Electromechanical Timer Replacement

Time Delay Relay Family

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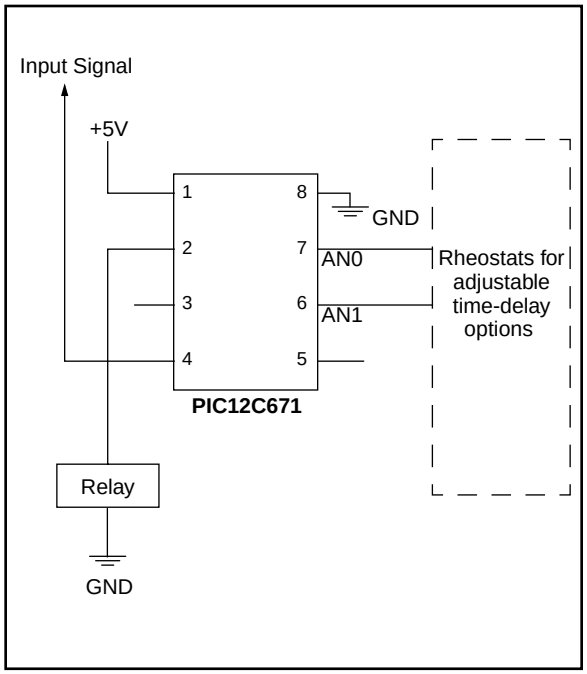
APPLICATION OPERATION

This design entry uses the PICmicro's ability to be programmed in-circuit to create a large family of devices from one simple design. This will allow the cost savings of mass production while giving the sales leverage of customized components without long turn-around times or increased inventory requirements. Additionally, since the target market for this product is consumer and industrial equipment manufacturers, the agency approvals (UL, CSA, European, etc.) should be easier to get and maintain since there is only a few hardware prototypes for the many incarnations.

The devices that are being replaced either provide a time delay between the control signal coming on and the relay activating, or provide a delay between the control signal going off and the relay deactivating. The time delay is either a set value at manufacture or adjustable within a set range. This functionality is duplicated in this design using the PIC12C671, a standard 5 VDC relay, and (in the case of an adjustable delay) a potentiometer. In fact this design makes it possible to have separate delays for turn on and turn off.

As mentioned previously, there are many implementations of the software for one common hardware design. The source code included in this application note is based on the dual adjustable model since the other implementations are a subset of this one. The range for the adjustment is 0 – 31 seconds in this example.

FIGURE 1: BLOCK DIAGRAM



MICROCHIP TOOLS USED

Assembler/Compiler Version:

MPLAB version 3.22.0 (MPASM)

