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'*****
'* Name      : Rocket / Firework Detonator          *
'* Author    : Roy H. Guerra Jr.                   *
'* Notice    : Copyright (c) 2009 .                 *
'*           : All Rights Reserved                  *
'* Date      : 11/15/2009                           *
'* Version   : 2.0                                   *
'* Notes     : Use PIC16F876A                       *
'*           : 4 Mhz Ceramic Resonator             *
'*****
'
' Hardware Connections:
' =====
' LCD is parallel 4 bit with HD44780 or equivalent
' LCD 4 Bit Data Bus (PORTB.0,1,2,3)to LCD (D4, D5, D6, D7)
' LCD RS Bit (PORTB.4) to LCD (RS)
' LCD Enable Biit (PORTB.5) to LCD (E)
' LCD R/W tied to Ground with LCD (D0, D1, D2, D3)
'
' Increase = (PORTA0) (use 4.7K pulldown to Gnd)
' Decrease = (PORTA1) (use 4.7K pulldown to Gnd)
' Enter = (PORTA2) (use 4.7K pulldown to Gnd)
' Abort = (PORTA3) (use 4.7K pulldown to Gnd)
'
' Beeper = (PORTA4) (need 4.7k pull-up resistor before transistor base)
'
' Fault LED = (PORTA5) (used for abort)
'
' Outputs (PORTC0,1,2,3,4,5,6,7) (use LED's & Transistor drivers for relay's)
'
' Software Declarations
' =====
'
'Define LOADER_USED to allow use of the boot loader.
'This will not affect normal program operation.
DEFINE LOADER_USED 1
'
' Special Register & Interrupt Declarations
' -----
OPTION_REG = %10000000 ' Disable PORTB pull-ups
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INTCON = %00000000  ' Disables all Interrupts
ADCON1 = 7          ' Set PORTA to Digital
'
' Define Crystal Oscillator & Frequency
' -----
'DEFINE OSC 20      ' Add this statement when using 20MHZ crystal
'
' Define LCD Registers and Bits
' -----
DEFINE LCD_DREG      PORTB
DEFINE LCD_DBIT      0
DEFINE LCD_RSREG     PORTB
DEFINE LCD_RSBIT     4
DEFINE LCD_EREG     PORTB
DEFINE LCD_EBIT     5
'
' Define Program Variables
' -----
B0 VAR BYTE        ' Temp variable to hold number of outputs
B1 VAR WORD        ' Temp variable to hold number of seconds
B10 VAR WORD       ' Temp variable to hold number of loop counts
B2 VAR BIT[1]     ' Temp array for holding a bistable state (sound)
B3 VAR BIT[1]     ' Temp array for holding a bistable state (sequence)
I VAR BYTE        ' Temp variable to keep track of loop sequence
J VAR WORD        ' Temp variable to countdown seconds
K VAR BYTE        ' Temp variable for loop timeout
Z VAR BYTE        ' Temp variable for loop timeout
Flag1 VAR BYTE   ' Subroutine permissive flags
Flag2 VAR BIT    ' Launch permissive bit
'
' Define Direction Registers
' -----
TRISC =%00000000  ' Set PORTC to all lines output
TRISA =%001111    ' Set PORTA to all lines input, except 4 & 5
'
' Define Program Modifiers
' -----
Increase VAR PORTA.0  ' Select for Button Depress
Decrease VAR PORTA.1  ' Select for Button Depress
Enter VAR PortA.2    ' Select for Button Depress
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Abort  VAR PORTA.3      ' Select for Button Depress
Beeper VAR PORTA.4      ' Buzzer
Fault  VAR PORTA.5      ' Abort LED Indicator
Out_1  VAR PORTC.0      ' Output Port line
Out_2  VAR PORTC.1      ' Output Port line
Out_3  VAR PORTC.2      ' Output Port line
Out_4  VAR PORTC.3      ' Output Port line
Out_5  VAR PORTC.4      ' Output Port line
Out_6  VAR PORTC.5      ' Output Port line
Out_7  VAR PORTC.6      ' Output Port line
Out_8  VAR PORTC.7      ' Output Port line
'
' Define initial Power Up Conditions
' -----
      GOSUB reset      ' Set all initial conditions to zero
'
' Display Introduction Banner
' -----
      LCDOUT $FE, 1      ' Clear the LCD Display
      LCDOUT $FE, 2, "Rocket Launcher"      ' Display Banner
      LCDOUT $FE, $C0, "By Roy Guerra"      ' Display Banner
      PAUSE 4000        ' 4 second delay
      LCDOUT $FE, 1      ' Clear the LCD Display

