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BS2p24 Demo Board – Rev C. (#45183)

BASIC Stamp 2p24 Demonstration Platform

Introduction

The BS2p Demo Board is designed as a low-cost platform to test and experiment with the extended features of the BASIC Stamp 2p24, in particular: Dallas Semiconductor 1-Wire® communications, Philips I²C™ communications and working with standard parallel LCDs (with Hitachi HD44780 or compatible driver). The BS2p24 Demo Board is not exclusive to the BS2p; it is physically and electrically compatible with all 24-pin BS2-series BASIC Stamps.

The purpose of this document is to introduce the BS2p24 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 BS2p24 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 BS2p Demo Board package include:

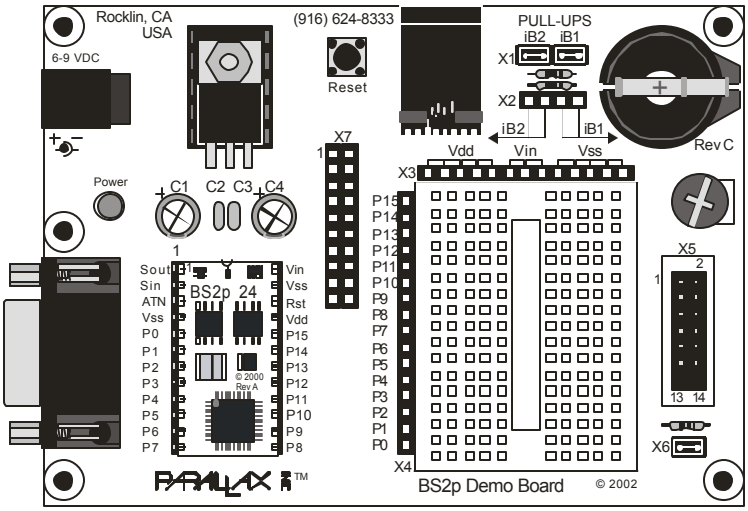
- BS2p24 Demo Board
- Jumper wires
- Documentation

Note: Source code for demonstration programs can be downloaded from www.parallax.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
- iButton™ socket (F5 MicroCan)
- RJ-11 jack for Dallas "Blue Dot Receptor" sockets
- 14-pin IDC connector for LCD (Parallax stocks a 2 x 16 LCD with cable - #27908)
- Contrast pot for LCD
- Selectable 4.7 k? pull-ups (1-Wire® bus) and pull-down (LCD)
- Connections for P0 – P15, Vin, Vdd, Vss and 1-Wire® sockets

BS2p24 Demo Board – Revision C.
(shown with BS2p24 installed)



Connections and Jumpers

The BS2p24-IC's 16 I/O lines are accessible through the X4 socket at the left edge of the breadboard. This socket, and the others on the board, are compatible with 22-guage hookup wire and Parallax flexible jumpers (stock #800-00016). Vin (unregulated power input), Vdd (regulated 5 volts) and Vss (ground) are made available through socket X3 at the top edge of the breadboard.

Connections to the 1-Wire® device sockets (iB1 and iB2) are made available through socket X2. The 4.7 kOhm pull-up resistor for the iButton socket is enabled by installing jumper iB1. The pull-up resistor for the RJ-11 "Blue Do Receptor" socket is enabled by installing jumper iB2. To use the iButton™ socket and the "Blue Dot Receptor" socket on the same BS2p I/O pin, install jumper iB1 or iB2, but not both (The iB1 and iB2 pull-ups may also be used for I²C™ components when no 1-Wire® devices are installed).

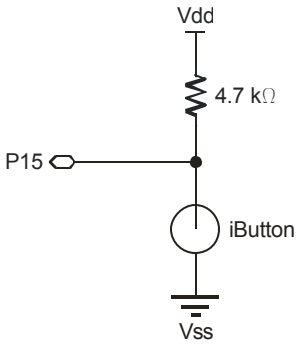
When using a parallel LCD with the demo board, install jumper X6 to enable the 4.7K pull-down resistor on the LCD's Enable (E) pin.

