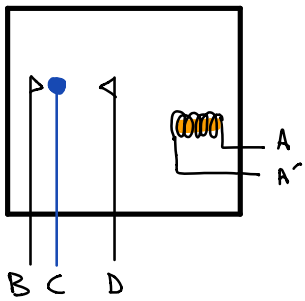
closes when pushed

NC → Normally closed

opens when pushed

Relay

A magnetic wire closer.

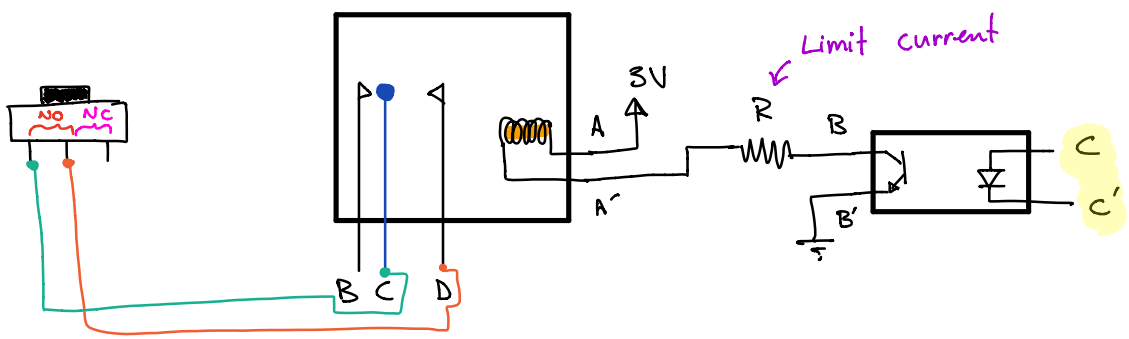


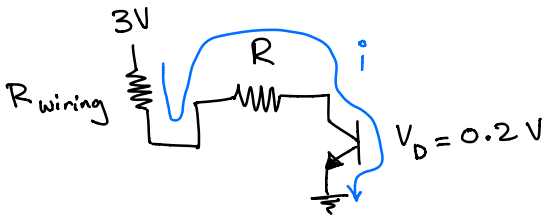
If curr. through AA', C pulled to D

NO → C+D

NC → B+C

Now want, when i into CC', relay switches.

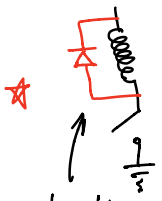




$$3V - i(R_{wiring}) - iR - 0.2 = 0$$

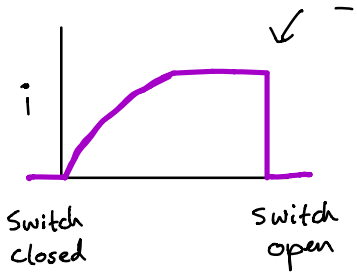
$$2.8 = i(R_{wiring} + R)$$

Inductor



built into relay

$$V = L\frac{di}{dt}$$



$-\infty\,V$ to prevent destroying, refer to ☆