

BS2p40 Demo Board (#45186)

BASIC Stamp 2p40 Demonstration Platform

Introduction

The BS2p40 Demo Board is designed as a low-cost platform to test and experiment with the new features of the BASIC Stamp 2p40, in particular: 16 additional I/O pins, Dallas Semiconductor 1-Wire[®] communications, Philips I²C[™] communications and working with standard parallel LCDs (with Hitachi HD44780 or compatible driver). The BS2p40 Demo Board is not exclusive to the BS2p family; it is physically and electrically compatible with all 24-pin BS2-series BASIC Stamps.

The purpose of this document is to introduce the BS2p40 Demo Board and explain the particular configuration requirements for connecting Dallas 1-Wire[®] devices, Philips I2C[™] devices and parallel LCDs.

Packing List

Verify that your BS2p40 Demo Board package is complete in accordance with the list below. For a selection of compatible 1-Wire[®] and I²C[™] parts, order the BS2p "Plus-Pack" (#45184). The contents of the BS2p40 Demo Board package include:

- Documentation
- BS2p40 Demo Board
- Jumper wires

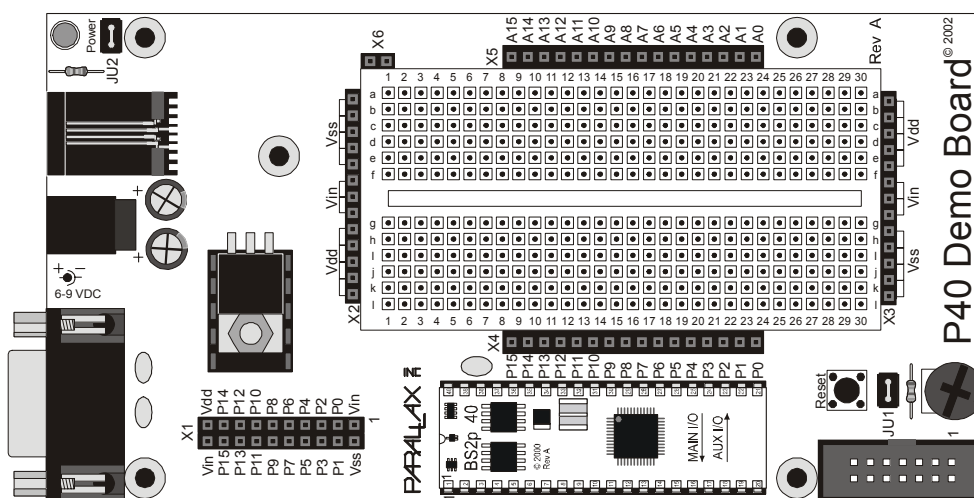
Note: Demo software files may be downloaded from www.parallaxinc.com.

Features

- Standard 2.1 mm center-positive DC power jack
- DB9-F connector for serial programming
- On-board 5-volt regulator (LM2940 low-dropout)
- Solderless breadboard
- RJ-11 jack for Dallas/Maxim "Blue Dot Receptor" (DS1402D-DR8 / DS1402RP8) sockets
- 14-pin IDC connector for LCD (Parallax stocks a 2 x 16 LCD with cable - #27908)
- Contrast potentiometer for LCD
- Selectable pull-up resistor for 1-Wire[®] bus (1 k Ω) and pull-down for LCD enable pin (4.7 k Ω)
- Connections for P0 – P15, A0 – A15, Vin, Vdd, Vss and 1-Wire[®] connection

A diagram of the BS2p40 Demo Board is shown on the following page.

BS2p40 Demo Board with BS2p40-IC Installed



Connections and Jumpers

The BS2p40-IC's 32 I/O lines are accessible through two sockets on either edge of the solderless breadboard. The main I/O (P0 – P15) group is available through socket X4 and the auxiliary I/O (A0 – A15) group is available through socket X5. These sockets, and the others on the board, are compatible with 22-gauge hookup wire and Parallax flexible jumpers (stock #800-00016). Vin (unregulated input), Vdd (regulated 5 volts) and Vss (ground) are made available through socket X2 at the top edge of the breadboard and X3 at the bottom edge of the breadboard.

