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BS2p “Plus Pack” AppKit (#45184)

Introduction

The BS2p “Plus Pack” is a selection of components and ready-to-run source code to assist experimenters with mastering some of the exciting new features of the BS2p; specifically the use of parallel LCDs, Phillips I²C™ components and Dallas Semiconductor 1-Wire® components.

Please note that this AppKit is designed for intermediate to advanced users. The schematics and source code have been carefully checked and are commented, but the expectation is that the user will consult the appropriate product data sheets (not duplicated here) for detailed explanation of each component’s operation.

Each of the enclosed experiments was built, tested and run on the BS2p Demo Board (#45183). Should you desire more space for connecting components, please consider the NX-1000 lab board (#28135).

Packing List

Verify that your BS2p “Plus Pack” package is complete in accordance with the list below. The contents of the package include:

- Packing List (this page)
- Documentation/Source Code Diskette
- Parallel LCD module; 2 lines x 16 characters (HD44780-compatible)
- PCF8574 Remote 8-Bit I/O Expander
- PCF8583 Clock/Calendar with 240 x 8-Bit RAM
- PCF8591 8-Bit A/D and D/A Converter
- 24LC32 32K Serial EEPROM
- (2) DS1822 Econo-MicoLAN Digital Thermometer
- DS2405 Addressable Switch
- DS2890 1-Wire Digital Potentiometer
- (4) Jumper wires packs
- 220 ohm resistor
- (2) 1K resistor
- 10K resistor
- 100K potentiometer
- 0.01 uF capacitor
- (2) low-current LED
- Normally-open pushbutton switch
- 32.678 kHz crystal

PP_LCDDEMO1.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display

```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_LCDDEMO1.BSP  
' Purpose... Basic LCD Demo - Single Line Mode  
' Author.... Parallax, Inc.  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
  
' {$STAMP BS2p}  
  
' -----[ Program Description ]-----  
'  
' This program demonstrates LCD basics using the BS2p.  
'  
' To run this program on the BS2p Demo Board, connect the LCD and install  
' Jumper X6. Adjust contrast pot for best display.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
  
' -----[ Revision History ]-----  
'  
  
' -----[ I/O Definitions ]-----  
'  
LCDpin  CON    0                ' connect LCD to OutL  
  
' -----[ Constants ]-----  
'  
NoCmd      CON    $00                ' No command in LCDOUT  
ClrLCD     CON    $01                ' clear the LCD  
CrsrHm     CON    $02                ' move cursor to home position  
CrsrLf     CON    $10                ' move cursor left  
CrsrRt     CON    $14                ' move cursor right  
DispLf     CON    $18                ' shift displayed chars left  
DispRt     CON    $1C                ' shift displayed chars right  
DDRam      CON    $80                ' Display Data RAM control  
  
DispCtrl   CON    %00001000        ' display control command  
  
On         CON    1  
Off        CON    0  
  
' -----[ Variables ]-----  
'  
cmd        VAR    Byte                ' command sent to LCD
```

```

display      VAR      cmd.Bit2      ' display on/off bit
cursor       VAR      cmd.Bit1      ' cursor on/off bit
blinking     VAR      cmd.Bit0      ' blinking on/off bit

char         VAR      cmd           ' character sent to LCD
idx          VAR      Byte          ' loop counter

' -----[ EEPROM Data ]-----
'

' -----[ Initialization ]-----
'
Initialize:
  PAUSE 500                                ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5        ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0        ' 4-bit mode
  LCDCMD LCDpin,%00001100 : PAUSE 0        ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0        ' inc crsr, no disp shift

' -----[ Main Code ]-----
'
Main:
  LCDCMD LCDpin,ClrLCD                      ' clear display
  PAUSE 500

Splash_Screen
  LCDCMD LCDpin,NoCmd,["THE BASIC STAMP!"]
  PAUSE 2000

Cursor_On:
  LCDCMD LCDpin,CrsrHm                      ' move the cursor home
  cmd = DispCtrl
  display = On
  cursor = On
  LCDCMD LCDpin,cmd
  PAUSE 500

Move_Cursor:
  FOR idx = 1 TO 15                          ' move the cursor across display
    LCDCMD LCDpin,CrsrRt
    PAUSE 150
  NEXT

  FOR idx = 14 TO 0                          ' go backward by moving cursor
    cmd = DDRam + idx                       ' to a specific address
    LCDCMD LCDpin,cmd
    PAUSE 150
  NEXT

  PAUSE 1000

Block_Cursor:
  cmd = DispCtrl
  display = On
  blinking = On                              ' enable block cursor
  LCDCMD LCDpin,cmd
  PAUSE 2000
  blinking = Off                            ' turn it off

```

```

LCDCMD LCDpin,cmd

Flash_Display:
cmd = DispCtrl
display = On

FOR idx = 1 TO 10           ' flash display by
  display = ~display       ' toggling display bit
  LCDCMD LCDpin,cmd
  PAUSE 250
NEXT

PAUSE 1000

Shift_Display:
FOR idx = 1 TO 16         ' shift display to right
  LCDCMD LCDpin,DispRt
  PAUSE 100
NEXT

PAUSE 1000

FOR idx = 1 TO 16         ' shift display back
  LCDCMD LCDpin,DispLf
  PAUSE 100
NEXT

PAUSE 1000
GOTO Main                ' do it all over
END

' -----[ Subroutines ]-----
'

```

PP_LCDDEMO2.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display

```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_LCDDEMO2.BSP  
' Purpose... Basic LCD Demo - Multi-line mode with custom characters  
' Author.... Parallax, Inc.  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
  
' {$STAMP BS2p}  
  
' -----[ Program Description ]-----  
'  
' This program demonstrates the use of the multi-line initialization and  
' the use of custom characters. When using the standard 5x7 font, the LCD  
' will hold up to eight customer characters.  
'  
' To run this program on the BS2p Demo Board, connect the LCD and install  
' Jumper X6. Adjust contrast pot for best display.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
  
' -----[ Revision History ]-----  
'  
  
' -----[ I/O Definitions ]-----  
'  
LCDpin          CON      0          ' connect LCD to OutL  
  
' -----[ Constants ]-----  
'  
NoCmd           CON      $00          ' No command in LCDOUT  
ClrLCD          CON      $01          ' clear the LCD  
CrsrHm          CON      $02          ' move cursor to home position  
CrsrLf          CON      $10          ' move cursor left  
CrsrRt          CON      $14          ' move cursor right  
DispLf          CON      $18          ' shift displayed chars left  
DispRt          CON      $1C          ' shift displayed chars right  
DDRam           CON      $80          ' Display Data RAM control  
CGRam           CON      $40          ' Custom character RAM  
Line1           CON      $80          ' DDRAM address of line 1  
Line2           CON      $C0          ' DDRAM address of line 2  
  
' -----[ Variables ]-----  
'
```

```

cmd          VAR      Byte      ' command sent to LCD
char         VAR      Byte      ' character sent to LCD
newChr       VAR      Byte      ' new character for animation
addr         VAR      Byte      ' address in EE and display
cNum         VAR      Byte      ' character number

' -----[ EEPROM Data ]-----
'
' custom character definitions

Mouth0       DATA    $0E,$1F,$1F,$1F,$1F,$1F,$0E,$00
Mouth1       DATA    $0E,$1F,$1F,$18,$1F,$1F,$0E,$00
Mouth2       DATA    $0E,$1F,$1C,$18,$1C,$1F,$0E,$00
Smile        DATA    $00,$0A,$0A,$00,$11,$0E,$06,$00

Msg          DATA    " IS VERY COOL! ",3      ' revealed message

' -----[ Initialization ]-----
'
Initialize:
  PAUSE 500          ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5      ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0      ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0      ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0      ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0      ' inc crsr, no disp shift

DLChars:          ' download custom chars to LCD
  LCDCMD LCDpin,CGRam          ' prepare to write CG data
  FOR addr = Mouth0 TO (Smile + 7)
    READ addr,char          ' get byte from EEPROM
    LCDOUT LCDpin,NoCmd,[char]          ' put into LCD CGRAM
  NEXT

' -----[ Main Code ]-----
'
Main:
  LCDCMD LCDpin,ClrLCD
  PAUSE 1000
  LCDOUT LCDpin,NoCmd,["THE BASIC STAMP"]
  PAUSE 2000

  ' Animation by character replacement

  FOR addr = 0 TO 15          ' cover 16 characters
    READ (Msg + addr),newChr          ' get new char from message
    cmd = Line2 + addr          ' set new DDRAM address
    FOR cNum = 0 TO 4          ' 5 characters in cycle
      LOOKUP cNum,[2,1,0,1,newChr],char
      LCDOUT LCDpin,cmd,[char]          ' write animation character
      PAUSE 100          ' delay between animation chars
    NEXT
  NEXT

  PAUSE 3000
  GOTO Main          ' do it all over
  END

```

```
' -----[ Subroutines ]-----  
'
```

PP_LCDFONT.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display

```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_LCDFONT.BSP  
' Purpose... Advanced LCD Demo - custom numeric font(s)  
' Author.... Parallax, Inc.  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
  
' {$STAMP BS2p}  
  
' -----[ Program Description ]-----  
'  
' This program demonstrates character definition replacement in order to create  
' a custom font for numbers. This program creates three custom characters that  
' are used to display the tens, ones and tenths value of a counter.  
'  
' The program analyzes the counter and updates the screen by downloading the  
' appropriate character map for each digit.  
'  
' To run this program on the BS2p Demo Board, connect the LCD and install  
' Jumper X6. Adjust contrast pot for best display.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
  
' -----[ Revision History ]-----  
'  
  
' -----[ I/O Definitions ]-----  
'  
LCDpin          CON      0          ' connect LCD to OutL  
  
' -----[ Constants ]-----  
'  
NoCmd           CON      $00          ' No command in LCDOUT  
ClrLCD          CON      $01          ' clear the LCD  
CrsrHm          CON      $02          ' move cursor to home position  
CrsrLf          CON      $10          ' move cursor left  
CrsrRt          CON      $14          ' move cursor right  
DispLf          CON      $18          ' shift displayed chars left  
DispRt          CON      $1C          ' shift displayed chars right  
DDRam           CON      $80          ' Display Data RAM control  
CGRam           CON      $40          ' Custom character RAM  
Line1           CON      $80          ' DDRAM address of line 1  
Line2           CON      $C0          ' DDRAM address of line 2  
  
CLines          CON      8          ' lines per character  
Space           CON      10
```



```

' -----[ Variables ]-----
,
char          VAR      Byte      ' character sent to LCD
addr          VAR      Byte      ' EE starting address of map
cNum          VAR      Nib       ' character number
idx           VAR      Nib       ' loop counter

counter       VAR      Word

' -----[ EEPROM Data ]-----
,
' character definitions - digits 0 - 9 and space
,
Dig_0         DATA    $1F,$11,$11,$19,$19,$19,$1F,$00
Dig_1         DATA    $04,$04,$04,$0C,$0C,$0C,$0C,$00
Dig_2         DATA    $1F,$01,$01,$1F,$18,$18,$1F,$00
Dig_3         DATA    $1E,$02,$02,$1F,$03,$03,$1F,$00
Dig_4         DATA    $18,$18,$18,$19,$1F,$01,$01,$00
Dig_5         DATA    $1F,$18,$18,$1F,$01,$01,$1F,$00
Dig_6         DATA    $18,$10,$10,$1F,$19,$19,$1F,$00
Dig_7         DATA    $1F,$11,$01,$03,$03,$03,$03,$00
Dig_8         DATA    $0E,$0A,$0A,$1F,$13,$13,$1F,$00
Dig_9         DATA    $1F,$11,$11,$1F,$03,$03,$03,$00
Dig_Spc       DATA    $00,$00,$00,$00,$00,$00,$00,$00

' -----[ Initialization ]-----
,
Initialize:
  PAUSE 500                                ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5        ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0        ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0        ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0        ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0        ' inc crsr, no disp shift

  FOR cNum = 0 TO 2                          ' initialize cust chars
    LOOKUP cNum,[Dig_0,Dig_0,Dig_Spc],addr
    GOSUB Update_CC
  NEXT

' -----[ Main Code ]-----
,
Main:
  LCDOUT LCDpin,ClrLCD,["CUSTOM DIGITS"]    ' setup display
  LCDOUT LCDpin,(Line2 + 12),[2,1,".",0]

Show_Counter:
  FOR counter = 0 TO 999                      ' count in tenths 0 - 99.9
    FOR cNum = 0 TO 2
      addr = counter DIG cNum                ' get a digit
      IF (cNum < 2) OR (addr > 0) THEN DigitOK
      addr = Space                          ' leading space if < 10
    DigitOK:
      addr = addr * CLines                   ' calculate map for this digit
      GOSUB Update_CC                       ' download to LCD
    NEXT