' Main Program Start
' =====
loop:
      GOSUB reset      ' Set the initial conditions
      LCDOUT $fe, 1      ' Clear LCD
      LCDOUT $fe, 2, "Press Enter"      ' Display message
      LCDOUT $FE, $C0, "To Begin"      ' Display Banner
      PAUSE 500        ' 500mS delay
      IF Enter = 1 THEN      ' Debounce
          PAUSE 200
      IF Enter = 1 THEN      ' Start of main program
          GOSUB number      ' Set the number of rockets
          GOSUB seconds      ' Set the number of seconds
          GOSUB noise      ' Set beeper on or off
          GOSUB all      ' Set devices independently or all at once sequence
          GOSUB launch      ' Main launch and shutdown sequence

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    ENDIF
ENDIF
GOTO loop           ' Repeat until enter key is depressed

'
' Subroutine to set the initial conditions
reset:
    Out_1=0  ' Set all initial conditions to zero
    Out_2=0
    Out_3=0
    Out_4=0
    Out_5=0
    Out_6=0
    Out_7=0
    Out_8=0
    Fault = 0
    Beeper = 0
    B0=1
    B1=1
    B10 = 0
    B2[0]=0
    B3[0]=0
    I=0
    J=0
    K=0
    Z=0
    Flag1=0
    Flag2=0

RETURN

' Subroutine to set the number of devices
number:
    LCDOUT $fe, 1           ' Clear LCD
    LCDOUT $fe, 2, "Enter Number" ' Display sign on message
    LCDOUT $fe, $C0, "Outputs (1-8)"
    PAUSE 2000           ' 2 second delay
    LCDOUT $fe, 1           ' Clear LCD

    LCDOUT $fe, 2, "Press Increase" ' Display sign on message
    LCDOUT $fe, $C0, "Press Decrease"
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PAUSE 2000      ' 2 second delay

Flag1=1          ' Set Flag
WHILE Flag1=1    ' Stay in loop while true
FOR Z = 0 TO 19  ' 10 second delay loop for no function
  WHILE (Increase = 1) OR (Decrease = 1) ' Stay in loop while true
  Z = 0
    IF (Increase = 1) AND (Flag1 = 1) THEN          ' Debounce section
      PAUSE 100          ' 100 ms delay
      IF (Increase= 1) AND (B0 < 8) AND (Flag1 = 1) THEN
        B0 = B0 + 1          ' Upward direction
        PAUSE 10          ' 10ms delay
      ENDIF
    ENDIF
    IF (Decrease = 1) AND (Flag1 = 1) THEN          ' Debounce section
      PAUSE 100          ' 100 ms delay
      IF (Decrease = 1) AND (B0 != 1) AND (Flag1 = 1) THEN
        B0 = B0 - 1          ' Sets downward direction
        PAUSE 10          ' 10ms delay
      ENDIF
    ENDIF
    LCDOUT $fe, 1          ' Clear LCD
    LCDOUT $fe, 2, "Outputs =", " ",#B0, " " ' Display message
    PAUSE 1000          ' 1 second delay
  WEND
  LCDOUT $fe, 1          ' Clear LCD
  LCDOUT $fe, 2, "Is", " ",#B0, " ", "correct?" ' Display message
  LCDOUT $FE, $C0, "Press Enter" ' Display Banner
  PAUSE 500          ' 500ms delay
  IF (Enter = 1) AND (Flag1 = 1) THEN          ' Debounce section
    PAUSE 100          ' 100 ms delay
  IF (Enter = 1) AND (Flag1 = 1) THEN          ' Next section
    LCDOUT $fe, 1          ' Clear LCD
    Z = 0
    RETURN          ' Go to next subroutine
  ENDIF
ENDIF
ENDIF
NEXT Z
  LCDOUT $fe, 1          ' If Z hits 19; then Clear LCD
  LCDOUT $fe, 2, "Timed Out" ' Display sign on message