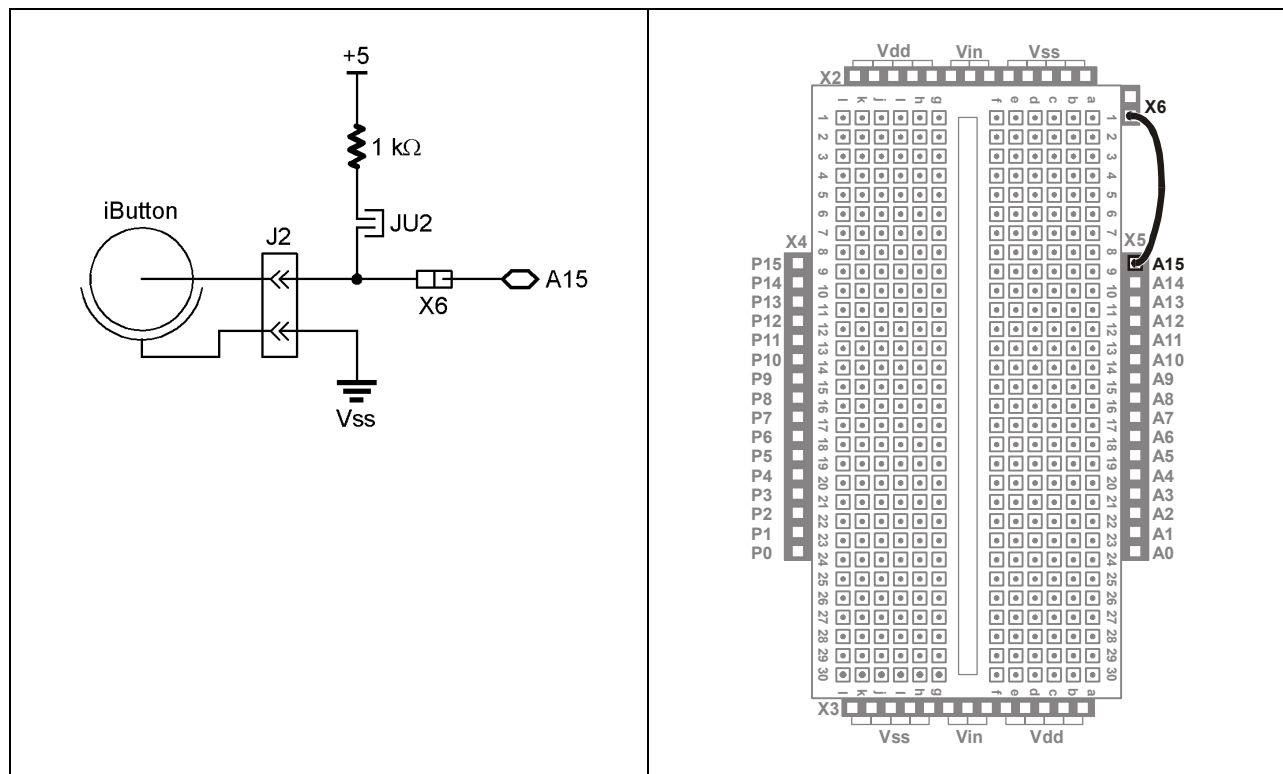
Connections to the 1-Wire[®] (iButton[®]) device sockets are made available through connection J2. Connect a compatible DS1402 "Blue Dot Receptor" cable (not included) to J2 and enable the 1 k Ω pull-up resistor by installing jumper JU2.

When using a parallel LCD with the demo board, install jumper JU1 to enable the 4.7 k Ω pull-down resistor on the LCD's Enable (E) pin.

