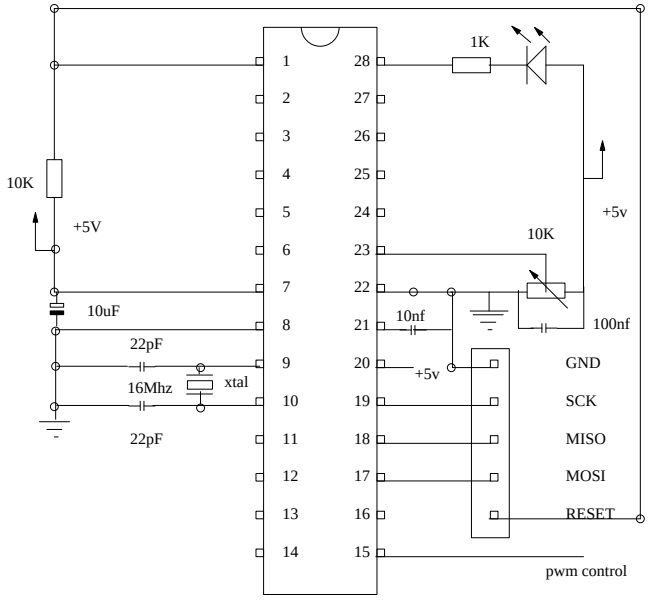
Using an ATMega328p to test a servo

- here we put together
  - an LED as an output device
  - a servo as an output device
  - and a potentiometer as an input device
  - all programmed in C

Circuit diagram



ATMega328P

Circuit diagram

```
#define F_CPU 16000000UL

#include <inttypes.h>
#include <avr/io.h>
#include <avr/pgmspace.h>
#include <avr/eeprom.h>
#include <avr/interrupt.h>
#include <stdio.h>
#include <util/delay.h>

#if !defined(TRUE)
#   define TRUE (1==1)
#endif

#if !defined(FALSE)
#   define FALSE (1==0)
#endif
```


Circuit diagram

```
#define ePRESCALER8

#if defined(ePRESCALER8)
#   define eICR1value 39936
#   define ePRESCALEBITS  (_BV(CS11))
#   define eLOW    2048
#   define eHIGH   3968
#   define eDELAYms   3
#endif

#if defined(ePRESCALER256)
#   define eICR1value 1248
#   define ePRESCALEBITS  (_BV(CS12))
#   define eLOW      64
#   define eHIGH    124
#   define eDELAYms 100
#endif

#if defined(ePRESCALER1024)
#   define eICR1value 1248*4
#   define ePRESCALEBITS  (_BV(CS10) | _BV(CS12))
#   define eLOW      16
/* not a good choice as eHIGH is not exact 124/4 is not a
#   define eHIGH     31
#   define eDELAYms 400
#endif
```

Circuit diagram

```
/*
 * initServo - initialises timer 1 for fast PWM operation
 *             servo is enabled on B1.
 */

void initServo (void)
{
  /* initialize TMR1 (PWM) */
  TCCR1A = _BV(COM1A1) | _BV(COM1B1) | _BV(WGM11); /* cle
  TCCR1B = _BV(WGM12) | _BV(WGM13) | ePRESCALEBITS; /* se
  ICR1 = eICR1value;
  OCR1A = -1;  /* off */
  OCR1B = -1;  /* off */
  DDRB |= _BV(1) | _BV(2);  /* output on PB1 and PB2 */
}
```


Circuit diagram

```
/*
 *  set_servo1 - sets the pwm length for servo1.  Value s
 */

void inline set_servo1 (int pwm)
{
  OCR1A = pwm;
}

/*
 *  set_servo2 - sets the pwm length for servo1.  Value s
 */

void inline set_servo2 (int pwm)
{
  OCR1B = pwm;
}
```


Circuit diagram

```
static void initLed (void)
{
  asm volatile ("sbi 7, 5") ;
}

static void turnLED (int value)
{
  if (value)
    asm volatile ("cbi 8, 5");
  else
    asm volatile ("sbi 8, 5");
}
```


Circuit diagram

```
void initADC (void)
{
  /* 16Mhz/128 = 125Khz the ADC reference clock */
  ADCSRA |= ((1<<ADPS2)|(1<<ADPS1)|(1<<ADPS0));
  /* use voltage reference from Avcc */
  ADMUX |= (1<<REFS0);
  /* Turn on the ADC */
  ADCSRA |= (1<<ADEN);
  /* Now start an A to D conversion as the initial one is
  ADCSRA |= (1<<ADSC);
}
```

Circuit diagram

```
uint16_t readADC (uint8_t channel)
{
  /* mask out the channel value */
  ADMUX &= 0xf0;
  /* set the channel bits */
  ADMUX |= channel;
  /* tell the hardware to start a new A to D conversion *
  ADCSRA |= (1<<ADSC);
  /* Wait for the A to D conversion to complete */
  while (ADCSRA & (1<<ADSC))
    ;
  /* and return the A to D value (0..1023) as a 16 bit un
  return ADCW;
}
```


Circuit diagram

```
main()
{
  uint16_t adc;
  int pos;

  initLed ();
  initADC ();
  initServo ();

  while (TRUE) {
    adc = readADC (0);
    _delay_ms(eDELAYms);
    pos = adc * 2 + eLOW;
    if (pos > eHIGH)
      pos = eHIGH;
    set_servo1 (pos);

    if (adc > 512)
      turnLED(0);
    else
      turnLED(1);
  }
}
```


Compile our code

```
$ avr-gcc -mmcu=atmega328 atod.c -o atod.elf
$ avr-objcopy -R .eeprom -O ihex atod.elf atod.hex
```

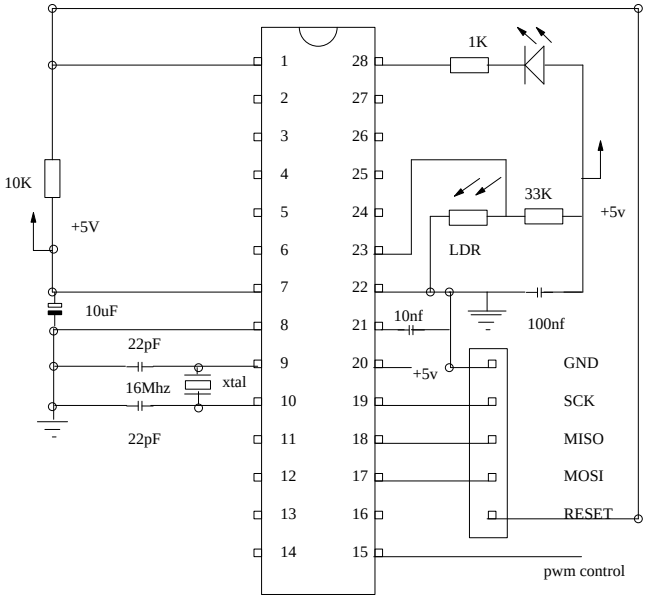

Download the executable

```
sudo avrdude -p m328p -U lfuse:w:0xff:m  -U hfuse:w:0xd9:
  -U efuse:w:0x07:m -c stk500v2 -e -v -U flash:w:atod.hex
```

Servo light meter

- obviously we could substitute the potentiometer for an LDR and introduce a limiting resistor
  - which turns the servo according to the light level
  - code remains the same

Circuit diagram



ATMega328P