# EmbeddedBlue™ 500

User Manual

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# Introduction

Congratulations on your purchase of the EmbeddedBlue 500 (eb500) module. The eb500 module provides Bluetooth® connectivity for 8/16 bit microcontroller applications without having to know the details of Bluetooth technology. Hobbyists, developers, and OEMs can take advantage of advanced wireless connectivity with this easy to use module.

The eb500 module provides a point to point connection much like a standard serial cable. Connections are made dynamically and can be established between two eb500 modules or an eb500 module and a standard Bluetooth v1.1 device. Devices can be dynamically discovered and connected in an ad-hoc manner.

## Manual Conventions

Below is a list of typographical conventions used in this manual:

`Text in this font`

- `Is used to show data that is sent to the eb500.`
- `Inside a gray box is used to show data that is sent from the eb500.`

`Text in this font`

- `Is used to show source code.`

In the eb500 Commands section of this manual

- Required parameters and placeholders appear in standard lowercase type.
- Placeholders appear in *italics*. For example, if *address* shows up in a syntax line, the actual address of the device must be entered.
- Required parameter options are separated by a vertical bar |.
- Optional parameters are enclosed in brackets [ ].

# eb500 Basics

The eb500 supports two main operating modes: command mode and data mode. Upon power up the eb500 enters command mode and is ready to accept serial commands. The factory default communication parameters are 9600 Baud, 8 Data Bits, 1 Stop Bit, No Parity, and No Flow Control. The eb500 supports commands to modify the baud rate and flow control settings.

## Command Mode

In this mode there are a number of commands that can be sent to change the baud rate, locate other devices that are in range, check the firmware version, etc. All commands are sent using visible ASCII characters (123 is 3 bytes "123"). Upon the successful transmission of a command, the ACK string will be returned. If there is a problem in the syntax of the transmission a NAK string is returned. After either the ACK or NAK, a carriage-return <CR> character is returned. When a prompt (<CR> followed by a '>') is returned, it means that the eb500 radio is in the idle state and is waiting for another command. White spaces do matter and are used to separate argument parameters of the command and a carriage-return <CR> (ASCII 13) is used to mark the end of the command.

## Data Mode

Once the eb500 radio is connected to another Bluetooth device, the eb500 automatically switches into data mode. All data transmitted while in this mode will be sent to the remote device and, therefore, NO further commands can be sent until the eb500 radio is disconnected or switched back to command mode by use of the mode control I/O line or the Switch to Command Mode command.

The connection status line of the eb500 module can be monitored to determine if there is an active connection. Additionally, whenever a connection is present, the Connection Status LED (Figure 1) on the eb500 module will be on.

# I/O Lines

The eb500 module features a 20 pin header for connecting to the Parallax AppMod header. A full device pinout is available in the Technical Specifications section of this manual. There are several pins that are important when performing the exercises in the Establishing a Connection and Communications sections of this manual.

Pin 3 of the eb500 module, which aligns with the pin designated “P0” of the AppMod header, is the UART data output pin.

Pin 4 of the eb500 module, which aligns with the pin designated “P1” of the AppMod header, is the UART data input pin.

Pin 8 of the eb500 module, which aligns with the pin designated “P5” of the AppMod header, is the Connection Status pin. A BASIC Stamp application can interrogate this pin to determine the connection status of the eb500 radio.

Pin 9 of the eb500 module, which aligns with the pin designated “P6” of the AppMod header, is the Mode Control pin. A BASIC Stamp application can drive this pin high to enter Data Mode or low to enter Command Mode.

# Resetting the eb500 to the Factory Default Settings

The eb500 module can be reset to the factory default settings by shorting Pin 8 and Pin 9 and then applying power to the eb500 module.

# Switching between Data Mode and Command Mode

When a Connection command is issued, the eb500 attempts to establish a connection to the device with the address specified in the command. Once a connection is established, the eb500 switches into data mode. At this point all data sent to the eb500 is transmitted to the remote Bluetooth device over the wireless link. It is possible to switch from data mode to command mode, issue commands, and then return to data mode, while maintaining a connection. The eb500 allows you to switch between data mode and command mode by issuing the Switch to Command Mode and Return to Data Mode serial commands or by driving the mode control I/O line (Pin 9) of the eb500 module.