Experimenting With Dallas/Maxim 1-Wire[®] Components

The BASIC Stamp 2p family makes interfacing to Dallas/Maxim 1-Wire[®] components very easy with the **OWOUT** and **OWIN** commands. The purpose of this experiment is to demonstrate these new commands by reading the unique ROM code from an iButton[®] device. When using 1-Wire[®] components, the bus pin must be pulled-up to Vdd (5 volts). The standard value for this pull-up is 4.7 k Ω , but the BS2p40 demo board uses a 1 k Ω pull-up on the Blue Dot Receptor port (J2) to overcome long-line impedance.

Schematic and Connections for the 1-Wire™ Experiment



Instructions

- Install BS2p40-IC in its socket (note polarity indicators on BS2p40-IC and socket)
- Connect DS1402 Blue Dot Receptor cable to J2 (RJ-11 jack)
- Insert iButton™ into Blue Dot Receptor socket (markings down)
- Enable iButton™ socket by installing pull-up jumper JU2
- Connect X5.A15 to X6 with 22-gauge jumper wire
- Connect serial cable and 9-volt power supply
- Enter and run the program

Program Listing

```

' =====
'
' File..... 1WIRE-ID-40.BSP
' Purpose... Reads ROM data from 1-Wire device
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 01 OCT 2002
'
' {$STAMP BS2p}
'
' =====
'

```

```

' Program Description
' -----

' Reads 1-Wire device ROM pattern.  Data is displayed in DEBUG window.  This
' version is written for the BS2p40.  Remove the AUXIO command to use the
' BS2p24.

' -----
' I/O Definitions
' -----

OWpin          CON      15          ' 1-wire device pin

' -----
' Constants
' -----

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

' -----
' Variables
' -----

idx            VAR      Byte        ' loop counter
romData        VAR      Byte(8)     ' ROM data from 1-Wire device
devCheck       VAR      Nib         ' device check return ocde

' -----
' Initialization
' -----

Initialize:
  PAUSE 250          ' let DEBUG window open

' -----
' Program Code
' -----

Main:
  DEBUG CLS
  GOSUB Device_Check ' look for device
  IF (devCheck <> NoDevice) THEN Display_ROM

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

Display_ROM:
  DEBUG "Dallas 1-Wire ID : "
  AUXIO            ' select auxiliary I/O set
  OWOUT OWpin, OW_FERst, [ReadROM] ' send Read ROM command
  OWIN  OWpin, OW_BERst, [STR romData\8] ' read serial number & CRC

  FOR idx = 0 TO 7
    DEBUG HEX2 romData(idx), " " ' show ID, serial num, CRC
  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
    AUXIO                                ' select auxiliary I/O set
    OWOUT OWpin, OW_FERst, [SearchROM]    ' reset and start search
    OWIN  OWpin, OW_BitMode, [devCheck.Bit1, devCheck.Bit0]
    RETURN

```

Experimenting With Philips I²C™ Components and Parallel LCDs

There are a myriad of components that communicate via the Philips I²C™ bus and the BASIC Stamp 2p family makes connecting to these parts very straightforward with **I2COUT** and **I2CIN**. When using I²C™ parts, the SDA and SCL lines must be pulled up to Vdd (5 volts). The BS2p limits the SDA and SCL connections to pins 0 and 1 or 8 and 9, respectively. When using the BS2p40, I²C™ commands may also use the auxiliary I/O pins, doubling the possible number of I²C™ connections. Refer to the Parallax Stamp Manual, version 2.0 (or later) for details.