```

```

    PAUSE 100
NEXT

GOTO Main
END

' -----[ Subroutines ]-----
'
Update_CC:                                ' update custom character
LCDCMD LCDpin,(CGRam + (cNum * CLines))  ' point to character map
FOR idx = 0 TO (CLines - 1)
    READ (addr + idx),char                ' get data for character line
    LCDOUT LCDpin,NoCmd,[char]           ' write to LCD CGRAM
NEXT
RETURN

```

PP_LCDODO.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display

```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_LCDODO.BSP  
' Purpose... Advanced LCD Demo - rewriting CGRAM on the fly  
' Author.... Parallax, Inc.  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
  
' {$STAMP BS2p}  
  
' -----[ Program Description ]-----  
'  
' This program demonstrates LCD character animation by writing to the  
' character map (in CGRAM) for a character that is already displayed. The  
' refresh cycle of the LCD will cause the character to change when its  
' map is changed. This technique (originally by Scott Edwards) allows  
' the programmer to create advanced animations by storing character (cell)  
' definitions in the Stamp's EEPROM.  
'  
' This program displays a rolling odometer type reading (last digit  
' "rolls"). Character definitions are copied from the standard set  
' (using "LCD Character Creator" software from Parallax).  
'  
' Each character definition is separated by 2 blank lines in order to create  
' 10 lines per "rolling" character. This makes the math for calculating  
' the starting line of the roller very easy.  
'  
' To run this program on the BS2p Demo Board, connect the LCD and install  
' Jumper X6. Adjust contrast pot for best display.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
  
' -----[ Revision History ]-----  
'  
  
' -----[ I/O Definitions ]-----  
'  
LCDpin          CON      0          ' connect LCD to OutL  
  
' -----[ Constants ]-----  
'  
NoCmd           CON      $00          ' No command in LCDOUT  
ClrLCD          CON      $01          ' clear the LCD  
CrsrHm          CON      $02          ' move cursor to home position  
CrsrLf          CON      $10          ' move cursor left  
CrsrRt          CON      $14          ' move cursor right  
DispLf          CON      $18          ' shift displayed chars left
```

```

DispRt      CON      $1C      ' shift displayed chars right
DDRam       CON      $80      ' Display Data RAM control
CGRam       CON      $40      ' Custom character RAM
Line1       CON      $80      ' DDRAM address of line 1
Line2       CON      $C0      ' DDRAM address of line 2

CLines      CON      8        ' lines per character
OdoChar     CON      0        ' animated odometer character

' -----[ Variables ]-----
'
cmd          VAR      Byte     ' command sent to LCD
char         VAR      Byte     ' character sent to LCD
addr        VAR      Byte     ' EE starting address of map
cNum        VAR      Nib      ' character number
idx         VAR      Nib      ' loop counter

counter     VAR      Word     '
hundreds    VAR      Byte     ' hundredths value of counter

temp        VAR      Word     ' temp value for RJ display
width       VAR      Nib      ' width of rt justified
pos         VAR      Byte     ' LCD display position
digits      VAR      Nib      ' digits to display

' -----[ EEPROM Data ]-----
'
' rolling odometer character definitions
'
Char0       DATA    $0E,$11,$13,$15,$19,$11,$0E,$00,$00,$00
Char1       DATA    $04,$0C,$04,$04,$04,$04,$0E,$00,$00,$00
Char2       DATA    $0E,$11,$01,$02,$04,$08,$1F,$00,$00,$00
Char3       DATA    $1F,$02,$04,$02,$01,$11,$0E,$00,$00,$00
Char4       DATA    $02,$06,$0A,$12,$1F,$02,$02,$00,$00,$00
Char5       DATA    $1F,$10,$1E,$01,$01,$11,$0E,$00,$00,$00
Char6       DATA    $06,$08,$10,$1E,$11,$11,$0E,$00,$00,$00
Char7       DATA    $1F,$01,$02,$04,$08,$08,$08,$00,$00,$00
Char8       DATA    $0E,$11,$11,$0E,$11,$11,$0E,$00,$00,$00
Char9       DATA    $0E,$11,$11,$0F,$01,$02,$0C,$00,$00,$00

' inverted character definitions (white on black)
'
Char0i      DATA    $11,$0E,$0C,$0A,$06,$0E,$11,$1F,$1F,$1F
Char1i      DATA    $1B,$13,$1B,$1B,$1B,$1B,$11,$1F,$1F,$1F
Char2i      DATA    $11,$0E,$1E,$1D,$1B,$17,$00,$1F,$1F,$1F
Char3i      DATA    $00,$1D,$1B,$1D,$1E,$0E,$11,$1F,$1F,$1F
Char4i      DATA    $1D,$19,$15,$0D,$00,$1D,$1D,$1F,$1F,$1F
Char5i      DATA    $00,$0F,$01,$1E,$1E,$0E,$11,$1F,$1F,$1F
Char6i      DATA    $19,$17,$0F,$01,$0E,$0E,$11,$1F,$1F,$1F
Char7i      DATA    $00,$1E,$1D,$1B,$17,$17,$17,$1F,$1F,$1F
Char8i      DATA    $11,$0E,$0E,$11,$0E,$0E,$11,$1F,$1F,$1F
Char9i      DATA    $11,$0E,$0E,$10,$1E,$1D,$13,$1F,$1F,$1F

MapStart    CON      Char0i

' -----[ Initialization ]-----
'
Initialize:

```

```

PAUSE 500 ' let the LCD settle
LCDCMD LCDpin,%00110000 : PAUSE 5 ' 8-bit mode
LCDCMD LCDpin,%00110000 : PAUSE 0
LCDCMD LCDpin,%00110000 : PAUSE 0
LCDCMD LCDpin,%00100000 : PAUSE 0 ' 4-bit mode
LCDCMD LCDpin,%00101000 : PAUSE 0 ' 2-line mode
LCDCMD LCDpin,%00001100 : PAUSE 0 ' no crsr, no blink
LCDCMD LCDpin,%00000110 : PAUSE 0 ' inc crsr, no disp shift

cNum = OdoChar
addr = 0
GOSUB Update_CC ' put "0" into custom character

' -----[ Main Code ]-----
Main:
LCDOUT LCDpin,ClrLCD,["ROLLER COUNTER"]
LCDOUT LCDpin,Line2, [" 0",OdoChar," 0.00"]
PAUSE 1000

Show_Counters:
FOR counter = 0 TO 999
  FOR hundreds = 0 TO 99
    temp = counter ' display odometer version
    width = 3
    pos = Line2 + 1
    GOSUB RJ_Print
    addr = hundreds
    GOSUB Update_CC ' update rolling character
    pos = Line2 + 10 ' display digital version
    GOSUB RJ_Print
    LCDOUT LCDpin,NoCmd,[".",DEC2 hundreds]
    PAUSE 100
  NEXT
NEXT

GOTO Main
END

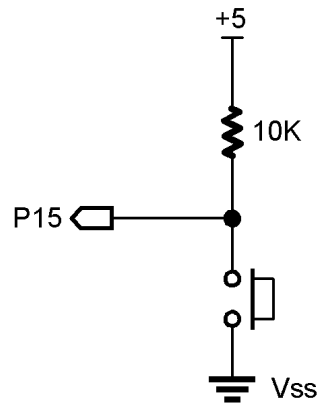
' -----[ Subroutines ]-----
Update_CC: ' update custom character
LCDCMD LCDpin,(CGRam + (cNum * CLines)) ' point to character map
FOR idx = 0 TO (CLines - 1)
  READ MapStart + (addr + idx // 100),char
  LCDOUT LCDpin,NoCmd,[char] ' write to LCD CGRAM
NEXT
RETURN

RJ_Print: ' right justified printing
digits = width
LOOKDOWN temp,<[0,10,100,1000,65535],digits
LCDOUT LCDpin,pos,[REP " "\ (width-digits),DEC temp]
RETURN

```


PP_LCD5x10.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display
- Assemble pushbutton circuit on breadboard



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_LCD5x10.BSP  
' Purpose... Basic LCD Demo -- Using 5x10 font and descended characters  
' Author.... Parallax, Inc.  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program demonstrates a method of intializing a 2x16 LCD so that it behaves  
' like a single-line LCD that will display the 5x10 character set. The LCD  
' character map includes properly descended characters, but they are not mapped  
' in the normal ASCII set. A simple conversion routine can be used to replace  
' "squishy" descended characters with proper ones.  
'  
' Stamp pin 15 is pulled up to Vdd (+5) through 10K. This pin is connected to  
' Vss (ground) through a N.O. pushbutton switch. The pin will read 1 when the  
' switch is open, 0 when pressed.  
'  
' To run this program on the BS2p Demo Board, assemble the the switch circuit on  
' the breadboard, connect the LCD to X5 and install Jumper X6. Adjust contrast  
' pot for best display.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
'  
' -----[ Revision History ]-----  
'
```

```

' -----[ I/O Definitions ]-----
'
LCDpin          CON      0          ' LCD is connected to OutL
AskBtn          VAR      In15       ' Ask button input pin

' -----[ Constants ]-----
'
NoCmd           CON      $00        ' No command in LCDOUT
ClrLCD         CON      $01        ' clear the LCD
CrsrHm         CON      $02        ' move cursor to home position
CrsrLf         CON      $10        ' move cursor left
CrsrRt         CON      $14        ' move cursor right
DispLf         CON      $18        ' shift displayed chars left
DispRt         CON      $1C        ' shift displayed chars right
DDRam          CON      $80        ' Display Data RAM control