The following BASIC Stamp application uses the Switch to Command Mode and Return to Data Mode serial commands to switch between data mode and command mode. This application is available in electronic form on the accompanying CD in the Samples folder in the file CmdModeSoft.bs2.

```
'{$STAMP BS2}

szData VAR BYTE(20)

'Wait for the eb500 radio to be ready

PAUSE 1000

'Connect to the remote device
```

```
SEROUT 1,84,["con 00:0C:84:00:07:D8",CR]
SERIN 0,84,[WAIT("ACK",CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection

DEBUG "Connected",CR

SEROUT 1,84,["This text is sent in data mode",CR]

'Switch to Command Mode
PAUSE 2000
SEROUT 1,84,["+++"]
SERIN 0,84,[WAIT(CR,">")]

DEBUG "In Command Mode",CR

'Get the eb500 Bluetooth Address
SEROUT 1,84,["get addr",CR]
SERIN 0,84,[WAIT("ACK",CR)]
'Read the local address from the get command
SERIN 0,84,[STR szData\17]
SERIN 0,84,[WAIT(CR,">")]
szData(17) = 0
DEBUG STR szData\17,CR

'Return to Data Mode
SEROUT 1,84,["ret",CR]
SERIN 0,84,[WAIT("ACK",CR)]

DEBUG "In Data Mode",CR

SEROUT 1,84,["My Bluetooth address is ",STR szData,CR]

'Switch to Command Mode
PAUSE 2000
```

```
      SEROUT 1,84,["+++"]
      SERIN 0,84,[WAIT(CR,">")]

      DEBUG "In Command Mode",CR

      'Disconnect from remote device
      SEROUT 1,84,["dis",CR]
      SERIN 0,84,[WAIT(CR,">")]
      DEBUG "Disconnected",CR
```

The following BASIC Stamp application uses the mode control I/O line of the eb500 module to switch between data mode and command mode. Switching between data mode and command mode via the mode control I/O line is preferred, as it is faster than the serial method. This application is available in electronic form on the accompanying CD in the Samples folder in the file CmdModeHard.bs2.

```
      '{$STAMP BS2}
      szData VAR BYTE(20)
      'Wait for the eb500 radio to be ready
      PAUSE 1000
      'Connect to the remote device
      SEROUT 1,84,["con 00:0C:84:00:07:D8",CR]
      SERIN 0,84,[WAIT("ACK",CR)]
      WaitForConnection:
            IF in5 = 0 THEN WaitForConnection

      DEBUG "Connected",CR

      SEROUT 1,84,["This text is sent in data mode",CR]

      'I/O Line 6 allows us to switch to Command Mode
      OUTPUT 6
      'Switch to Command Mode
      LOW 6
      SERIN 0,84,[WAIT(CR,">")]

      DEBUG "In Command Mode",CR
```

```
'Get the eb500 Bluetooth Address
SEROUT 1,84,["get addr",CR]
SERIN 0,84,[WAIT("ACK",CR)]
'Read the local address from the get command
SERIN 0,84,[STR szData\17]
SERIN 0,84,[WAIT(CR,">")]
szData(17) = 0
DEBUG STR szData\17,CR

'Return to Data Mode
HIGH 6
PAUSE 50

DEBUG "In Data Mode",CR

SEROUT 1,84,["My Bluetooth address is ",STR szData,CR]

'Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,">")]

DEBUG "In Command Mode",CR

'Disconnect from remote device
SEROUT 1,84,["dis",CR]
SERIN 0,84,[WAIT(CR,">")]
DEBUG "Disconnected",CR
```

# BASIC Stamp Application Debugging

When debugging your BASIC Stamp application that uses an eb500 it is important that the BASIC Stamp application and the eb500 are in sync. When the BASIC Stamp Editor begins the downloading process the BASIC Stamp is reset; however, this reset does not reset the eb500. This can cause an existing application on the BASIC Stamp to begin executing, which can lead to a situation where the new application and the eb500 are not in sync. It is possible that the eb500 could be in Data Mode or in an unpredictable command mode state, due to the execution of the existing BASIC Stamp application. Therefore, during the application debugging process, it is recommended that the following code be inserted at the beginning of your BASIC Stamp application, before you read or set any I/O points or issue any commands to the eb500.

```
‘*************************************************************
      IF in5 = 0 THEN ClearCmd
      DEBUG “eb500 Connected (in Data Mode)”,CR
      ‘Switch to Command Mode
      LOW 6
      SERIN 0,84,[WAIT(CR,”>”)]
      ‘Disconnect from the remote device
      SEROUT 1,84,[“dis”,CR]
      SERIN 0,84,[WAIT(CR,”>”)]
      GOTO Start
ClearCmd:
      DEBUG “eb500 in Command Mode”,CR
      ‘Issue a carriage-return to clear any commands
      SEROUT 1,84,[CR]
      SERIN 0,84,[WAIT(“>”)]
‘*************************************************************
```