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        PAUSE 2000          ' 2 second delay
        GOTO loop          ' Go back and start over
WEND

' Subroutine to set the number of seconds of delay time
seconds:
Flag1 = 0                  ' Reset Flag
LCDOUT $fe, 1              ' Clear LCD
LCDOUT $fe, 2, "Enter Delay" ' Display sign on message
LCDOUT $fe, $C0, "Seconds (1-999)"
PAUSE 2000                 ' 2 second delay
LCDOUT $fe, 1              ' Clear LCD

LCDOUT $fe, 2, "Press Increase" ' Display sign on message
LCDOUT $fe, $C0, "Press Decrease"
PAUSE 2000                 ' 2 second delay

Flag1=1                    ' Set Flag
WHILE Flag1=1              ' Stay in loop while true
FOR Z = 0 TO 19           ' 10 second delay loop for no function
B10 = 0                    ' speed adjust loop counter
    WHILE (Increase = 1) OR (Decrease = 1) ' Stay in loop while true
    Z = 0                   ' Loop timeout
    B10 = B10 + 1           ' Slow, medium, fast speed adjust for display
    IF (Increase = 1) AND (Flag1 = 1) THEN ' Debounce section
        PAUSE 100          ' 100 ms delay
        IF (Increase= 1) AND (B1 < 999) AND (Flag1 = 1) THEN
            B1 = B1 + 1    ' Upward direction
            PAUSE 10       ' 10mS delay
        ENDIF
    ENDIF
    IF (Decrease = 1) AND (Flag1 = 1) THEN ' Debounce section
        PAUSE 100          ' 100 mS delay
        IF (Decrease = 1) AND (B1 != 1) AND (Flag1 = 1) THEN
            B1 = B1 - 1    ' Sets downward direction
            PAUSE 10       ' 10ms delay
        ENDIF
    ENDIF
    IF B10 <= 10 THEN      ' Slow number changes
        LCDOUT $fe, 1      ' Clear LCD
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LCDOUT $fe, 2, "Delay sec =", " ",#B1," " ' Display message
PAUSE 1000 ' 1 second delay
ENDIF
IF (B10 > 10) AND (B10 <= 31) THEN ' Medium number changes
LCDOUT $fe, 1 ' Clear LCD
LCDOUT $fe, 2, "Delay sec =", " ",#B1," " ' Display message
PAUSE 200 ' 200 mS delay
ENDIF
IF B10 > 31 THEN ' Fast number changes
LCDOUT $fe, 1 ' Clear LCD
LCDOUT $fe, 2, "Delay sec =", " ",#B1," " ' Display message
PAUSE 50 ' 50ms delay
ENDIF
WEND
LCDOUT $fe, 1 ' Clear LCD
LCDOUT $fe, 2, "Is", " ",#B1," ", "correct?" ' Display message
LCDOUT $FE, $C0, "Press Enter" ' Display Banner
PAUSE 500 ' 500mS delay
IF (Enter = 1) AND (Flag1 = 1) THEN ' Debounce section
PAUSE 100 ' 100 mS delay
IF (Enter = 1) AND (Flag1 = 1) THEN ' Next section
LCDOUT $fe, 1 ' Clear LCD
Z = 0
RETURN ' Go to next subroutine
ENDIF
ENDIF
NEXT Z
LCDOUT $fe, 1 ' If Z hits 19, then Clear LCD
LCDOUT $fe, 2, "Timed Out" ' Display sign on message
PAUSE 2000 ' 2 second delay
GOTO loop ' Go back and start over
WEND