NumAns         CON      6          ' 6 possible answers

_g             CON      $E7        ' DDROM addresses of descenders
_j             CON      $EA
_p             CON      $F0
_q             CON      $F1
_y             CON      $F9

Pressed        CON      0          ' button input is active low

' -----[ Variables ]-----
'
char           VAR      Byte       ' character sent to LCD
addr           VAR      Byte       ' message address
answer         VAR      Nib        ' answer pointer
clock          VAR      Nib        ' animation clock
pntr           VAR      Nib        ' pointer to animation character

' -----[ EEPROM Data ]-----
'
Prompt         DATA    "Ask a question",0  ' messages for LCD

Ans0           DATA    "Definitely YES",0
Ans1           DATA    "Possible...",0
Ans2           DATA    "Definitely NO",0
Ans3           DATA    "Not likely...",0
Ans4           DATA    "Answer uncertain",0
Ans5           DATA    "Please ask again",0

' -----[ Initialization ]-----
'
Initialize:
  PAUSE 500          ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5      ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0      ' 4-bit mode
  LCDCMD LCDpin,%00100100 : PAUSE 0      ' 5x10 font
  LCDCMD LCDpin,%00001100 : PAUSE 0      ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0      ' inc crsr, no disp shift

```



```

' -----[ Main Code ]-----
,
Main:
  LCDCMD LCDpin,ClrLCD          ' clear the LCD
  addr = Prompt
  GOSUB Show_Msg                ' print prompt

Rollem:
  GOSUB Shuffle                  ' shuffle until button pressed
  PAUSE 5
  IF (AskBtn = Pressed) THEN Show_Answer
  GOTO Rollem

Show_Answer:
  ' get address of answer message
  LOOKUP answer,[Ans0,Ans1,Ans2,Ans3,Ans4,Ans5],addr

  LCDCMD LCDpin,ClrLCD
  GOSUB Show_Msg

  PAUSE 2000                    ' give time to read answer
  GOTO Main                      ' do it all over
  END

' -----[ Subroutines ]-----
,
Show_Msg:
  READ addr,char                ' read a character
  IF (char = 0) THEN Msg_Done   ' if 0, message is complete
  GOSUB Translate               ' fix letters with descenders
  LCDOUT LCDpin,NoCmd,[char]
  addr = addr + 1               ' point to next character
  GOTO Show_Msg

Msg_Done:
  RETURN

' convert to descender font
' - does not change other characters

Translate:
  LOOKDOWN char,["g","j","q","p","y"],char ' translate decended characters
  LOOKUP char,[_g,_j,_q,_p,_y],char
  RETURN

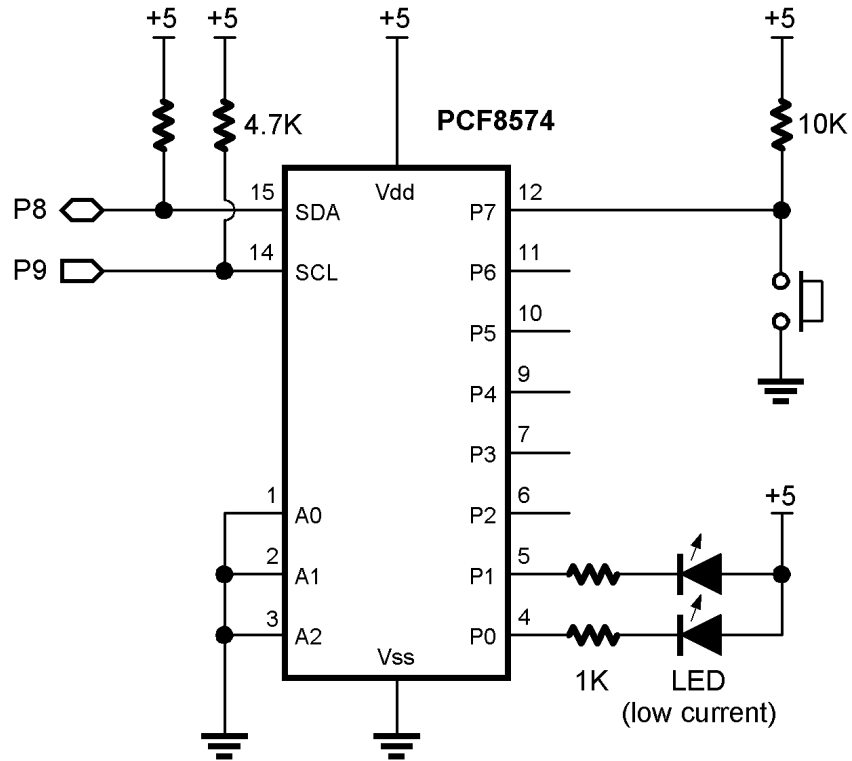
Shuffle:
  answer = answer + 1 // NumAns ' update answer pointer
  clock = clock + 1 // 15      ' update pointer clock
  IF (clock > 0) THEN Shuffle_Done ' time to update animation?
  LOOKUP pntr,["-+|*"],char    ' load animation character
  LCDOUT LCDpin,DDRam + 15,[char] ' write it at column 15
  pntr = pntr + 1 // 4        ' update animation char

Shuffle_Done:
  RETURN

```

PP_PCF8574.BSP

- Assemble PCF8583574 circuit on breadboard
 - use on-board 4.7K resistors (R1 and R2) for pull-ups



```

' -----[ Title ]-----
'
' BS2p Plus Pack
'
' File..... PP_PCF8574.BSP
' Purpose... Reads remote input and updates 2 remote outputs on PCF8574
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 26 SEP 2001
'
' {$STAMP BS2p}
'
' -----[ Program Description ]-----
'
' This program reads bit 7 from the PCF8574.  If that bit is high (button is
' pressed), a counter is incremented and displayed via LEDs on PCF8574 bits
' 0 and 1.
'
' Note: Most (not all) I2C devices have multiple internal addresses, so the
' I2CIN and I2COUT commands support this with an address parameter (this byte
' comes after the Slave Address byte).  With the PCF8574, replace the address
' byte with a value that reflects the desired state of the I/O pins, where

```

```

' 1 is an input. For example:
'
' %11100000 = Bits 0 - 4 are outputs, bits 5 - 7 are inputs
'
' For the PCF8574 the syntax becomes:
'
'     I2CIN  pin, ddr_value, [in_byte]
'     I2COUT pin, ddr_value, [out_byte]
'
' Special Note: When reading inputs while using the PCF8574 in mixed I/O mode,
' you must refresh the output bits during the read. This is easily accomplished
' by ORing the state of the output pins with the DDR value.
'
'     I2CIN  pin, (ddr_value | out_bits), [out_byte]
'
' This program uses the bits in mixed mode and will use the syntax described
' immediately above.
'
' I/O Notes:
'
' The input bit is pulled up to Vdd (+5) through 10K. This input is connected
' to Vss (ground) through a N.O. pushbutton switch. The input will read 1 when
' the switch is open, 0 when pressed.
'
' PCF8574 can sink current, but provide almost no source current. Outputs for
' this program are setup as active-low. The tilde (~) in front of the variable
' cntr inverts the bits since we're using active low outputs.
'
' -----[ Revision History ]-----
'
' -----[ I/O Definitions ]-----
'
I2Cpin          CON      8          ' SDA on 8; SCL on 9
'
' -----[ Constants ]-----
'
DevType         CON      %0100 << 4    ' Device type
DevAddr         CON      %000 << 1      ' address = %000 -> %111
Wr8574          CON      DevType | DevAddr ' write to PCF8574
Rd8574          CON      Wr8574 | 1      ' read from PCF8574
MixDDR          CON      %11111100      ' 1 = input, 0 = output
'
' -----[ Variables ]-----
'
ioByte          VAR      Byte           ' i/o byte for PCF8574
btn             VAR      ioByte.Bit7    ' button input (0 = pressed)
cntr            VAR      Nib            ' counter
'
' -----[ EEPROM Data ]-----
'
' -----[ Initialization ]-----
'
Initialize:
  DEBUG CLS

```

```

PAUSE 100
DEBUG "PCF8574 Demo", CR
DEBUG "Press button to update counter"

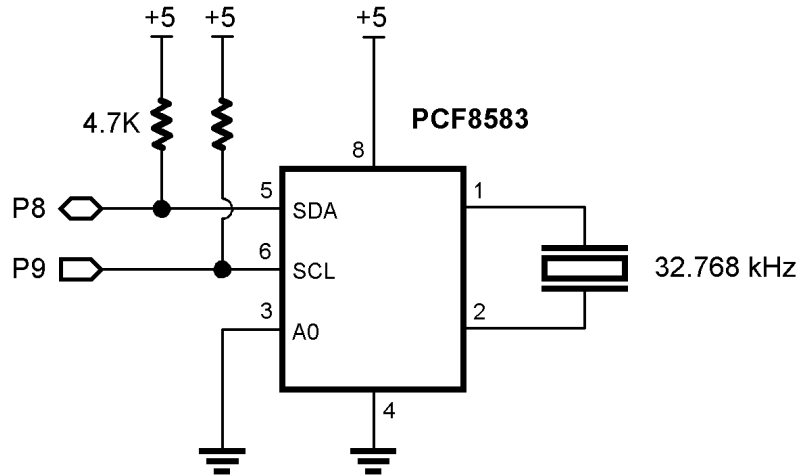
' -----[ Main Code ]-----
'
Main:
I2CIN I2Cpin, Rd8574, (MixDDR | ~cntr), [ioByte]
IF (btn) THEN Main           ' wait for press
cntr = cntr + 1 // 4         ' update counter
DEBUG Home, 10, 10, 10, BIN2 cntr   ' display on screen
I2COUT I2Cpin, Wr8574, MixDDR, [~cntr] ' send new value
PAUSE 200
GOTO Main