# Hardware Connections

The eb500 module is designed to interface with a 5V CMOS signal environment. It supports a power supply of 5 – 12V and can be connected directly to boards supporting the Parallax AppMod header. When inserting the eb500 module to any of the supported Parallax boards, it is important that Pin 1 of the eb500 module, marked with a white dot and a square (Figure 1), is inserted into the VSS pin of the AppMod header on the Parallax boards. A full device pinout is available in the Technical Specifications section of this manual.

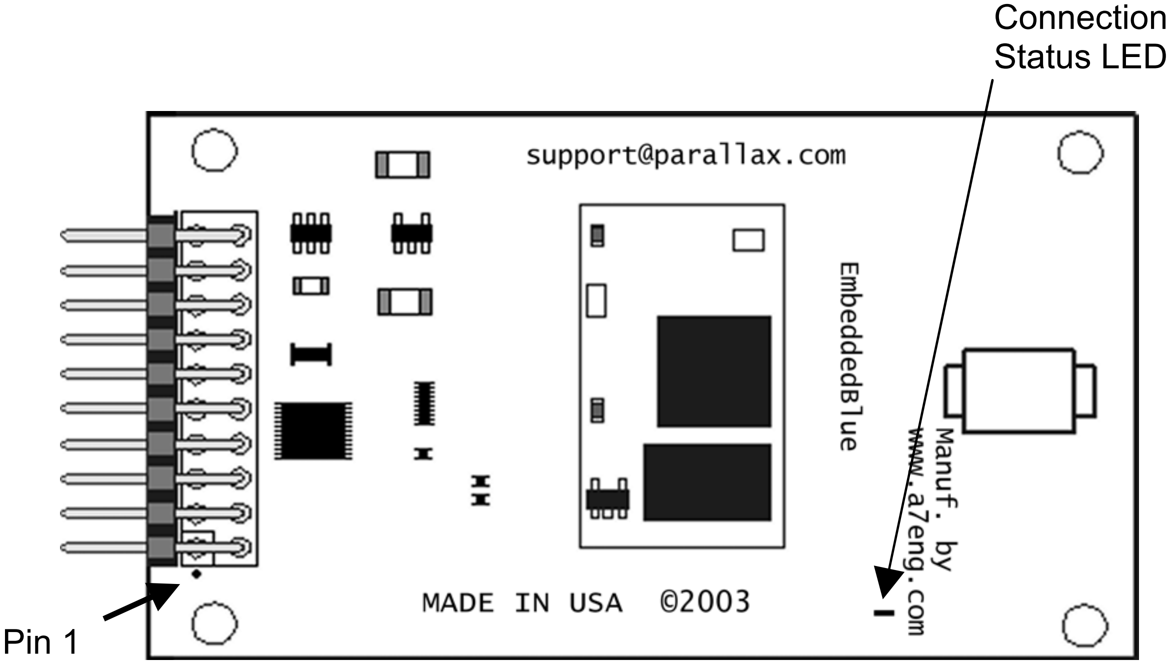
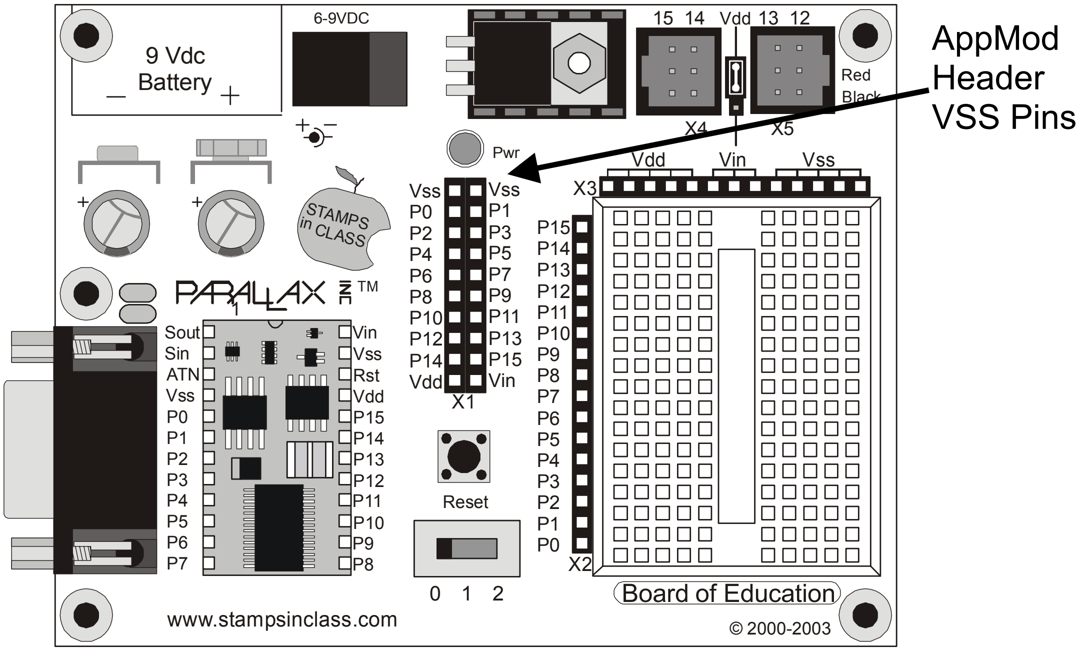