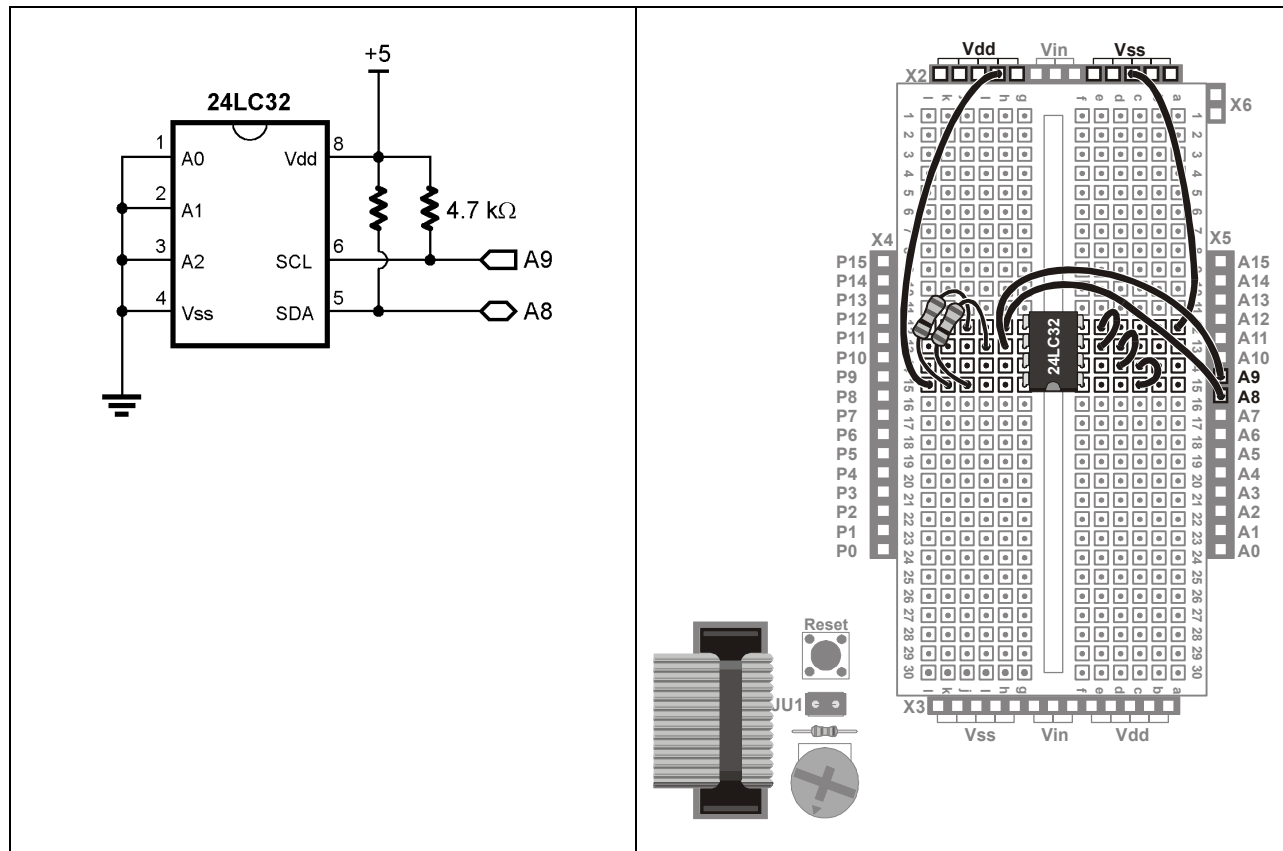
Parallel LCDs, especially those controlled by the Hitachi HD44780 (or compatible) driver, have become as commonplace as LEDs in embedded applications. The BS2p family supports the use of parallel LCDs with **LCDCMD**, **LCDOUT** and **LCDIN**.

This experiment demonstrates the use of the I²C™ protocol along with text and numeric output to an LCD. Specifically, the program generates an address and a pseudo-random value. The value is written to a Microchip 24LC32 EEPROM and read back. The address, output value and input value are displayed on the LCD. The LCD initialization includes the creation of a custom character (superscripted "2").

The schematic on the following page shows the connections for the 24LC32 EEPROM. The LCD is connected to the lower eight I/O pins (OutL) of the BS2p40. To use a parallel LCD with the BS2p40 Demo Board, jumper JU1 must be installed to enable the 4.7 kΩ pull-down resistor on the LCD's Enable (E) pin.

Note: The components for this experiment are included in the BS2p "Plus Pack" (#45184).