' -----[ Subroutines ]-----
'

```

PP_PCF8583.BSP

- Assemble PCF8583 circuit on breadboard
-- use on-board 4.7K resistors (R1 and R2) for pull-ups



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_PCF8583.BSP  
' Purpose... PCF8583 RTC Demo  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' The program demonstrates the PCF8583 RTC/RAM.  When the program starts, you  
' will be asked if you want to set the time.  If Yes, you'll enter the hours,  
' minutes and day.  When running, the program displays the time and the day  
' (by name) on a two-line LCD.  
'  
' To run this program on the BS2p Demo Board, connect the LCD and install  
' Jumper X3.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
'  
' -----[ Revision History ]-----  
'  
' -----[ I/O Definitions ]-----  
'
```

```

LCDpin      CON      0          ' LCD is connected to OutL
I2Cpin      CON      8          ' SDA on 8; SCL on 9
RxD         CON      16         ' serial receive (from DEBUG)

' -----[ Constants ]-----
'
DevType      CON      %1010 << 4    ' device type
DevAddr      CON      %000 << 1    ' address = %000 -> %001
Wr8583       CON      DevType | DevAddr ' write to PCF8583
Rd8583       CON      Wr8583 | 1    ' read from PCF8583

' LCD control characters
'
NoCmd        CON      $00          ' just print
ClrLCD       CON      $01          ' clear the LCD
CrsrHm       CON      $02          ' cursor home
CrsrLf       CON      $10          ' cursor left
CrsrRt       CON      $14          ' move cursor right
DispLf       CON      $18          ' shift display left
DispRt       CON      $1C          ' shift displayright
DDRam        CON      $80          ' Display Data RAM control
Line1        CON      $80          ' address of line 1
Line2        CON      $C0          ' address of line 2

Yes          CON      1
No           CON      0

Baud96       CON      240         ' 9600-8-N-1 (matches DEBUG)

' -----[ Variables ]-----
'
seconds      VAR      Byte
minutes      VAR      Byte
hours        VAR      Byte
day          VAR      Nib          ' 0 - 6 (day of week)
date         VAR      Byte          ' 1 - 31
month        VAR      Nib
year         VAR      Nib          ' 0 - 3 (LeapYear offset)

rawTime      VAR      Word          ' minutes past midnight

regCtrl      VAR      Byte          ' [0] control/status
regHuns      VAR      Byte          ' [1] hundredths (bcd)
regSecs      VAR      Byte          ' [2] seconds (bcd)
regMins      VAR      Byte          ' [3] minutes (bcd)
regHrs       VAR      Byte          ' [4] hours (bcd)
regYrDate    VAR      Byte          ' [5] year & date (bcd+)
regMoDay     VAR      Byte          ' [6] day & month (bcd+)

regAddr      VAR      Byte          ' register address
regData      VAR      Byte          ' data to/from register

eeAddr       VAR      Byte          ' EE data pointer
char         VAR      Byte          ' character from EE
idx          VAR      Byte          ' loop counter

response     VAR      Byte

' -----[ EEPROM Data ]-----
'

```

```

Su          DATA    "    SUNDAY",0
Mo          DATA    "    MONDAY",0
Tu          DATA    "    TUESDAY",0
We          DATA    "WEDNESDAY",0
Th          DATA    "    THURSDAY",0
Fr          DATA    "    FRIDAY",0
Sa          DATA    "    SATURDAY",0

' -----[ Initialization ]-----
'
Initialize:
  DEBUG CLS          ' open DEBUG window
  PAUSE 500         ' let LCD settle

LCD_Setup:
  LCDCMD LCDpin,%00110000 : PAUSE 5          ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0          ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0          ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0          ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0          ' inc crsr, no disp shift

  LCDOUT LCDpin,ClrLCD,["BSP <--> PCF8583"] ' splash screen

Check_Set_Clock:
  DEBUG "Would you like to set the clock? (Y/N)"
  SERIN RxD,Baud96,10000,Main,[response]
  idx = 99
  LOOKDOWN response,["nNyY"],idx
  idx = idx / 2
  IF (idx = 0) THEN Main

Enter_Hours:
  DEBUG CR, "Hours (0..23): "
  SERIN RxD,Baud96,[DEC2 hours]
  IF (hours < 24) THEN Enter_Minutes
  hours = 6

Enter_Minutes:
  DEBUG CR, "Minutes (0..59): "
  SERIN RxD,Baud96,[DEC2 minutes]
  IF (hours < 60) THEN Enter_Day
  minutes = 0

Enter_Day:
  DEBUG CR, "Day (0..6 [0 = Sunday]): "
  SERIN RxD,Baud96,[DEC1 day]
  IF (day < 7) THEN Set_The_Clock
  day = 0

Set_The_Clock:
  month = 9
  date = 18
  year = 1
  GOSUB Put_Clock

```

```

' -----[ Main Code ]-----
,
Main:
  DEBUG CLS, "The clock is running..."
  LCDCMD LCDpin, ClrLCD

Show_Clock:
  GOSUB Get_Time_And_Day
  LCDOUT LCDpin,Line1,[DEC2 hours,":",DEC2 minutes,":",DEC2 seconds]
  LCDCMD LCDpin, (Line2 + 7)
  GOSUB Print_Day
  GOTO Show_Clock

' -----[ Subroutines ]-----
,
Put_Register:
  I2COUT I2Cpin,Wr8583,regAddr,[regData]      ' send data to register
  RETURN

Get_Register:
  I2CIN I2Cpin,Rd8583,regAddr,[regData]      ' get data from register
  RETURN

Put_Raw_Clock:
                                          ' set with rawTime
  minutes = rawTime // 60
  hours = rawTime / 60

Put_Clock:
  regSecs = 0
  regMins.HighNib = minutes / 10              ' convert regs to BCD
  regMins.LowNib = minutes // 10
  regHrs.HighNib = hours / 10
  regHrs.LowNib = hours // 10
  regMoDay.HighNib = month / 10
  regMoDay.LowNib = month // 10
  regMoDay = regMoDay | (day << 5)           ' pack weekday in
  I2COUT I2Cpin,Wr8583,2,[STR regSecs\5]    ' write time & day
  RETURN

Get_Time_And_Day:
  I2CIN I2Cpin,Rd8583,0,[STR regCtrl\7]

  ' convert from BCD

  seconds = (regSecs.HighNib * 10) + regSecs.LowNib
  minutes = (regMins.HighNib * 10) + regMins.LowNib
  hours = (regHrs.HighNib * 10) + regHrs.LowNib
  rawTime = (hours * 60) + minutes
  day = regMoDay >> 5
  RETURN

Print_Day:
  LOOKUP day,[Su,Mo,Tu,We,Th,Fr,Sa],eeAddr   ' point to EE string
Print_Loop:
  READ eeAddr,char                          ' read a character
  IF (char = 0) THEN Print_Done              ' done?

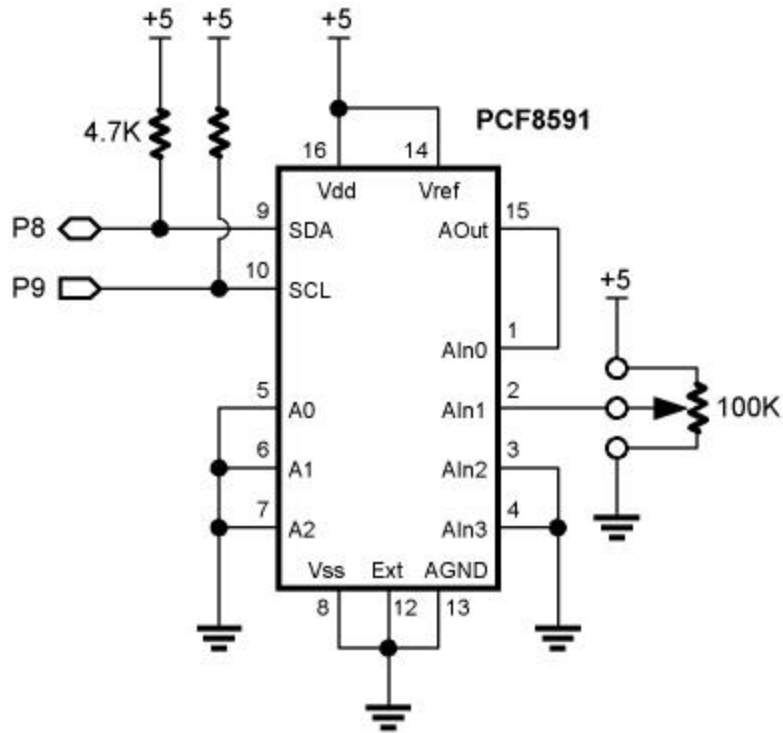
```



```
LCDOUT LCDpin,NoCmd,[char]      ' print the character
eeAddr = eeAddr + 1             ' point to next
GOTO Print_Loop:                 ' go get it
Print_Done:
RETURN
```

PP_PCF8591.BSP

- Assemble PCF8591 circuit on breadboard
-- use on-board 4.7K resistors (R1 and R2) for pull-ups



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_PCF8591.BSP  
' Purpose... PCF8591 A2D/D2A Demo  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program demonstrates the Philips PCF8591 4-channel A2D plus 1-channel  
' D2A. Channel 0 input is tied to the output of the D2A pin. Channel 1 input  
' is tied to the wiper of a pot. Channels 2 and 3 are tied to Vss.  
'  
' The PCF8591 uses a control byte after the Slave Address. The control byte  
' data (see details in PCF8591 documentation) is used to enable the analog  
' output bit and set the kind of analog inputs. In this demo, the analog output  
' bit is enabled and four single-ended analog inputs are used.  
'  
' Note that the first byte transmitted in a read cycle contains the conversion
```

```

' result code of the previous read cycle, so a dummy byte is placed ahead of
' the analog input array in the I2CIN command.

' -----[ Revision History ]-----
,

' -----[ I/O Definitions ]-----
,
I2Cpin          CON      8          ' SDA on 8; SCL on 9

' -----[ Constants ]-----
,
DevType         CON      %1001 << 4      ' device type
DevAddr         CON      %000 << 1      ' address = %000 -> %111
Wr8591          CON      DevType | DevAddr  ' write to PCF8591
Rd8591          CON      Wr8591 | 1      ' read from PCF8591

D2A_Enable      CON      %01000000      ' enable analog output
Auto_Inc        CON      %00000100      ' auto inc a2d channels

MVPB            CON      $139C          ' millivolts per bit factor

' -----[ Variables ]-----
,
aOut            VAR      Byte          ' analog out value
aIn             VAR      Byte(4)       ' analog input channels
mVolts         VAR      Word          ' convert to millivolts
dummy          VAR      mVolts.LowByte
chan           VAR      Nib           ' channel

' -----[ EEPROM Data ]-----
,

' -----[ Initialization ]-----
,
Initialize:
  DEBUG CLS          ' call DEBUG window
  PAUSE 250          ' let it open

' -----[ Main Code ]-----
,
Main:
  DEBUG Home, "PCF8591 Demo"

Set_D2A:
  DEBUG Home, CR, CR, "D2A Out..... ", DEC aOut, " ", CR
  I2COUT I2Cpin, Wr8591, D2A_Enable, [aOut]

Get_A2D:
  I2CIN I2Cpin, Rd8591, (D2A_Enable | Auto_Inc), [dummy, STR aIn\4]

  FOR chan = 0 TO 3
    DEBUG "Channel ", DEC1 chan, " In... ", DEC aIn(chan), " ", Tab
    mVolts = aIn(chan) * MVPB
    DEBUG "( ", DEC mVolts DIG 3, ".", DEC3 mVolts, " volts)", CR

```

```
NEXT
```

```
PAUSE 500
```

```
aOut = aOut + 1
```

```
GOTO Set_D2A
```

```
' delay between updates
```

```
' increment analog output
```

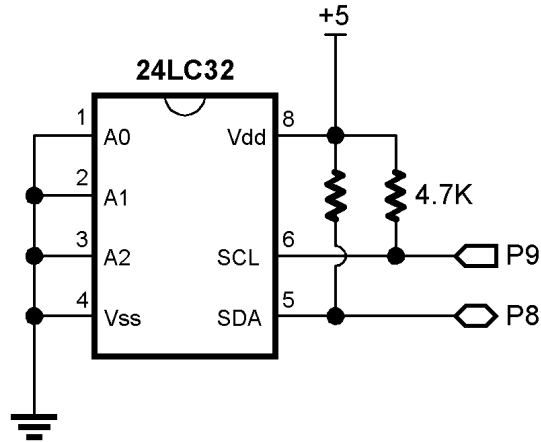
```
' go again
```