' Subroutine to set the beeper on or off
noise:
Flag1 = 0 ' Reset Flag
LCDOUT $fe, 1 ' Clear LCD
LCDOUT $fe, 2, "Beeper" ' Display sign on message
LCDOUT $fe, $C0, "On or Off"
PAUSE 2000 ' 2 second delay

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```
LCDOUT $fe, 1          ' Clear LCD

LCDOUT $fe, 2, "Default is" ' Display sign on message
LCDOUT $fe, $C0, "Off"
PAUSE 1000           ' 1 second delay
LCDOUT $fe, 1          ' Clear LCD

LCDOUT $fe, 2, "Increase = On" ' Display sign on message
LCDOUT $fe, $C0, "Decrease = Off"
PAUSE 200           ' 200mS delay

Flag1 = 1
WHILE Flag1 = 1      ' Stay in loop while true
  FOR Z = 0 TO 19    ' 10 second delay loop for no function
    WHILE (Increase = 1) OR (Decrease = 1) ' Stay in loop while true
      Z = 0
      IF (Increase = 1) AND (Flag1 = 1) THEN          ' Debounce section
        PAUSE 100          ' 100 ms delay
        IF (Increase = 1) AND (Flag1 = 1) THEN
          B2[0] = 1      ' Turn sound on
          LCDOUT $fe, 1      ' Clear LCD
          LCDOUT $fe, 2, "Beeper On" ' Display sign on message
          LCDOUT $fe, $C0, "Press Enter"
          Z = 0
          PAUSE 200          ' 200 mS delay
        ENDIF
      ENDIF
      IF (Decrease = 1) AND (Flag1 = 1) THEN          ' Debounce section
        PAUSE 100          ' 100 mS delay
        IF (Decrease = 1) AND (Flag1 = 1) THEN
          B2[0] = 0      ' turn sound off
          LCDOUT $fe, 1      ' Clear LCD
          LCDOUT $fe, 2, "Beeper Off" ' Display sign on message
          LCDOUT $fe, $C0, "Press Enter"
          Z = 0
          PAUSE 200          ' 200mS delay
        ENDIF
      ENDIF
    WEND
  IF (Enter = 1) AND (Flag1 = 1 ) THEN          ' Debounce section
```



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PAUSE 100           ' 100 mS delay
IF (Enter = 1) AND (Flag1 = 1) THEN           ' Next section
    LCDOUT $fe, 1           ' Clear LCD
    Z = 0
    RETURN                 ' Go to next subroutine
ENDIF
ENDIF
PAUSE 500           ' Delay 500mS
NEXT Z
LCDOUT $fe, 1           ' Clear LCD
LCDOUT $fe, 2, "Timed Out" ' Display sign on message
PAUSE 2000           ' 2 second delay
GOTO loop             ' Go back and start over
WEND

```

' Subroutine to launch all at once or in an individual sequence

all:

```

Flag1 = 0           ' Reset Flag
LCDOUT $fe, 1           ' Clear LCD
LCDOUT $fe, 2, "Seperate Outputs" ' Display sign on message
LCDOUT $fe, $C0, "On or Off"
PAUSE 2000           ' 2 second delay
LCDOUT $fe, 1           ' Clear LCD

LCDOUT $fe, 2, "Default is" ' Display sign on message
LCDOUT $fe, $C0, "Off"
PAUSE 1000           ' 1 second delay
LCDOUT $fe, 1           ' Clear LCD

LCDOUT $fe, 2, "Increase = On" ' Display sign on message
LCDOUT $fe, $C0, "Decrease = Off"
PAUSE 200           ' 200mS delay

Flag1 = 1
WHILE Flag1 = 1           ' Stay in loop while true
    FOR Z = 0 TO 19           ' 10 second delay loop for no function
        WHILE (Increase = 1) OR (Decrease = 1) ' Stay in loop while true
            Z = 0
            IF (Increase = 1) AND (Flag1 = 1) THEN           ' Debounce section
                PAUSE 100           ' 100 ms delay

