EET 250 - Interfacing a Photocell with the PIC

This lab demonstrates interfacing a Photocell Sensor to the PIC Demo Board, using the Analog to Digital Converter and developing a light controlled device. A schematic for PIC Demo board is shown

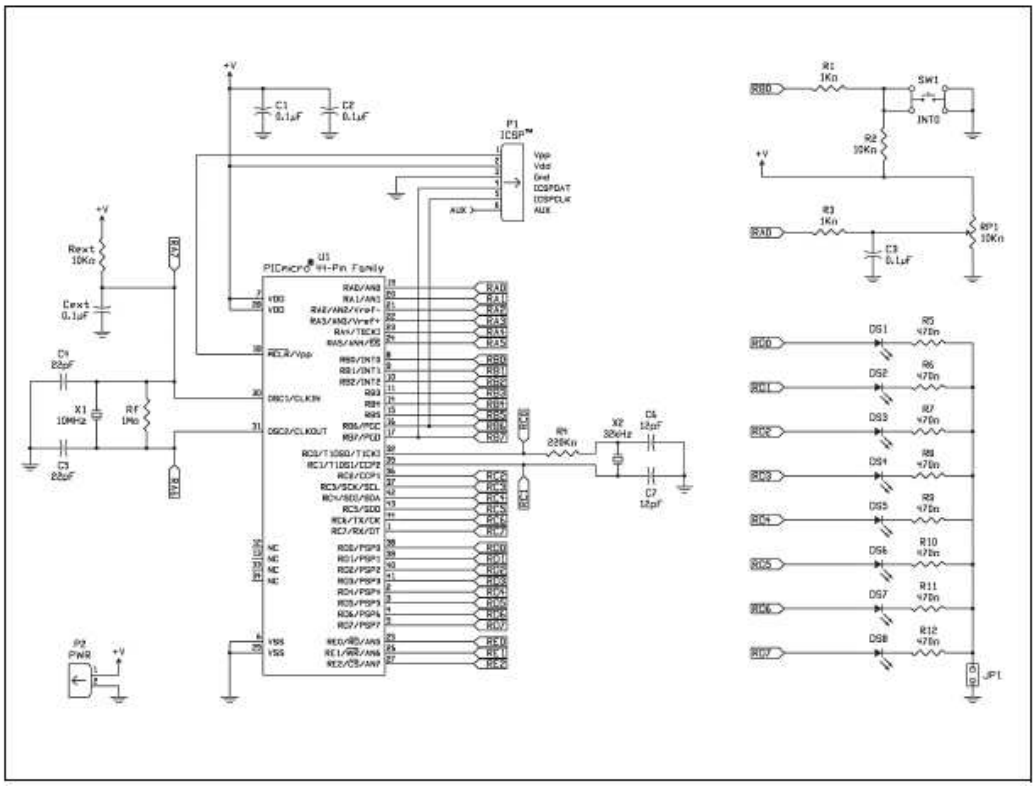


Figure 1 Demo Schematic

Analog to Digital Input Service:

To perform an A/D conversion the following needs to be done:

These steps should be followed for an A/D conversion:

1. Configure the A/D module:
   - Configure analog/digital I/O (ANSEL)
   - Configure voltage reference (ADCON0)
   - Select A/D input channel (ADCON0)
   - Select A/D conversion clock (ADCON1)
   - Turn on A/D module (ADCON0)
2. Configure A/D interrupt (if desired):
   - Clear ADIF bit (PIR1<6>)
   - Set ADIE bit (PIE1<6>)
   - Set PEIE and GIE bits (INTCON<7:6>)
3. Wait the required acquisition time.
4. Start conversion:
   - Set GO/$\overline{\text{DONE}}$ bit (ADCON0<1>)
5. Wait for A/D conversion to complete, by either:
   - Polling for the GO/$\overline{\text{DONE}}$ bit to be cleared (with interrupts disabled); OR
   - Waiting for the A/D interrupt
6. Read A/D Result register pair (ADRESH:ADRESL); clear bit ADIF if required.
7. For next conversion, go to step 1 or step 2 as required. The A/D conversion time per bit is defined as TAD. A minimum wait of 2 TAD is required before the next acquisition starts.