Experimenting With Dallas 1-Wire® Components

The BASIC Stamp 2p-series makes interfacing to Dallas 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 a 1-Wire® (iButton™) device. When using 1-Wire® components, the bus pin must be pulled-up to Vdd (5 volts) through a 4.7 k? resistor. The components for this experiment are included in the BS2p "Plus Pack."

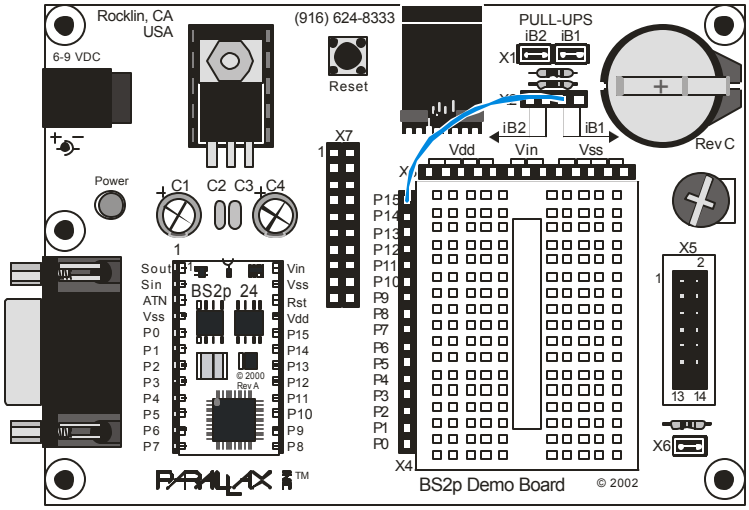
Note: The components for this experiment are included in the BS2p "Plus Pack."

Schematic for the 1-Wire™ experiment



Connecting the 1-Wire® components on BS2p24 Demo Board:

