Cascade switching of an LED

EAS 199B

Winter 2013

Objectives

- Be able to describe the circuit that uses an NPN transistor to switch an LED on and off
- Be able to describe the circuit that uses an NPN transistor and a relay to switch an LED on and off
- Be able to describe the role of a fly-back diode on a relay coil or solenoid valve
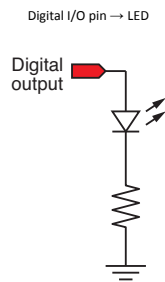- Be able to describe the cascade switching circuit used to control the solenoid valves for the fish tank.

Use Digital I/O pin to switch LED on/off

Digital I/O pin → LED

Digital output

Code to blink the LED

```
int  LED_pin = 11;  // array of pins for digital output

void setup() {
  pinMode( LED_pin, OUTPUT );
}

void loop() {
  digitalWrite( LED_pin, HIGH);
  delay(1000);
  digitalWrite( LED_pin, LOW);
  delay(1000);
}
```

In the following examples, the Arduino code does not need
to change when the electrical circuit is changed. The
Arduino code only needs to used a single digital output pin,
which in this code is LED_pin.

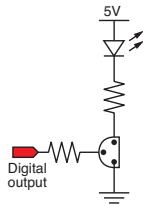## Use a Transistor to switch LED on/off

Digital I/O pin → Transistor → LED
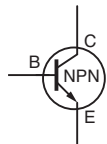

NPN Transistors as Switches

Transistors can be used as switches: By applying relatively
small voltage to the Base, electrical current will flow from
the collector to the base.

C is the collector.
B is the base
E is the emitter
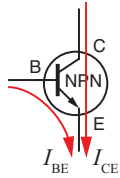
NPN Transistors as Switches

When used as a switch, I_{CE}, the current from the collector to the emitter is large compare to I_{BE}, the current from the base to the emitter.
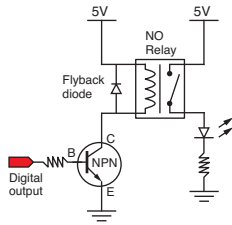
C is the collector.
B is the base
E is the emitter

I_{BE} I_{CE}

Use a Relay switch the LED on/off

Digital I/O pin → Transistor → Relay → LED

Compare switching circuits
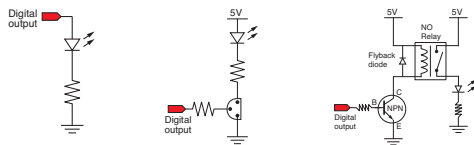
Application to solenoid switching