```
END
```

```
' -----[ Subroutines ]-----  
'
```

PP_24LC32.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display
- Assemble 24LC32 circuit on breadboard
 - use on-board 4.7K resistors (R1 and R2) for pull-ups



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_24LC32.BSP  
' Purpose... Demonstrates I2CIN, I2COUT and using an LCD  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program writes to and reads from a 24LC32 I2C EEPROM. The status of the  
' program and data are displayed on a 2x16 LCD.  
'  
' To run this program on the BS2p Demo Board, install the 24LC32 in the bread-  
' board and wire connect to the BS2p with jumper wires. Connect the LCD to X5  
' and enable by installing Jumper X6.  
'  
' Refer to the Hitachi HD44780 documentation for details on LCD control.  
'  
' -----[ I/O Definitions ]-----  
'  
LCDpin          CON      0          ' LCD is connected to OutL  
I2Cpin          CON      8          ' SDA on 8; SCL on 9
```

```

' -----[ Constants ]-----
,
DevType          CON      %1010 << 4          ' device type
DevAddr          CON      %000 << 1          ' address = %000 -> %111
Wr2432           CON      DevType | DevAddr   ' write to 24LC32
Rd2432           CON      Wr2432 | 1         ' read from 24LC32

MaxEE            CON      4095              ' highest EE address

' LCD control characters
,
NoCmd            CON      $00                ' No command in LCDOUT
ClrLCD           CON      $01                ' clear the LCD
CrsrHm           CON      $02                ' move cursor to home position
CrsrLf           CON      $10                ' move cursor left
CrsrRt           CON      $14                ' move cursor right
DispLf           CON      $18                ' shift displayed chars left
DispRt           CON      $1C                ' shift displayed chars right
DDRam           CON      $80                ' Display Data RAM control
CGRam           CON      $40                ' Custom character RAM
Line1            CON      $80                ' DDRAM address of line 1
Line2            CON      $C0                ' DDRAM address of line 2

' -----[ Variables ]-----
,
addr             VAR      Word               ' EE address
addrHi           VAR      addr.HighByte
addrLo           VAR      addr.LowByte
rVar             VAR      Word               ' for random number
tOut             VAR      Byte               ' test value to LCD
tIn              VAR      Byte               ' test value read from LCD
temp             VAR      Word               ' temp value for display
width            VAR      Nib                ' width of rt justified
pos              VAR      Byte               ' column position
digits           VAR      Nib                ' digits to display

' -----[ EEPROM Data ]-----
,
Super2           DATA    %01100           ' superscript 2 (custom char)
                 DATA    %00010
                 DATA    %00100
                 DATA    %01000
                 DATA    %01110
                 DATA    %00000
                 DATA    %00000
                 DATA    %00000

' -----[ Initialization ]-----
,
LCD_Setup:
  PAUSE 500          ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5      ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0      ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0      ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0      ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0      ' inc crsr, no display shift

```

```

' download custom character map to LCD

LCDCMD LCDpin,(CGRAM + (2 * 8))           ' write to CGRAM (character 2)
FOR addr = Super2 TO (Super2 + 7)        ' build custom char
  READ addr,temp                          ' get byte from EEPROM
  LCDOUT LCDpin,NoCmd,[temp]             ' put into LCD CG RAM
NEXT

' -----[ Main Code ]-----
,
Splash:
LCDOUT LCDpin,ClrLCD,[" BS2P <-> I",2,"C"]
LCDOUT LCDpin,Line2, [" Communications"]
PAUSE 2000

Main:
LCDOUT LCDpin,ClrLCD,["I",2,"C:      Out="]
LCDOUT LCDpin,(Line2 + 10),["In="]

FOR addr = 0 TO MaxEE STEP 5             ' create addresses
  RANDOM rVar                             ' create "random" value
  tOut = rVar.HighByte

  ' write value then read it back

  I2COUT I2Cpin,Wr2432,addrHi\addrLo,[tOut]
  PAUSE 100
  I2CIN I2Cpin,Rd2432,addrHi\addrLo,[tIn]

  ' display results

  LCDOUT LCDpin,(Line1 + 4),[DEC addr]
  temp = tOut : width = 3 : pos = Line1 + 13
  GOSUB RJ_Print
  temp = tIn : width = 3 : pos = Line2 + 13
  GOSUB RJ_Print
  PAUSE 250
NEXT

END

' -----[ Subroutines ]-----
,
RJ_Print:                                ' right justified printing
  digits = width
  LOOKDOWN temp,<[0,10,100,1000,65535],digits
  LCDOUT LCDpin,pos,[REP " "\ (width-digits),DEC temp]
RETURN

```

PP_OWID.BSP

```
' -----[ Title ]-----
'
' BS2p Plus Pack
'
' File..... PP_OWID.BSP
' Purpose... Reads ROM data from 1-Wire device
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 26 SEP 2001
'
' {$STAMP BS2p, PP_OWNAME.BSP}

' -----[ Program Description ]-----
'
' Reads 1-Wire device ROM pattern.  Data is displayed in DEBUG window
'
' If using the iButton socket on the BS2p demo board, install Jumper iB1.
'
' If using a "Blue Dot Receptor" (RJ-11 connection) with the BS2p Demo
' Board, install Jumper iB2
'
' Do not connect more than one device.

' -----[ I/O Definitions ]-----
'
OWpin          CON      15          ' 1-wire device pin

' -----[ Constants ]-----
'
' 1-Wire Support
'
OW_FERst       CON      %0001      ' Front-End Reset
OW_BERst       CON      %0010      ' Back-End Reset
OW_BitMode     CON      %0100
OW_HighSpd     CON      %1000

ReadROM        CON      $33         ' read ID, serial num, CRC
SearchROM      CON      $F0         ' search

NoDevice       CON      %11         ' no device present
NamesPgm       CON      1           ' names are stored in slot 1

' -----[ Variables ]-----
'
idx            VAR      Byte        ' loop counter
romData        VAR      Byte(8)     ' ROM data from device
devType        VAR      romData
devCheck       VAR      Nib         ' device check return ocde
addr           VAR      Word        ' address of string pointer
strPtr         VAR      Word        ' string pointer (device address)
char           VAR      Byte        ' character for LCD
```



```

' -----[ Initialization ]-----
,
Initialize:
  PAUSE 500                                ' let DEBUG window open

' -----[ Main Code ]-----
,
Main:
  DEBUG CLS
  GOSUB Device_Check                        ' look for device
  IF (devCheck <> NoDevice) THEN Display_ROM

No_Device_Found:
  DEBUG "No 1-Wire device present."
  END

Display_ROM:
  OWOUT OWpin,OW_FERst,[ReadROM]           ' send Read ROM command
  OWIN  OWpin,OW_BERst,[STR romData\8]     ' read serial number & CRC

  IF (romData(7) < $FF) THEN Show_Device
  DEBUG CLS,"Bad device?"
  END

Show_Device
  DEBUG "Dallas 1-Wire ID : ", HEX2 romData(0), " ("
  GOSUB Display_Device_Type
  DEBUG ") ",CR

  DEBUG "  Serial Number : "

  FOR idx = 6 TO 1
    DEBUG HEX2 romData(idx)
  NEXT

  DEBUG CR, "          Checksum : ", HEX2 romData(7),CR,CR

  DEBUG "          Stamp Data : ",IHEX2 romData(0)
  FOR idx = 1 TO 7
    DEBUG ",",IHEX2 romData(idx)
  NEXT

  END

' -----[ Subroutines ]-----
,

' This subroutine checks to see if any 1-Wire devices are present on the
' bus.  It does NOT search for ROM codes
,
Device_Check:
  devCheck = 0
  OWOUT OWpin,OW_FERst,[SearchROM]         ' reset and start search
  OWIN  OWpin,OW_BitMode,[devCheck.Bit1,devCheck.Bit0]
  RETURN

' This subroutine is used to display the part number of a 1-Wire device.
' The text data and pointers to it are stored in the EE of a different
' program slot.

```

```

Display_Device_Type:
  addr = devType * 2 + $600          ' calculate string pointer addr
  STORE NamesPgm                    ' point to names EEPROM
  READ addr, strPtr.LowByte          ' get the string location
  READ addr+1, strPtr.HighByte
Read_Char:
  READ strPtr, char                  ' read character from string
  IF (char = 0) THEN Dev_Type_Done  ' at end? (0 = Yes)
  DEBUG char                         ' no, print the char
  strPtr = strPtr + 1                ' point to next char
  GOTO Read_Char
Dev_Type_Done:
  STORE 0                            ' point to main pgm slot
  RETURN

```

```

' -----[ Title ]-----
'
' BS2p Plus Pack
'
' File..... PP_OWNAME.BSP
' Purpose... Device names for Dallas 1-Wire components
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 26 SEP 2001
'
' {$STAMP BS2p}
'
' -----[ Program Description ]-----
'
' There is no actual code in this module. This program stores the names
' of various Dallas Semiconductor 1-Wire devices. The device family code
' is used to map the strings in EEPROM. The pointer to a device's string
' discription is stored at the location determined by this formula:
'
'     pointer = device_id * 2 + $600
'
' "pointer" is actually the low-byte of the address location. The high
' byte is at pointer+1.
'
' -----[ Constants ]-----
'
PntrBase      CON      $600
'
' -----[ EEPROM Data ]-----
'
' Store strings first so labels can be used in address pointer table
'
Unknown       DATA    "Unknown device",0
' shared family codes
FCode01       DATA    "DS1990/DS2401",0
FCode04       DATA    "DS1994/DS2404",0
FCode10       DATA    "DS1920/DS18S20",0
FCode14       DATA    "DS1971/DS2430",0
FCode23       DATA    "DS1973/DS2433",0
' iButtons

```

```

DS1920      DATA      "DS1920" ,0
DS1921      DATA      "DS1921" ,0
DS1963      DATA      "DS1963" ,0
DS1971      DATA      "DS1971" ,0
DS1973      DATA      "DS1973" ,0
DS1982      DATA      "DS1982" ,0
DS1985      DATA      "DS1985" ,0
DS1986      DATA      "DS1986" ,0
DS1990      DATA      "DS1990" ,0
DS1991      DATA      "DS1991" ,0
DS1992      DATA      "DS1992" ,0
DS1993      DATA      "DS1993" ,0
DS1994      DATA      "DS1994" ,0
DS1995      DATA      "DS1995" ,0
DS1996      DATA      "DS1996" ,0

```

' 1-Wire chips

```

DS1822      DATA      "DS1822" ,0
DS18B20     DATA      "DS18B20" ,0
DS18S20     DATA      "DS18S20" ,0
DS2401      DATA      "DS2401" ,0
DS2404      DATA      "DS2404" ,0
DS2405      DATA      "DS2405" ,0
DS2406      DATA      "DS2406" ,0
DS2417      DATA      "DS2417" ,0
DS2430      DATA      "DS2430" ,0
DS2433      DATA      "DS2433" ,0
DS2450      DATA      "DS2450" ,0
DS2505      DATA      "DS2505" ,0
DS2506      DATA      "DS2506" ,0
DS2890      DATA      "DS2890" ,0