The following program is offered as a example to be used for Program 1. Make sure to provide the INCLUDE and CONFIG statements.

```
      cblock 0x20
 Delay1          ; Assign an address to label Delay1
 Delay2
 Display          ; define a variable to hold the diplay
      endc

      org 0
 Start:
      bsf       STATUS,RP0      ; select Register Page 1
      movlw     0xFF
      movwf     TRISA           ; Make PortA all input
      clrf      TRISD           ; Make PortD all output
      movlw     0x10            ; A2D Clock Fosc/8
      movwf     ADCON1
      movlw     0xFF            ; we want all Port A pins Analoga
      movwf     ANSEL
      bcf       STATUS,RP0      ; back to Register Page 0

      movlw     0x01
      movwf     ADCON0          ; configure A2D for Channel 0 (RA0), Left justified, and turn on the A2D module
 MainLoop:
      nop                       ; wait 5uS for A2D amp to settle and capacitor to charge.
      nop                       ; wait 1uS
      nop                       ; wait 1uS
      nop                       ; wait 1uS
      nop                       ; wait 1uS
      bsf       ADCON0,GO_DONE  ; start conversion
      btfss     ADCON0,GO_DONE  ; this bit will change to zero when the conversion is complete
      goto      $-1

      movf      ADRESH,w        ; Copy the display to the LEDs
      movwf     PORTD
      goto      MainLoop

      end
```

Figure 2 AD Assembly Program Example

Program #1: Understanding A/D Configuration and Operation

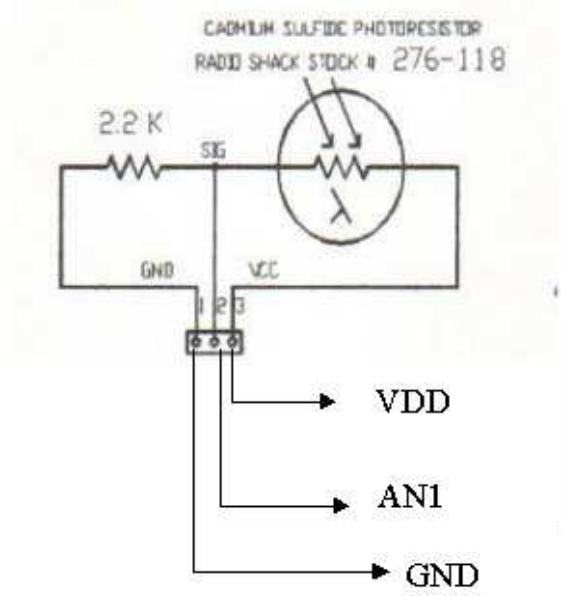
Analog to Digital Conversion is a technique frequently used by Microcontroller to measure external voltage (typically from a external sensor) and convert the incoming voltage to a digital number. The PIC supports a 10-bit A/D or count of 0 to 1023. Incoming voltages value controls the count. Use the built in pot on the board to pin AN0. Enter, built and run the following program shown above. The A/D value present at AN) is converted and displayed continuously on the LEDs.

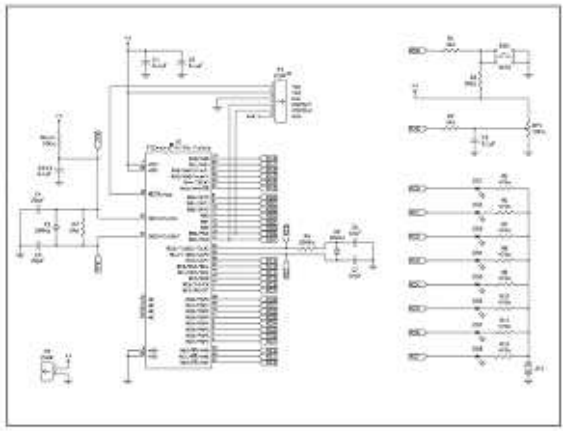
The pot represents a simulated sensor that you can control the control the input to A/D by varying pot setting. The LEDS will represent the 8 bit high portion of the 10 bit digital A/D output count. Get a digital voltmeter and measure the voltage between the wiper and ground for each of the following digital counts. VDD represents +5VDv and the ground and AN0 pins are available.

LED Output	**Voltage**
00H	
2FH	
3FH	

Program#2 Hooking up the photocell sensor and recording light/dark levels

Modify program #1 to read AN1 versus AN0 and have the following circuit constructed and hooked to AN2. Have instructor verify circuit before power up. Instructor Signoff _____





The photocell varies it's internal resistance based upon available light. As a result you should get a digital output for both normal and dark conditions observing the LEDS and covering and uncovering the photo sensor.

Record the two levels. You will need them for the next program.

Normal_____

Dark_____

Program #3 Implemented a Light Controlled LED

Design and implement a program, modifying what has been done so far, that uses the photocell dark condition to turn on the most significant LED and then turn off automatically the same LED when light returns to normal. You will need to used the A/D service. Write as a continuous loop. Draw out a flowchart. Demo to instructor. Instructor Signoff _____.

Program 3 Flowchart