APPENDIX A: SOURCE CODE

```
;*****************************************************************
;                          TM_DLY01.ASM
;              Variable time delay, on & off, relay program
;*****************************************************************
;          AUTHOR:            Paul McCoy
;          DATE:              31 May 1997
;          ORGANIZATION:      Zykora Inc.
;          REVISION:          1.00.00
;
;*****************************************************************
;
        LIST    p=12C671; PIC12C671 is the target processor
#include <P12C671.INC>

 CBLOCK      0x20                    ; autosets register variable addresses
             flag                    ; flag register for program flags
             second_cnt              ; counter for one second timer
             temp_stat               ; holds status register for interrupts
             temp_w                  ; holds W register for interrupts
             time_cnt
 ENDC

;*****************************************************************
;                         FLAG BITS
;*****************************************************************

COMMAND       equ          00        ; Set - input line is set
ACTUAL        equ          01        ; Set - output line is set
TIMING        equ          02        ; Set - Timer is running


;*****************************************************************
;          OTHER DEFINES
;*****************************************************************

LAST_LOCATE   equ          0x3ff

;*****************************************************************
;          Program
;*****************************************************************

org           0x00                          ;reset vector
goto          start

              org          0x04             ;interupt vector
              movwf        temp_w           ;note: if Bank1 is used this space must
                                            ;be reserved
              swapf        STATUS,W
              bcf          STATUS,RP0
              movwf        temp_stat
              btfsc        INTCON,2
              call         Timer
              btfsc        INTCON,1
              bcf          INTCON,1
              btfsc        INTCON,0
              call         Input_change
              swapf        temp_stat,W
              movwf        STATUS
              swapf        temp_w,F
              swapf        temp_w,W
              retfie

;*****************************************************************
;                         Initialization block
```

```
;*****************************************************************

start:
              clrf         GPIO
              clrf         flag
              bsf          STATUS,RP0        ;switch to Bank 1
              movlw        B'11000101'
              movwf        OPTION_REG        ;tmr0 scaled 64:1
              movlw        B'00000100'       ;GPIO 0 & 1 A/D; 3, 4, & 5 digital
              movwf        ADCON1
              movlw        B'11101111'       ;GPIO 5 output; all others input
              movwf        TRISIO
              clrf         PIE1
              call         LAST_LOCATE
              movwf        OSCCAL
              bcf          STATUS,RP0        ;switch back to Bank 0
              movlw        B'01000001'       ;select channel 0 and turn on A/D
              movwf        ADCON0
              btfsc        GPIO,3
              call         Initial_set
              movlw        -D'125'           ;count up 125 to rollover
              movwf        TMR0
              movlw        B'10101000'       ;enable timer interrupt
              movwf        INTCON




;*****************************************************************
;                         Main program loop
;*****************************************************************

top:
              goto         top


;*****************************************************************
;                       Normally energized initialization routine
;*****************************************************************

Initial_set:
              bsf          GPIO,3
              bsf          flag,ACTUAL
              bsf          flag,COMMAND
              bsf          ADCON0,3
              return

;*****************************************************************
;                         A/D Conversion Subroutine
;          This subroutine assumes the A/D channel has already been
;          selected and stabilized and that the output destination is
;          specified in FSR. It waits for the A/D to be complete before
;          returning, not using the A/D interrupt.
;*****************************************************************

Adloop:
              bsf          ADCON0,2
adwait:
              btfss        PIR1,6
              goto         adwait
              bcf          PIR1,6
              return

;*****************************************************************
;                         Timer interrupt routine
;*****************************************************************
```

```
Timer:
              bcf          INTCON,2
              movlw        -D'125'           ;count up 125 to rollover
              movwf        TMR0
              decfsz       second_cnt,F
              return
              movlw        D'125'            ;125*125*64=1 million clocks
                                             ;equals one second
              movwf        second_cnt
              decfsz       time_cnt,F
              return
              btfss        flag,TIMING
              return
              bcf          flag,TIMING
              btfsc        flag,COMMAND
              goto         set_out
              bcf          GPIO,5
              bcf          flag,ACTUAL
              return
set_out:
              bsf          GPIO,5
              bsf          flag,ACTUAL
              return

;*****************************************************************
;                        Input interrupt routine
;*****************************************************************


Input_change:
              bcf          INTCON,0
              btfss        GPIO,3
              goto         input_off
              btfsc        flag,COMMAND
              return
              bsf          flag,COMMAND
              btfsc        flag,ACTUAL
              goto         error_on
              call         Adloop
              bsf          ADCON0,3
              rrf          ADRES,F
              rrf          ADRES,F
              rrf          ADRES,F
              movf         ADRES,W
              btfsc        STATUS,Z
              goto         timed_on
              movwf        time_cnt
              movlw        -D'125'
              movwf        TMR0
              bcf          INTCON,2
              movlw        D'125'
              movwf        second_cnt
              bsf          flag,TIMING
              return
error_on:
              bcf          flag,TIMING
              return
timed_on:
              bsf          GPIO,5
              bsf          flag,ACTUAL
              return
input_off:
              btfss        flag,COMMAND
              return
              btfss        flag,ACTUAL
```

```
             call        Adloop
             bcf         ADCON0,3
             rrf         ADRES,F
             rrf         ADRES,F
             rrf         ADRES,F
             movf        ADRES,W
             btfsc       STATUS,Z
             goto        timed_off
             movwf       time_cnt
             movlw       -D'125'
             movwf       TMR0
             bcf         INTCON,2
             movlw       D'125'
             movwf       second_cnt
             bsf         flag,TIMING
             return
error_off:
             bcf         flag,TIMING
             return
timed_off:
             bcf         GPIO,5
             bcf         flag,ACTUAL
;
     END
```

NOTES:

NOTES:

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7/29/97