```

' string pointers

```

Pointers    DATA      @$01*2+PntrBase,Word FCode01
            DATA      @$04*2+PntrBase,Word FCode04
            DATA      @$10*2+PntrBase,Word FCode10
            DATA      @$14*2+PntrBase,Word FCode14
            DATA      @$23*2+PntrBase,Word FCode23

            DATA      @$02*2+PntrBase,Word DS1991
            DATA      @$06*2+PntrBase,Word DS1993
            DATA      @$08*2+PntrBase,Word DS1992
            DATA      @$09*2+PntrBase,Word DS1982
            DATA      @$0A*2+PntrBase,Word DS1995
            DATA      @$0C*2+PntrBase,Word DS1996
            DATA      @$1A*2+PntrBase,Word DS1963
            DATA      @$21*2+PntrBase,Word DS1921

            DATA      @$05*2+PntrBase,Word DS2405
            DATA      @$0B*2+PntrBase,Word DS2505
            DATA      @$0F*2+PntrBase,Word DS2506
            DATA      @$12*2+PntrBase,Word DS2406
            DATA      @$20*2+PntrBase,Word DS2450
            DATA      @$22*2+PntrBase,Word DS1822
            DATA      @$27*2+PntrBase,Word DS2417
            DATA      @$28*2+PntrBase,Word DS18B20
            DATA      @$2C*2+PntrBase,Word DS2890

```

PP_OWID-LCD.BSP

```
' -----[ Title ]-----
'
' BS2p Plus Pack
'
' File..... PP_OWID-LCD.BSP
' Purpose... Reads ROM data from 1-Wire device
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 26 SEP 2001
'
' {$STAMP BS2p, PP_OWNAME.BSP}
'
' -----[ Program Description ]-----
'
' Reads 1-Wire device ROM pattern.  Data is displayed on a 2x16 LCD.
'
' To run this program on the BS2p Demo Board, connect the LCD and install
' Jumper X6. Adjust contrast pot for best display.
'
' Refer to the Hitachi HD44780 documentation for details on LCD control.
'
' If using the iButton socket on the BS2p demo board, install Jumper X1-iB1.
'
' If using a "Blue Dot Receptor" (RJ-11 connection) with the BS2p Demo Board,
' install Jumper X1-iB2
'
' Do not connect more than one device.
'
' -----[ I/O Definitions ]-----
'
LCDpin      CON      0          ' connect LCD to OutL
OWpin       CON      15         ' 1-wire device pin
'
' -----[ Constants ]-----
'
NoCmd       CON      $00         ' No command in LCDOUT
ClrLCD      CON      $01         ' clear the LCD
CrsrHm      CON      $02         ' move cursor to home position
CrsrLf      CON      $10         ' move cursor left
CrsrRt      CON      $14         ' move cursor right
DispLf      CON      $18         ' shift displayed chars left
DispRt      CON      $1C         ' shift displayed chars right
DDRam       CON      $80         ' Display Data RAM control
CGRam       CON      $40         ' Custom character RAM
Line1       CON      $80         ' DDRAM address of line 1
Line2       CON      $C0         ' DDRAM address of line 2
'
' 1-Wire Support
'
OW_FERst    CON      %0001       ' Front-End Reset
OW_BERst    CON      %0010       ' Back-End Reset
OW_BitMode  CON      %0100
OW_HighSpd  CON      %1000
```

```

ReadROM      CON      $33      ' read ID, serial num, CRC
SearchROM    CON      $F0      ' search

NoDevice     CON      %11      ' no device present
NamesPgm     CON      1        ' names are stored in slot 1

' -----[ Variables ]-----
'
idx          VAR      Byte      ' loop counter
romData      VAR      Byte(8)   ' ROM data from device
devType      VAR      romData
devCheck     VAR      Nib       ' device check return ocde
addr         VAR      Word      ' address of string pointer
strPtr       VAR      Word      ' string pointer (device address)
char         VAR      Byte      ' character for LCD

' -----[ Initialization ]-----
'
Initialize:
  PAUSE 500      ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5      ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0      ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0      ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0      ' no crsr, no blink
  LCDCMD LCDpin,%00000110 : PAUSE 0      ' inc crsr, no disp shift

' -----[ Main Code ]-----
'
Main:
  LCDOUT LCDpin,ClrLCD,["1-Wire"]      ' splash screen
  LCDOUT LCDpin,(Line2 + 6),["Identifier"]
  PAUSE 2500

  GOSUB Device_Check      ' look for device
  IF (devCheck <> NoDevice) THEN Get_ROM

No_Device_Found:
  LCDOUT LCDpin,ClrLCD,["No 1-Wire device."]
  END

Get_ROM:
  OWOUT OWpin,OW_FERst,[ReadROM]      ' send Read ROM command
  OWIN  OWpin,OW_BERst,[STR romData\8] ' read serial number & CRC

  IF (romData(7) < $FF) THEN Show_Device
  LCDOUT LCDpin,ClrLCD,["Bad device?"]
  END

Show_Device:
  LCDCMD LCDpin,ClrLCD
  GOSUB Display_Device_Type

  ' serial number
  LCDCMD LCDpin,Line2
  FOR idx = 6 TO 1
    LCDOUT LCDpin,NoCmd,[HEX2 romData(idx)]
  NEXT

```

```

' checksum
LCDOUT LCDpin,NoCmd,["  ",HEX2 romData(7)]

END

' -----[ Subroutines ]-----
'
' This subroutine checks to see if any 1-Wire devices are present on the
' bus. It does NOT search for ROM codes
'
Device_Check:
  devCheck = 0
  OWOUT OWpin,OW_FERst,[SearchROM]          ' reset and start search
  OWIN  OWpin,OW_BitMode,[devCheck.Bit1,devCheck.Bit0]
  RETURN

' This subroutine is used to display the part number of a 1-Wire device.
' The text data and pointers to it are stored in the EE of a different
' program slot.

Display_Device_Type:
  addr = devType * 2 + $600                 ' calculate string pointer addr
  STORE NamesPgm                          ' point to names EEPROM
  READ  addr,strPtr.LowByte                 ' get the string location
  READ  addr+1,strPtr.HighByte

Read_Char:
  READ strPtr,char                         ' read character from string
  IF (char = 0) THEN Dev_Type_Done         ' at end? (0 = Yes)
  LCDOUT LCDpin,NoCmd,[char]              ' no, print the char
  strPtr = strPtr + 1                      ' point to next char
  GOTO Read_Char

Dev_Type_Done:
  STORE 0                                  ' point to main pgm slot
  RETURN

```

```

' -----[ Title ]-----
'
' BS2p Plus Pack
'
' File..... PP_OWNames.BSP
' Purpose... Device names for Dallas 1-Wire components
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 26 SEP 2001

' {$STAMP BS2p}

' -----[ Program Description ]-----
'
' There is no actual code in this module. This program stores the names
' of various Dallas Semiconductor 1-Wire devices. The device family code
' is used to map the strings in EEPROM. The pointer to a device's string
' discription is stored at the location determined by this formula:
'
'   pointer = device_id * 2 + $600
'

```

```

' "pointer" is actually the low-byte of the address location.  The high
' byte is at pointer+1.

' -----[ Constants ]-----
,
PntrBase      CON      $600

' -----[ EEPROM Data ]-----
,
' Store strings first so labels can be used in address pointer table
,
Unknown       DATA    "Unknown device",0

' shared family codes

FCode01       DATA    "DS1990/DS2401",0
FCode04       DATA    "DS1994/DS2404",0
FCode10       DATA    "DS1920/DS18S20",0
FCode14       DATA    "DS1971/DS2430",0
FCode23       DATA    "DS1973/DS2433",0

' iButtons

DS1920        DATA    "DS1920",0
DS1921        DATA    "DS1921",0
DS1963        DATA    "DS1963",0
DS1971        DATA    "DS1971",0
DS1973        DATA    "DS1973",0
DS1982        DATA    "DS1982",0
DS1985        DATA    "DS1985",0
DS1986        DATA    "DS1986",0
DS1990        DATA    "DS1990",0
DS1991        DATA    "DS1991",0
DS1992        DATA    "DS1992",0
DS1993        DATA    "DS1993",0
DS1994        DATA    "DS1994",0
DS1995        DATA    "DS1995",0
DS1996        DATA    "DS1996",0

' 1-Wire chips

DS1822        DATA    "DS1822",0
DS18B20       DATA    "DS18B20",0
DS18S20       DATA    "DS18S20",0
DS2401        DATA    "DS2401",0
DS2404        DATA    "DS2404",0
DS2405        DATA    "DS2405",0
DS2406        DATA    "DS2406",0
DS2417        DATA    "DS2417",0
DS2430        DATA    "DS2430",0
DS2433        DATA    "DS2433",0
DS2450        DATA    "DS2450",0
DS2505        DATA    "DS2505",0
DS2506        DATA    "DS2506",0
DS2890        DATA    "DS2890",0

' string pointers

Pointers      DATA    @$01*2+PntrBase,Word FCode01
              DATA    @$04*2+PntrBase,Word FCode04

```

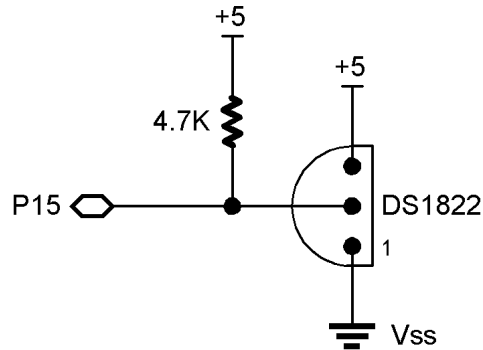
```
DATA @$10*2+PntrBase,Word FCode10
DATA @$14*2+PntrBase,Word FCode14
DATA @$23*2+PntrBase,Word FCode23

DATA @$02*2+PntrBase,Word DS1991
DATA @$06*2+PntrBase,Word DS1993
DATA @$08*2+PntrBase,Word DS1992
DATA @$09*2+PntrBase,Word DS1982
DATA @$0A*2+PntrBase,Word DS1995
DATA @$0C*2+PntrBase,Word DS1996
DATA @$1A*2+PntrBase,Word DS1963
DATA @$21*2+PntrBase,Word DS1921

DATA @$05*2+PntrBase,Word DS2405
DATA @$0B*2+PntrBase,Word DS2505
DATA @$0F*2+PntrBase,Word DS2506
DATA @$12*2+PntrBase,Word DS2406
DATA @$20*2+PntrBase,Word DS2450
DATA @$22*2+PntrBase,Word DS1822
DATA @$27*2+PntrBase,Word DS2417
DATA @$28*2+PntrBase,Word DS18B20
DATA @$2C*2+PntrBase,Word DS2890
```


PP_DS1822.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display
- Assemble DS1822 circuit on breadboard
 - use on-board 4.7K resistor (R1) for pull-up



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_DS1822.BSP  
' Purpose... Reads and displays information from a Dallas DS1822  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program demonstrates using the DS1822 in its simplest form for direct  
' temperature measurement. With only one sensor, we can use SkipROM and ignore  
' the device serial number.  
'  
' Program output is via DEBUG.  
'  
' -----[ Revision History ]-----  
'  
' -----[ I/O Definitions ]-----  
'  
OWpin          CON          15  
'  
' -----[ Constants ]-----  
'
```