- Install BS2p24 in socket (note polarity indictors on BS2p24 and socket)
- Insert iButton™ into socket (markings down)
- Connect P15 to iB1 with 22-guage wire
- Enable iButton™ socket by installing pull-up jumper iB1
- Connect serial cable and 9-volt power supply
- Enter and run the program




```
' ================================================================================
'
'   File..... 1WIRE-ID.BSP
'   Purpose... Reads ROM data from 1-Wire device
'   Author.... Parallax
'   E-mail.... stamptech@parallaxinc.com
'   Started...
'   Updated... 31 JAN 2003
'
'   {$STAMP BS2p}
'   {$PBASIC 2.5}
'
' ================================================================================

' -----[ Program Description ]---------------------------------------------
'
' Reads 1-Wire device ROM pattern.  Data is displayed in DEBUG window

' -----[ I/O Definitions ]-------------------------------------------------

OWpin           PIN     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 DS1820
devCheck        VAR     Nib                     ' device check return ocde

' -----[ Initialization ]--------------------------------------------------

Setup:
  PAUSE 250                                     ' let DEBUG window open

' -----[ Program Code ]----------------------------------------------------

Main:
  DEBUG CLS
  GOSUB DeviceCheck                             ' look for device
  IF (devCheck <> NoDevice) THEN
    DEBUG "Dallas 1-Wire ID : "
    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
  ELSE
    DEBUG "No 1-Wire device(s) present."
  ENDIF

  END

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

' This subroutine checks to see if any 1-Wire devices are present on the
' bus.  It does NOT search for ROM codes
'
DeviceCheck:
  devCheck = 0
  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

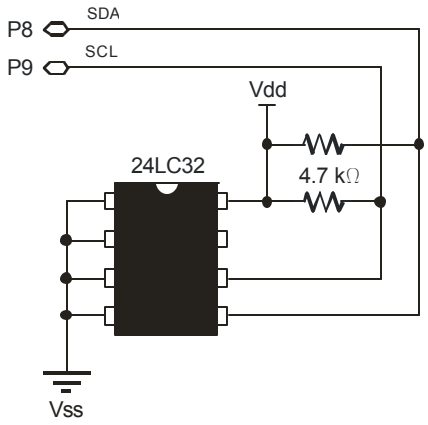
There are myriad components that communicate via the Philips I2C® bus and the BASIC Stamp 2p makes connecting to these parts very straightforward with I2COUT and I2CIN. When using I2C® parts, the SDA and SCL lines must be pulled up to Vdd (5 volts). The BS2p24 limits the SDA and SCL connections to pins 0 and 1 or 8 and 9, respectively. 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 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 with 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").

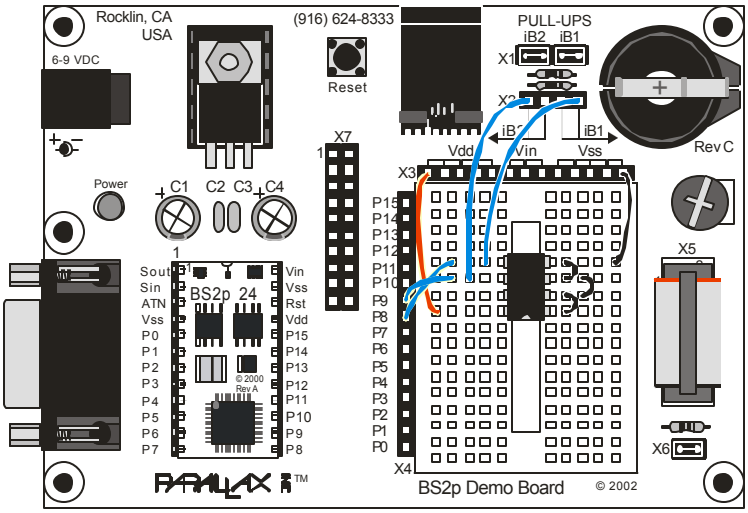
The schematic below shows the connections for the 24LC32 EEPROM. The LCD is connected to the lower eight I/O pins (OutL) of the BS2p24. To use a parallel LCD with the BS2p Demo Board, jumper X6 must be installed to enable the 4.7K pull-down resistor on the LCD's Enable (E) pin.

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



Instructions for using I2C and LCDs with the BS2p24 Demo Board

- Install BS2p in socket (note polarity indictors on BS2p and socket)
- Remove all 1-Wire® parts
- Wire the 24LC32 in accordance with the schematic
- Install jumpers iB1, iB2 and X6
- Connect the LCD to X5
- Connect serial cable and 9-volt power supply
- Enter and run the program
- Adjust contrast pot for best display




```
' =============================================================================
'
'   File..... 24LC32.BSP
'   Purpose... Demonstrates I2CIN, I2COUT and using an LCD
'   Author.... Parallax
'   E-mail.... stamptech@parallaxinc.com
'   Started...
'   Updated... 31 JAN 2003
'
'   {$STAMP BS2p}
'   {$PBASIC 2.5}
'
' =============================================================================

' -----[ 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

' -----[ I/O Definitions ]-------------------------------------------------
'
LCDpin          PIN     0                       ' LCD is connected to OutL
I2Cpin          PIN     8                       ' SDA on 8; SCL on 9


' -----[ Constants ]-------------------------------------------------------
'
```

```
NoCmd           CON     0
ClrLCD          CON     $01                     ' clear the LCD
CrsrHm          CON     $02                     ' move cursor to home position
CrsrL           CON     $10                     ' move cursor left
CrsrR           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
                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
```

```
' -----[ Main Code ]-----------------------------------------------------
'
Splash:
  LCDOUT LCDpin, ClrLCD, ["  BS2P <-> 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

    I2COUT I2Cpin, $A0, addrHi\addrLo, [tOut]
    PAUSE 100
    I2CIN I2Cpin, $A1, 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
```

Additional Experiments

For more experiments with the BS2p and BS2p demo board, you may download the BS2p "Plus Pack" documentation and code samples from Parallax, free of charge. You may also order the BS2p "Plus Pack" (#45184) via the Internet or directly from Parallax.

Using Other BS2 Microcontrollers

The BS2p24 Demo Board is electrically compatible with the BS2, BS2e, BS2sx and BS2pe24 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 and BS2sx without an external co-processor. I^2C™ communications with these microcontrollers is possible with PBASIC code.