```

```

    IF (Increase = 1) AND (Flag1 = 1) THEN
        B3[0] = 1           ' Seperate outputs
        LCDOUT $fe, 1      ' Clear LCD
        LCDOUT $fe, 2, "Seperate Outputs" ' Display sign on message
        LCDOUT $fe, $C0, "Press Enter"
        Z = 0
        PAUSE 200         ' 200 mS delay
    ENDIF
ENDIF
IF (Decrease = 1) AND (Flag1 = 1) THEN           ' Debounce section
    PAUSE 100                                     ' 100 mS delay
    IF (Decrease = 1) AND (Flag1 = 1) THEN
        B3[0] = 0           ' Launch all at once
        LCDOUT $fe, 1      ' Clear LCD
        LCDOUT $fe, 2, "Launch at Once" ' Display sign on message
        LCDOUT $fe, $C0, "Press Enter"
        Z = 0
        PAUSE 200         ' 200mS delay
    ENDIF
ENDIF
WEND
IF (Enter = 1) AND (Flag1 = 1) THEN           ' Debounce section
    PAUSE 100                                     ' 100 mS delay
    IF (Enter = 1) AND (Flag1 = 1) THEN           ' Next section
        LCDOUT $fe, 1      ' Clear LCD
        Z = 0
        RETURN             ' Go to next subroutine
    ENDIF
ENDIF
PAUSE 500         ' Delay 500mS
NEXT Z
LCDOUT $fe, 1      ' Clear LCD
LCDOUT $fe, 2, "Timed Out" ' Display sign on message
PAUSE 2000        ' 2 second delay
GOTO loop        ' Go back and start over
WEND

```

' Subroutine to launch and / or abort and display coutdown information

launch:

```

    Flag1 = 0           ' Reset Flag

```

```
LCDOUT $fe, 1          ' Clear LCD
LCDOUT $fe, 2, "Launch Or" ' Display sign on message
LCDOUT $fe, $C0, "Abort"
PAUSE 1000            ' 1 second delay
LCDOUT $fe, 1          ' Clear LCD

LCDOUT $fe, 2, "Press Increase" ' Display sign on message
LCDOUT $fe, $C0, "For Launch"
PAUSE 1000            ' 1 second delay

Flag1 = 1
FOR K = 0 TO 50      ' 10 second delay
  IF (Flag1 = 1) AND (Increase = 1) THEN
    PAUSE 100        ' Debounce
    IF (Flag1 = 1) AND (Increase = 1) THEN
      LCDOUT $fe, 1          ' Clear LCD
      LCDOUT $fe, 2, "Get Ready" ' Display message
      LCDOUT $FE, $C0, "To Launch" ' Display Banner
      Flag2 = 1              ' Sets Flag
      K = 0
      PAUSE 2000            ' 2 second delay
      GOTO fire              ' Goto launch sequence
    ENDIF
  ENDIF

IF Abort = 1 THEN    ' Debounce section
  PAUSE 100
  IF Abort = 1 THEN  ' Abort is depressed
    Flag2 = 0
    LCDOUT $fe, 1          ' Clear LCD
    LCDOUT $fe, 2, "Abort; Turn" ' Display message
    LCDOUT $FE, $C0, "Power Off / On" ' Display Banner
    GOSUB reset           ' clear all outputs
    Fault = 1             ' Turn on Fault LED
    PAUSE 200             ' 200mS delay
    STOP
  ENDIF
ENDIF
PAUSE 200              ' Delay 200mS
```

```

IF K = 50 THEN
LCDOUT $fe, 1
LCDOUT $fe, 2, "Timed Out" ' Display sign on message
PAUSE 2000 ' 2 second delay
GOTO loop ' Go to beginning on timeout
ENDIF
NEXT K