```

' 1-Wire Support
'
OW_FERst      CON      %0001      ' Front-End Reset
OW_BERst      CON      %0010      ' Back-End Reset
OW_BitMode    CON      %0100
OW_HighSpd    CON      %1000

ReadROM       CON      $33         ' read ID, serial num, CRC
MatchROM      CON      $55         ' look for specific device
SkipROM       CON      $CC         ' skip rom (one device)
SearchROM     CON      $F0         ' search

' DS1822 control
'
CnvertTemp    CON      $44         ' do temperature conversion
RdScratch     CON      $BE         ' read scratchpad

NoDevice      CON      %11         ' no device present
DS1822        CON      $22         ' device code
DegSym        CON      176

' -----[ Variables ]-----
'
devCheck      VAR      Nib         ' device check return ocde
idx           VAR      Byte        ' loop counter
romData       VAR      Byte(8)     ' ROM data from DS1820
tempIn        VAR      Word        ' raw temperature
sign          VAR      tempIn.Bit11 ' 1 = negative temperature
tLo           VAR      tempIn.LowByte
tHi           VAR      tempIn.HighByte
tSign         VAR      Bit
tempC         VAR      Word        ' Celsius
tempF         VAR      Word        ' Fahrenheit

' -----[ EEPROM Data ]-----
'

' -----[ Initialization ]-----
'
Initialize:
  DEBUG CLS
  PAUSE 250      ' allow DEBUG screen to open

' -----[ Main Code ]-----
'
Main:
  GOSUB Device_Check      ' look for device
  IF (devCheck <> NoDevice) THEN Get_ROM

No_Device_Found:
  DEBUG CLS,"No DS1822 present.", CR
  DEBUG "-- Insert device and re-start."
  END

Get_ROM
  OWOUT OWpin,OW_FERst,[ReadROM]      ' send Read ROM command
  OWIN  OWpin,OW_BERst,[STR romData\8] ' read serial number & CRC

  IF (romData(0) = DS1822) THEN Show_Data

```

```

DEBUG "Installed device is not DS1822", CR
DEBUG "-- Code = ",HEX2 romData(0)
END

Show_Data:
DEBUG Home, "DS1822 Data",CR,CR
DEBUG "Serial Number : "
FOR idx = 6 TO 1
    DEBUG HEX2 romData(idx)
NEXT
DEBUG CR,"      Checksum : ",HEX2 romData(7),CR,CR

Show_Raw:
GOSUB Get_Temp
DEBUG "      Raw Input : ",BIN16 tempIn,CR,CR

Display_Temperatures:
DEBUG "      Temp C : ", SDEC tempC,DegSym,CR
DEBUG "      Temp F : ", SDEC tempF,DegSym,CR

PAUSE 1000
GOTO Main
END

' -----[ Subroutines ]-----
'
' This subroutine checks to see if any 1-Wire devices are present on the
' bus. It does NOT search for ROM codes
'
Device_Check:
devCheck = 0
OWOUT OWpin,OW_FERst,[SearchROM]          ' reset and start search
OWIN  OWpin,OW_BitMode,[devCheck.Bit1,devCheck.Bit0]
RETURN

Get_Temp:
OWOUT OWpin,OW_FERst,[SkipROM,CnvrtTemp]   ' send conversion command
PAUSE 500                                  ' give it some time
OWOUT OWpin,OW_FERst,[SkipROM,RdScratch]   ' go get the temperature
OWIN  OWpin,OW_BERst,[tLo,tHi]

tSign = sign                               ' save sign bit
tempC = tempIn
tempC = tempC >> 4                          ' round to whole degrees
IF (tSign = 0) THEN NoNegC
tempC = tempC | $FF00                       ' extend sign bits for negs

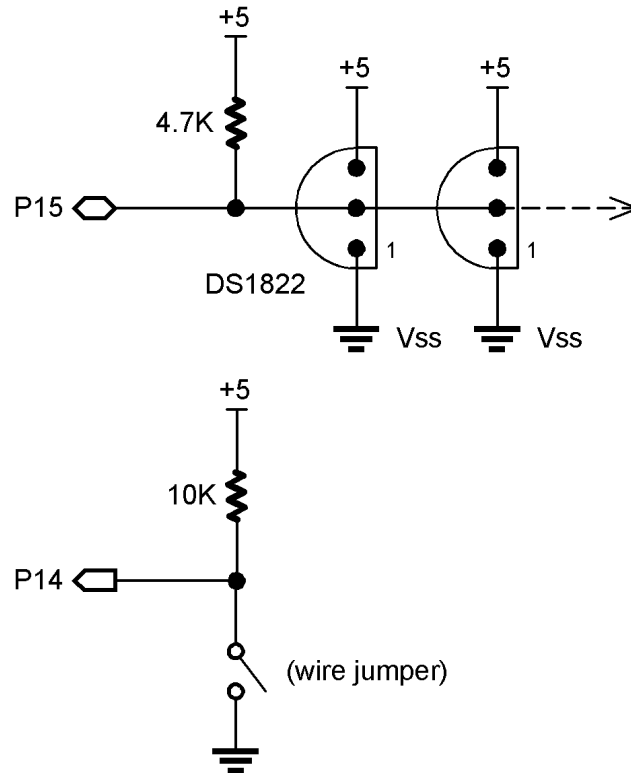
NoNegC:
tempF = tempC */ $01CD                      ' multiply by 1.8
IF tSign = 0 THEN NoNegF
tempF = tempF | $FF00

NoNegF:
tempF = tempF + 32                          ' finish C -> F conversion
RETURN

```


PP_DS1822-2.BSP

- Connect LCD to the BS2p Demo Board X5
- Install jumper X6
- Adjust contrast pot for best display
- Assemble DS1822 circuit on breadboard
 - use on-board 4.7K resistor (R1) for 1-Wire pull-up



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_DS1822-2.BSP  
' Purpose... Reads and displays information from two Dallas DS1822  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program demonstrates individual device addressing with the Dallas  
' 1-Wire bus. Before running the program, the individual device addresses  
' must be determined and stored in the EEPROM.  
'
```

```

' Use the program PP_OWID.BSP to determine the data table for your
' DS1822 sensors.
'
' To run this program on the BS2p Demo Board, connect the LCD and
' install Jumper X6. Adjust contrast pot for best display.
'
' Refer to the Hitachi HD44780 documentation for details on LCD control.

' -----[ Revision History ]-----
'
' -----[ I/O Definitions ]-----
'
OWpin          CON      15
TempType      VAR      In14          ' 1 = Fahrenheit
LCDpin        CON      0             ' connect LCD to OutL

' -----[ Constants ]-----
'
NoCmd         CON      $00          ' No command in LCDOUT
ClrLCD        CON      $01          ' clear the LCD
CrsrHm        CON      $02          ' move cursor to home position
CrsrLf        CON      $10          ' move cursor left
CrsrRt        CON      $14          ' move cursor right
DispLf        CON      $18          ' shift displayed chars left
DispRt        CON      $1C          ' shift displayed chars right
DDRam         CON      $80          ' Display Data RAM control
CGRam         CON      $40          ' Custom character RAM
Line1         CON      $80          ' DDRAM address of line 1
Line2         CON      $C0          ' DDRAM address of line 2

DegSym        CON      223          ' degrees symbol

' 1-Wire Support
'
OW_FERst      CON      %0001        ' Front-End Reset
OW_BERst      CON      %0010        ' Back-End Reset
OW_BitMode    CON      %0100
OW_HighSpd    CON      %1000

ReadROM       CON      $33          ' read ID, serial num, CRC
MatchROM      CON      $55          ' look for specific device
SkipROM       CON      $CC          ' skip ROM (one device)
SearchROM     CON      $F0          ' search

' DS1822 control
'
CnvertTemp    CON      $44          ' do temperature conversion
RdScratch     CON      $BE          ' read scratchpad

TC            CON      0             ' read in Celcius
TF            CON      1             ' read in Fahrenheit
NumSensors    CON      2             ' inside and outside

' -----[ Variables ]-----
'
sensor        VAR      Nib          ' sensor number to process
idx           VAR      Nib          ' loop counter
eeAddr        VAR      Byte         ' ee address of ROM match
romData       VAR      Byte(8)      ' ROM data to DS1822

```

```

tempIn      VAR      Word      ' raw temperature
sign        VAR      tempIn.Bit11 ' 1 = negative temperature
tInLow      VAR      tempIn.LowByte
tInHigh     VAR      tempIn.HighByte
tSign       VAR      Bit

tempC       VAR      Word      ' Celsius
tempF       VAR      Word      ' Fahrenheit
char        VAR      Byte      ' character for LCD
rjNum       VAR      tempIn     ' right justified number
rjSign      VAR      Bit       ' sign for rj number
pos         VAR      Byte      ' position to print
digits      VAR      Nib       ' digits in rjNum
width       VAR      Nib       ' width of display

' -----[ EEPROM Data ]-----
'
'           ' ROM codes for connected sensors
'           ' -- these values MUST be edited for your sensors

T_ID0       DATA    $22,$30,$34,$01,$00,$00,$00,$6C
T_ID1       DATA    $22,$85,$42,$01,$00,$00,$00,$71

'           ' labels for temperature sensors

T_Label0    DATA    "INSIDE ",0
T_Label1    DATA    "OUTSIDE ",0

' -----[ Initialization ]-----
'
Initialize:
  PAUSE 500 ' let the LCD settle
  LCDCMD LCDpin,%00110000 : PAUSE 5 ' 8-bit mode
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00110000 : PAUSE 0
  LCDCMD LCDpin,%00100000 : PAUSE 0 ' 4-bit mode
  LCDCMD LCDpin,%00101000 : PAUSE 0 ' 2-line mode
  LCDCMD LCDpin,%00001100 : PAUSE 0 ' no crsr, no blink
  LCDCMD LCDpin,%00000110 ' inc crsr, no disp shift

' -----[ Main Code ]-----
'
Main:
  LCDOUT LCDpin,ClrLCD,[" DS1822"] ' splash screen
  LCDOUT LCDpin,Line2, [" Thermometer"]
  PAUSE 2000
  LCDCMD LCDpin,ClrLCD

Show_Sensors:
  LOOKUP sensor,[T_ID0,T_ID1],eeAddr ' point to ROM code
  GOSUB Get_Temp ' get temperature

  LOOKUP sensor,[T_Label0,T_Label1],eeAddr ' display sensor label
  LCDCMD LCDpin, Line1
  GOSUB Print_Label

width = 4