**Figure 1: eb500 Module**

# Board Of Education

The Board Of Education (BOE) contains an AppMod header and supports a direct connection with the eb500 module. On the Board of Education, the AppMod header is labeled X1 (Figure 2). When inserting the eb500 module into the Board of Education AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin of the AppMod header.

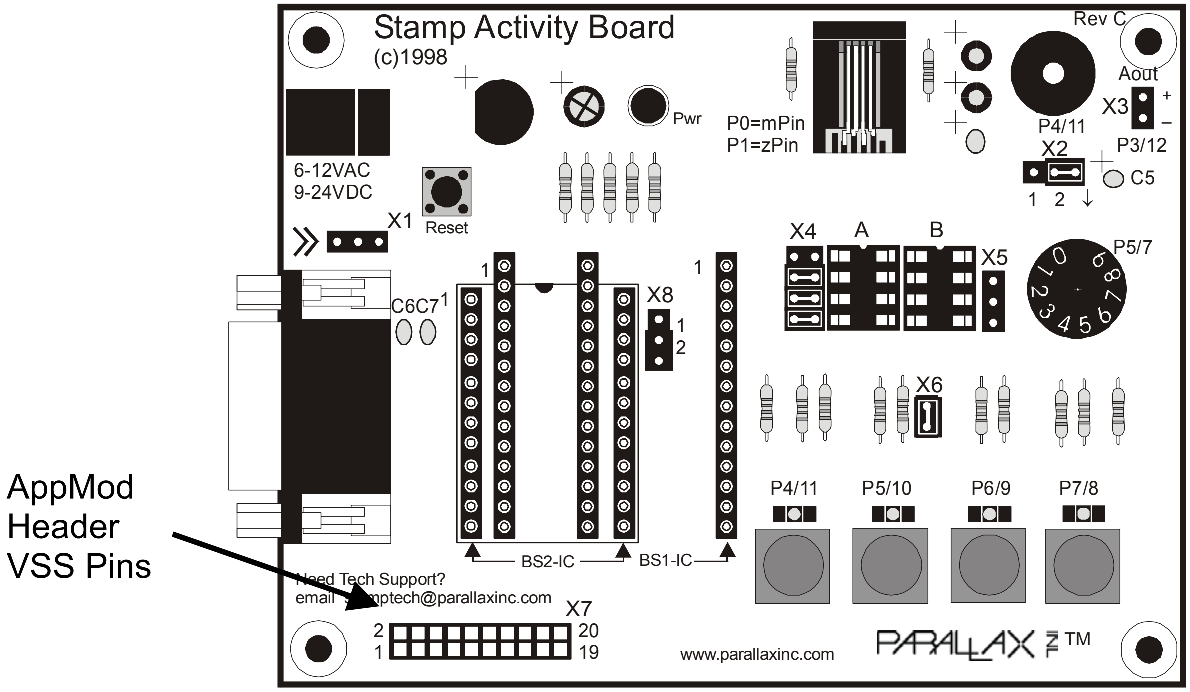


AppMod Header VSS Pins

**Figure 2: Board of Education Board**

# Basic Stamp Activity Board

The Basic Stamp Activity Board contains an AppMod header and supports a direct connection with the eb500 module when using a BS2 processor. On the Basic Stamp Activity Board, the AppMod header is labeled X7 (Figure 3). When inserting the eb500 module into the Basic Stamp Activity Board AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin (Pin 1) of the AppMod header.