Schematic and Connections for the I²C™ Experiment



Instructions

- Install BS2p40-IC in its socket (note polarity indicators on BS2p40-IC and socket)
- Wire the 24LC32 in accordance with the schematic
- Install jumper JU1 to enable the LCD
- Connect the LCD to J1
- Connect serial cable and 9-volt power supply
- Enter and run the program
- Adjust contrast potentiometer for best display

Program Listing

```

' =====
'
' File..... 24LC32-40.BSP
' Purpose... Demonstrates I2CIN, I2COUT and using an LCD
' Author.... Parallax
' E-mail.... stamptech@parallaxinc.com
' Started...
' Updated... 01 OCT 2002
'
' {$STAMP BS2p}
'
' =====

```

```

' -----
' Program Description
' -----

' Writes to and reads from I2C EEPROM.  Data is displayed on a 2x16 LCD.
'
' Program requires a 2x16 LCD
'
'   - LCD.E      --> Pin0 (pulled down [to ground] through 4.7K)
'   - LCD.R/W    --> Pin2
'   - LCD.RS     --> Pin3
'   - LCD.D4     --> Pin4
'   - LCD.D5     --> Pin5
'   - LCD.D6     --> Pin6
'   - LCD.D7     --> Pin7
'
' This version is written for the BS2p40.  Remove the AUXIO command to use the
' BS2p24.
' -----
' I/O Definitions
' -----

LCDpin      CON      0      ' LCD is connected to OutL
I2Cpin      CON      8      ' SDA on 8; SCL on 9
' -----
' Constants
' -----

NoCmd       CON      0      ' placeholder
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 control
Line1       CON      $80
Line2       CON      $C0

MaxEE       CON      4095   ' highest EE address
' -----
' 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
LCDCMD LCDpin, %00110000 : PAUSE 5      ' 8-bit mode
LCDCMD LCDpin, %00110000 : PAUSE 0
LCDCMD LCDpin, %00110000 : PAUSE 0
LCDCMD LCDpin, %00100000      ' 4-bit mode
LCDCMD LCDpin, %00101000      ' 2-line mode
LCDCMD LCDpin, %00001100      ' no crsr, no blink
LCDCMD LCDpin, %00000110      ' inc crsr, no disp shift

```

```

' download custom character map to LCD

```

```

LCDCMD LCDpin, CGRam      ' write to CGRAM

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

```

```

' -----
' Program Code
' -----

```

Splash:

```

LCDOUT LCDpin, ClrLCD, [" BS2P40 <-> I", 0, "C"]
LCDOUT LCDpin, Line2, [" Communications"]
PAUSE 2000

```

Main:

```

LCDOUT LCDpin, ClrLCD, ["I", 0, "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

  AUXIO      ' select auxilliary I/O set
  I2COUT I2Cpin, $A0, addrHi\addrLo, [tOut]
  PAUSE 100
  I2CIN I2Cpin, $A1, addrHi\addrLo, [tIn]

  ' display results

  MAINIO      ' select main I/O set
  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

PAUSE 2000
LCDOUT LCDpin, ClrLCD, ["Done!"]

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

```

Additional Experiments

For more experiments with the BS2p family and BS2p40 Demo Board, you may wish to download the BS2p “Plus Pack” documentation and code samples from Parallax, free of charge. You may also order the BS2p “Plus Pack” (#45184) directly from Parallax.

Using Other Parallax Microcontrollers

The BS2p40 Demo Board is electrically compatible with the BS2, BS2e, BS2sx, BS2p24 and Javelin microcontrollers. The demo board is particularly useful for experiments with parallel LCDs (download the StampWorks experiments from Parallax for LCD examples using the BS2, BS2e and BS2sx). Please note that 1-Wire[®] interfacing is not possible with the BS2, BS2e, BS2sx or Javelin without an external co-processor. I²C[™] communications with these microcontrollers is possible with code.

When using a 24-pin Parallax microcontroller with the BS2p40 Demo Board, be sure to align the module as shown in the diagram below.