```

```

pos = Line2 + 10
rjNum = tempC
IF (TempType = TC) THEN Print_Temp
rjNum = tempF

Print_Temp:
GOSUB RJ_Print
LCDOUT LCDpin,NoCmd,[DegSym,TempType * ("F" - "C") + "C"]

Next_Sensor:
sensor = sensor + 1 // NumSensors
PAUSE 5000
GOTO Show_Sensors

END

' -----[ Subroutines ]-----
'
Get_Temp:
FOR idx = 0 TO 7                                ' load ROM pattern
  READ (eeAddr+idx),romData(idx)
NEXT

OWOUT OWpin,OW_FERst,[MatchROM,STR romData\8,CnvrtTemp]
PAUSE 500
OWOUT OWpin,OW_FERst,[MatchROM,STR romData\8,RdScratch]
OWIN  OWpin,OW_BERst,[tInLow,tInHigh]

tSign = sign                                    ' save sign bit
tempC = tempIn
tempC = tempC >> 4                              ' round to whole degrees
IF (tSign = 0) THEN NoNeg1
tempC = tempC | $FF00                            ' extend sign bits for negs

NoNeg1:
tempF = tempC * / $01CD                          ' multiply by 1.8
IF (tSign = 0) THEN NoNeg2                       ' if neg, extend sign bits
tempF = tempF | $FF00

NoNeg2:
tempF = tempF + 32                               ' finish C -> F conversion
RETURN

Print_Label:
READ eeAddr,char                                ' get a character
IF (char = 0) THEN Print_Done                    ' if 0, exit
LCDOUT LCDpin,NoCmd,[char]                      ' send to LCD
eeAddr = eeAddr + 1                              ' move to next char address
GOTO Print_Label

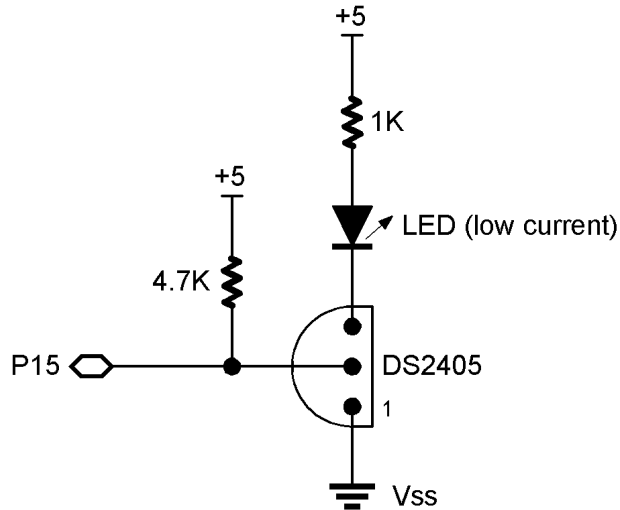
Print_Done:
RETURN

RJ_Print:
rjSign = rjNum.Bit15                             ' save sign
rjNum = ABS(rjNum)                               ' convert to positive
digits = width
LOOKDOWN rjNum,<[0,10,100,1000,65535],digits
LCDOUT LCDpin,pos,[REP " "\width-digits-1),13 * rjSign + " ",DEC rjNum]
RETURN

```


PP_DS2405.BSP

- Assemble DS2405 circuit on breadboard
-- use on-board 4.7K resistor (R1) for 1-Wire pull-up



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_DS2405.BSP  
' Purpose... Simple DS2405 addressable switch demo  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' Flashes an LED with a DS2405 addressable switch. In this demo, the LED  
' status follows a bit in a randomly generated variable.  
'  
' Note that the sink capability of the DS2405 is only 4 mA. Use at least 1K  
' in series with the LED.  
'  
' Note: The DS2405 is toggled. Its current status is available only after  
' addressing the device -- which also toggles it. Status (0 = on) of the  
' device is read in bit mode after addressing it with Match ROM.  
'  
' Refer to PP_DS1822-2.BSP for an example of dealing with multiple 1-Wire  
' devices on the same pin.  
'  
' -----[ Revision History ]-----  
'
```

```

' -----[ I/O Definitions ]-----
'
OWpin          CON      15          ' 1-Wire bus

' -----[ Constants ]-----
'
On             CON      0          ' pull cathode to ground
Off           CON      1

' 1-Wire Support
'
OW_FERst      CON      %0001      ' Front-End Reset
OW_BERst      CON      %0010      ' Back-End Reset
OW_BitMode    CON      %0100
OW_HighSpd    CON      %1000

ReadROM       CON      $33        ' read ID, serial num, CRC
MatchROM      CON      $55        ' look for specific device

' -----[ Variables ]-----
'
romData       VAR      Byte(8)     ' ROM data from device
idx           VAR      Nib
rndValue      VAR      Word        ' random value
flags         VAR      rndValue.LowByte ' flags byte
ledFlag       VAR      flags.Bit7   ' LED flag
status        VAR      bit

' -----[ EEPROM Data ]-----
'

' -----[ Initialization ]-----
'
Get_SN:
  DEBUG CLS
  PAUSE 250          ' let debug window open
  DEBUG "DS2405 - Reading serial number"
  OWOUT OWpin,OW_FERst,[ReadROM] ' send Read ROM command
  OWIN  OWpin,OW_BERst,[STR romData\8] ' read serial number & CRC
  DEBUG CR, "      "
  FOR idx = 6 TO 1 ' display serial number
    DEBUG HEX2 romData(idx)
  NEXT
  PAUSE 1000

' -----[ Main Code ]-----
'
Main:
  DEBUG CLS
  DEBUG "DS2405 Digital Switch Demo (LED = flags.Bit7)"

Show_Flags
  PAUSE 1000          ' delay between tests
  GOSUB Shake_Flags  ' randomize output
  DEBUG Home, CR, CR, "Flags... ", BIN8 flags, CR
  IF (ledFlag) THEN LED_On

```

```

LED_Off:
  DEBUG "LED..... Off"
  IF (status = Off) THEN Show_Flags      ' if off, shake flags
  GOTO Toggle_LED                       ' otherwise, turn off

LED_On:
  DEBUG "LED..... On "
  IF (status = On) THEN Show_Flags      ' if on, shake flags
  GOTO Toggle_LED                       ' otherwise, turn on

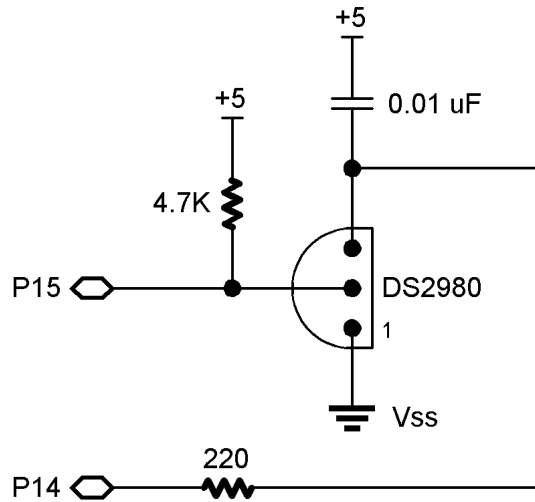
' -----[ Subroutines ]-----
'
Shake_Flags:
  FOR idx = 0 TO 15                      ' let all bits change
    RANDOM rndValue
  NEXT
  RETURN

Toggle_LED:
  OWOUT OWpin, OW_FERst, [MatchROM, STR romData\8]
  OWIN OWpin, OW_BitMode + OW_BERst, [status] ' get new status
  GOTO Show_Flags

```

PP_DS2890.BSP

- Assemble DS2890 circuit on breadboard
-- use on-board 4.7K resistor (R1) for 1-Wire pull-up



```
' -----[ Title ]-----  
'  
' BS2p Plus Pack  
'  
' File..... PP_DS2890.BSP  
' Purpose... Demonstrates DS2890 digital pot by adjusting an RC circuit  
' Author.... Parallax  
' E-mail.... stamptech@parallaxinc.com  
' Started...  
' Updated... 26 SEP 2001  
'  
' {$STAMP BS2p}  
'  
' -----[ Program Description ]-----  
'  
' This program demonstrates the DS2890 digital pot by placing it in an RC  
' circuit that would typically be used with RCTIME. This program assumes only  
' one device on the 1-Wire bus and reads the ROM code for the connected  
' device.  
'  
' Refer to PP_DS1822-2.BSP for an example of dealing with multiple 1-Wire  
' devices on the same pin.  
'  
' -----[ Revision History ]-----  
'  
' -----[ I/O Definitions ]-----  
'  
' OWpin          CON      15          ' 1-Wire bus  
' RCpin          CON      14          ' RCTIME pin
```

```

' -----[ Constants ]-----
'
' 1-Wire Support
'
OW_FERst      CON      %0001      ' Front-End Reset
OW_BERst      CON      %0010      ' Back-End Reset
OW_BitMode    CON      %0100
OW_HighSpd    CON      %1000

ReadROM       CON      $33         ' read ID, serial num, CRC
MatchROM      CON      $55         ' look for specific device

' DS2890 control
'
RdPot         CON      $F0         ' read pot position
WrPot         CON      $0F         ' write pot position
RdCtrl        CON      $AA         ' read control register
WrCtrl        CON      $55         ' write control register
IncPot        CON      $C3         ' increment resistance
DecPot        CON      $99         ' decrement resistance
Release       CON      $96         ' release new pot setting

' -----[ Variables ]-----
'
romData       VAR      Byte(8)     ' ROM data from device
idx           VAR      Byte
temp          VAR      Byte
potLevel      VAR      Byte
rcValue       VAR      Word

' -----[ EEPROM Data ]-----
'

' -----[ Initialization ]-----
'
Get_SN:
  DEBUG CLS
  PAUSE 250      ' let debug window open
  DEBUG "DS2980 - Reading serial number"
  OWOUT OWpin,OW_FERst,[ReadROM]      ' send Read ROM command
  OWIN  OWpin,OW_BERst,[STR romData\8] ' read serial number & CRC
  DEBUG CR, "      "
  FOR idx = 6 TO 1      ' display serial number
    DEBUG HEX2 romData(idx)
  NEXT
  PAUSE 1000

  DEBUG CLS
  DEBUG "DS2980 - Setting control register"

Set_Ctrl:
  ' wiper 1, charge pump off
  OWOUT OWpin, OW_FERst, [MatchROM, STR romData\8, WrCtrl, %00001100]
  OWIN  OWpin, OW_BERst, [temp]      ' read back ctrl data
  IF (temp = $FF) THEN Set_Ctrl      ' $FF = invalid ctrl reg val
  PAUSE 1000

```

```

' -----[ Main Code ]-----
,
Main:
  DEBUG CLS
  DEBUG "DS2980 1-Wire Pot Demo", CR, CR
  DEBUG "Pot Setting... ",CR
  DEBUG "RC Value..... "

Demo_Pot:
  FOR potLevel = 255 TO 0 STEP 5
    DEBUG Home, CR, CR, "Pot Setting... ", DEC potLevel, " ", CR
    ' send new level to pot
    OWOUT OWpin, OW_FERst, [MatchROM, STR romData\8, WrPot, potLevel]
    OWIN OWpin, 0, [temp] ' read new level back
    IF (temp <> potLevel) THEN Pot_Error ' check for correct receipt
    OWOUT OWpin, OW_BERst, [Release] ' release new value
    PAUSE 100

    HIGH RCpin ' discharge RC cap
    PAUSE 1
    RCTIME RCpin, 1, rcValue ' read pot
    DEBUG "RC Value..... ", DEC rcValue, " "
    PAUSE 500
  NEXT

  GOTO Main
END

' -----[ Subroutines ]-----
,
Pot_Error:
  DEBUG CLS
  DEBUG "Error -- could not set pot"
  END

```