```

fire:

```

WHILE (Flag1 = 1) AND (Flag2 = 1) ' Launch sequence
    K = 0
    FOR I = 1 TO B0 ' Device number loop
        FOR J = B1 TO 0 STEP -1 ' Countdown seconds loop
            LCDOUT $fe, 1 ' Clear LCD
            LCDOUT $fe, 2, "Device =", " ", "#", #I, " " ' Display message
            LCDOUT $FE, $C0, "Countdown =", " ", #J, " " ' Display message
            SELECT CASE I ' Choose the case based on the index
                CASE 1
                    IF (B3[0] = 0) AND (J <=0) THEN ' All Launch sequence
                        LCDOUT $fe, 1 ' Clear LCD
                        LCDOUT $fe, 2, "Device = All"
                        PAUSE 100
                        Out_1 = 1 ' Turn on all all outputs
                        Out_2 = 1
                        Out_3 = 1
                        Out_4 = 1
                        Out_5 = 1
                        Out_6 = 1
                        Out_7 = 1
                        Out_8 = 1
                        Beeper = 0 ' Turn off sound
                        GOTO loop2 ' Jump to loop 2
                    IF (B2[0] = 1) AND (J = 1) THEN ' Turn sound on
                        Beeper = 1 ' Sound is on
                    ENDIF
                ENDIF
                IF (B2[0] = 1) AND (J = 1) THEN ' Turn sound on
                    Beeper = 1 ' Sound is on
                ENDIF
            IF J <= 0 THEN
                Out_1 = 1 ' Turn on Output
            ENDIF
        NEXT J
    NEXT I

```

```
Beeper = 0      ' sound is off
ENDIF
CASE 2
IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
Beeper = 1      ' Sound is on
ENDIF
IF J <= 0 THEN
Out_2 = 1      ' Turn on Output
Beeper = 0      ' Sound is off
ENDIF
CASE 3
IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
Beeper = 1      ' Sound is on
ENDIF
IF J <= 0 THEN
Out_3 = 1      ' Turn on Output
Beeper = 0      ' Sound is off
ENDIF
CASE 4
IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
Beeper = 1      ' sound is on
ENDIF
IF J <= 0 THEN
Out_4 = 1      ' Turn on Output
Beeper = 0      ' sound is off
ENDIF
CASE 5
IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
Beeper = 1      ' Sound is on
ENDIF
IF J <= 0 THEN
Out_5 = 1      ' Turn on Output
Beeper = 0      ' sound is off
ENDIF
CASE 6
IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
Beeper = 1      ' sound is on
ENDIF
IF J <= 0 THEN
Out_6 = 1      ' Turn on Output
```

```

    Beeper = 0          ' sound is off
    ENDIF
    CASE 7
    IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
    Beeper = 1          ' sound is on
    ENDIF
    IF J <= 0 THEN
    Out_7 = 1          ' Turn on Output
    Beeper = 0          ' sound is off
    ENDIF
    CASE 8
    IF (B2[0] = 1) AND (J = 1) THEN      ' Turn sound on
    Beeper = 1          ' Sound is on
    ENDIF
    IF J <= 0 THEN
    Out_8 = 1          ' Turn on Output
    Beeper = 0          ' sound is off
    ENDIF
    END SELECT

IF Abort = 1 THEN          ' Debounce section
    PAUSE 100
    IF Abort = 1 THEN
    Flag2 = 0
    LCDOUT $fe, 1          ' Clear LCD
    LCDOUT $fe, 2, "Abort; Turn"      ' Display message
    LCDOUT $FE, $C0, "Power Off / On"  ' Display Banner
    GOSUB reset
    Fault = 1          ' Turn on LED
    STOP              ' Halt microcontroller in this state
    ENDIF
ENDIF

    PAUSE 1000          ' delay 1 second
NEXT J
NEXT I

loop2:
    LCDOUT $fe, 1          ' Clear LCD
    LCDOUT $fe, 2, "Complete"      ' Display message
    PAUSE 2000
```