AppMod Header VSS Pins

**Figure 3: Basic Stamp Activity Board**

# BS2P40 Demo Board

The BS2P40 Demo Board contains an AppMod header and supports a direct connection with the eb500 module. On the BS2P40 Demo Board, the AppMod header is labeled X1 (Figure 4). When inserting the eb500 module into the BS2P40 Demo Board AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin of the AppMod header.

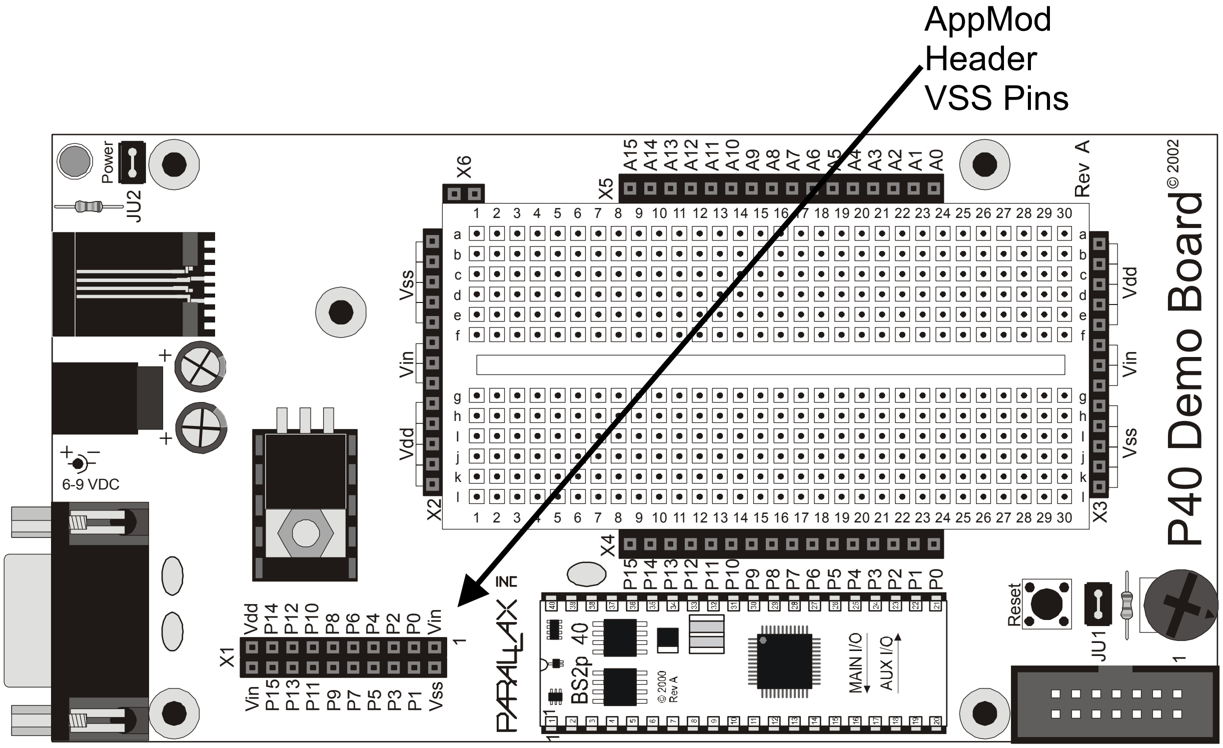


Figure 4: BS2P40 Demo Board

# Javelin Stamp Demo Board

The Javelin Stamp Demo Board contains an AppMod header and supports a direct connection with the eb500 module. On the Javelin Stamp Demo Board, the AppMod header is labeled X1 (Figure 5). When inserting the eb500 module into the Javelin Stamp Demo Board AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin of the AppMod header.