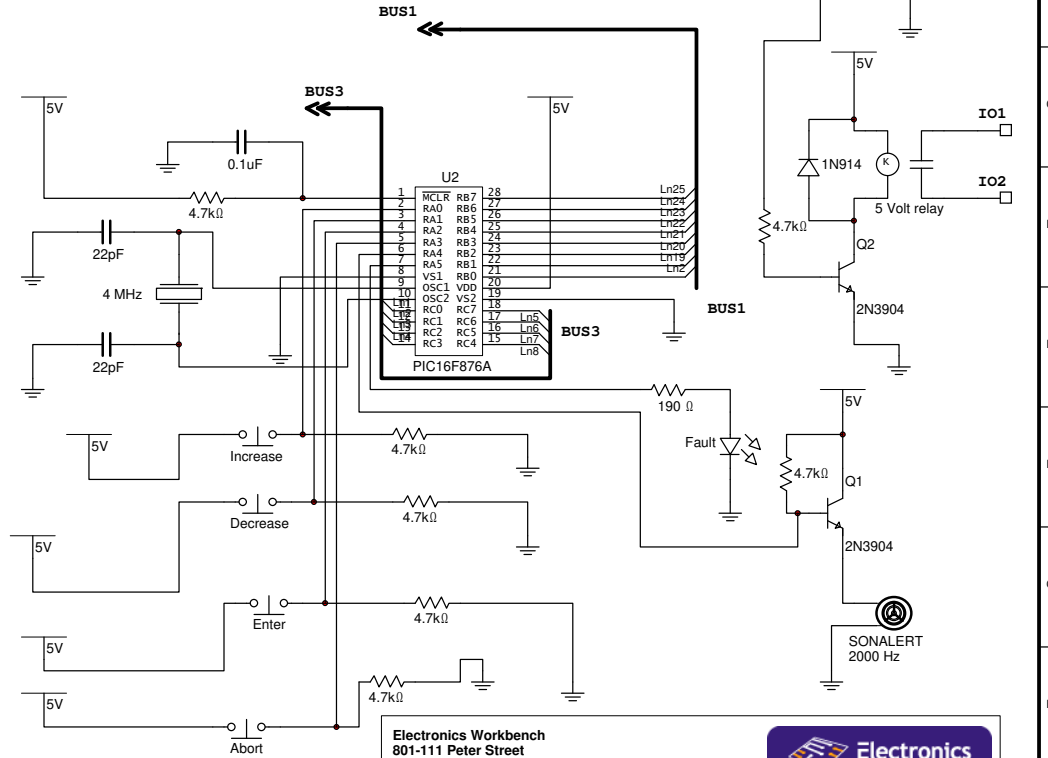
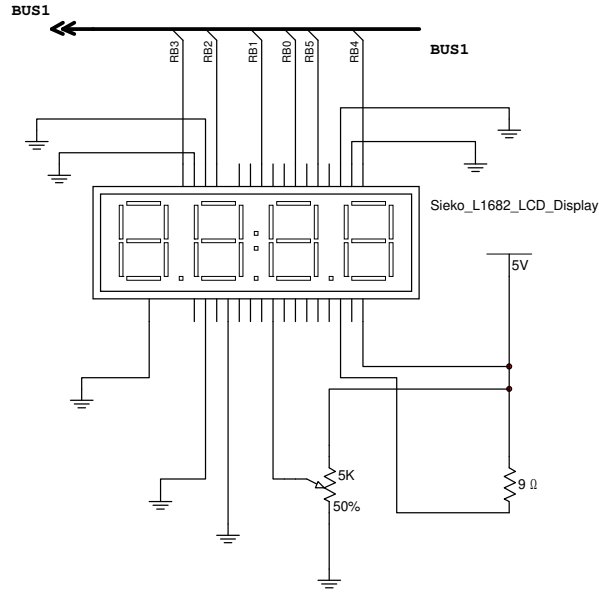
```
loop1:
    LCDOUT $fe, 1           ' Clear LCD
    LCDOUT $fe, 2, "Press Enter" ' Display message
    LCDOUT $FE, $C0, "To Return" ' Display Banner
    PAUSE 500

    IF Enter = 1 THEN      ' debounce section
    PAUSE 100
    IF Enter = 1 THEN      ' Proceed for button depress
    RETURN
    ENDIF
    ENDIF
    GOTO loop1             ' Go back to start

WEND

END
```

Rocket / Firework Launcher



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