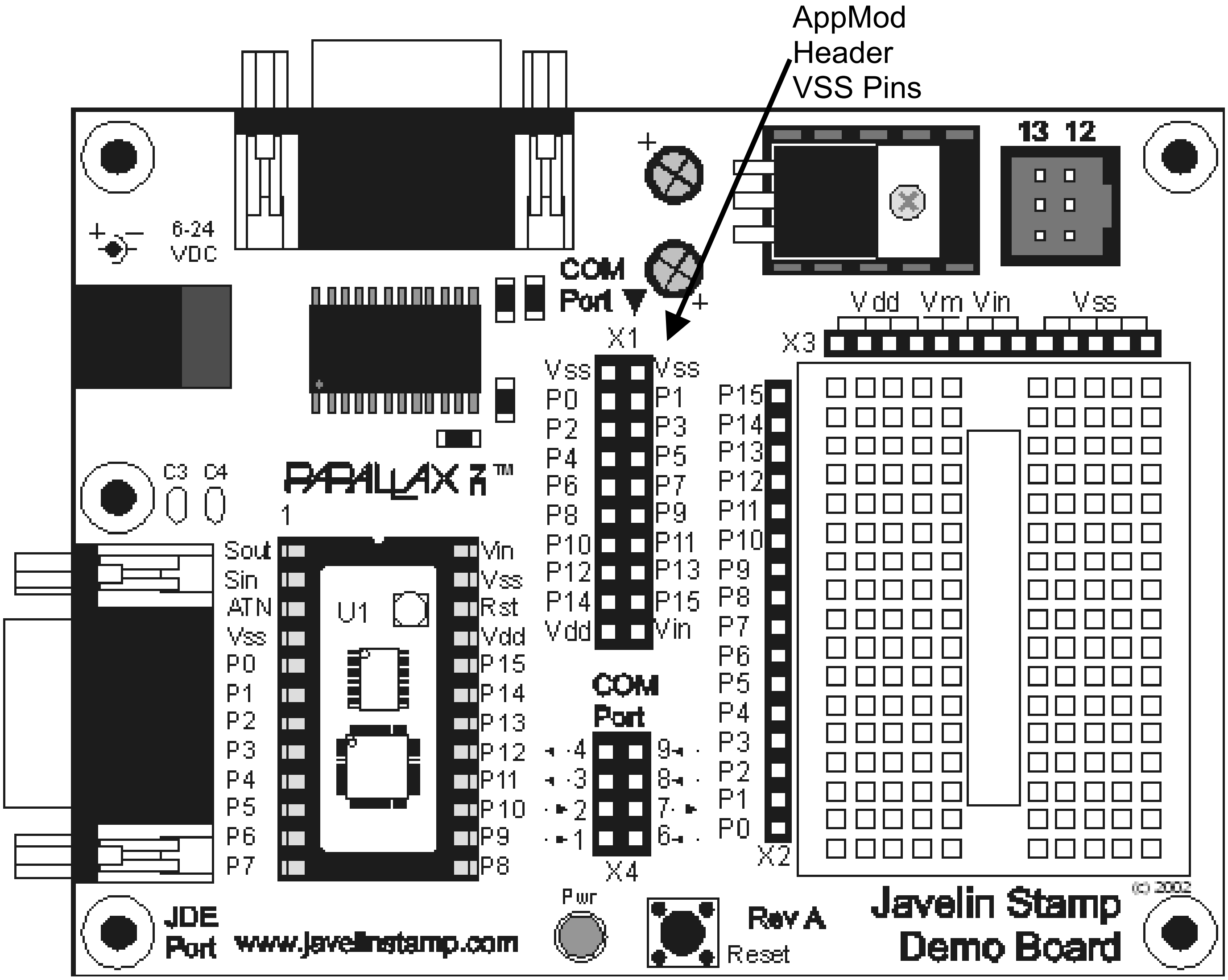
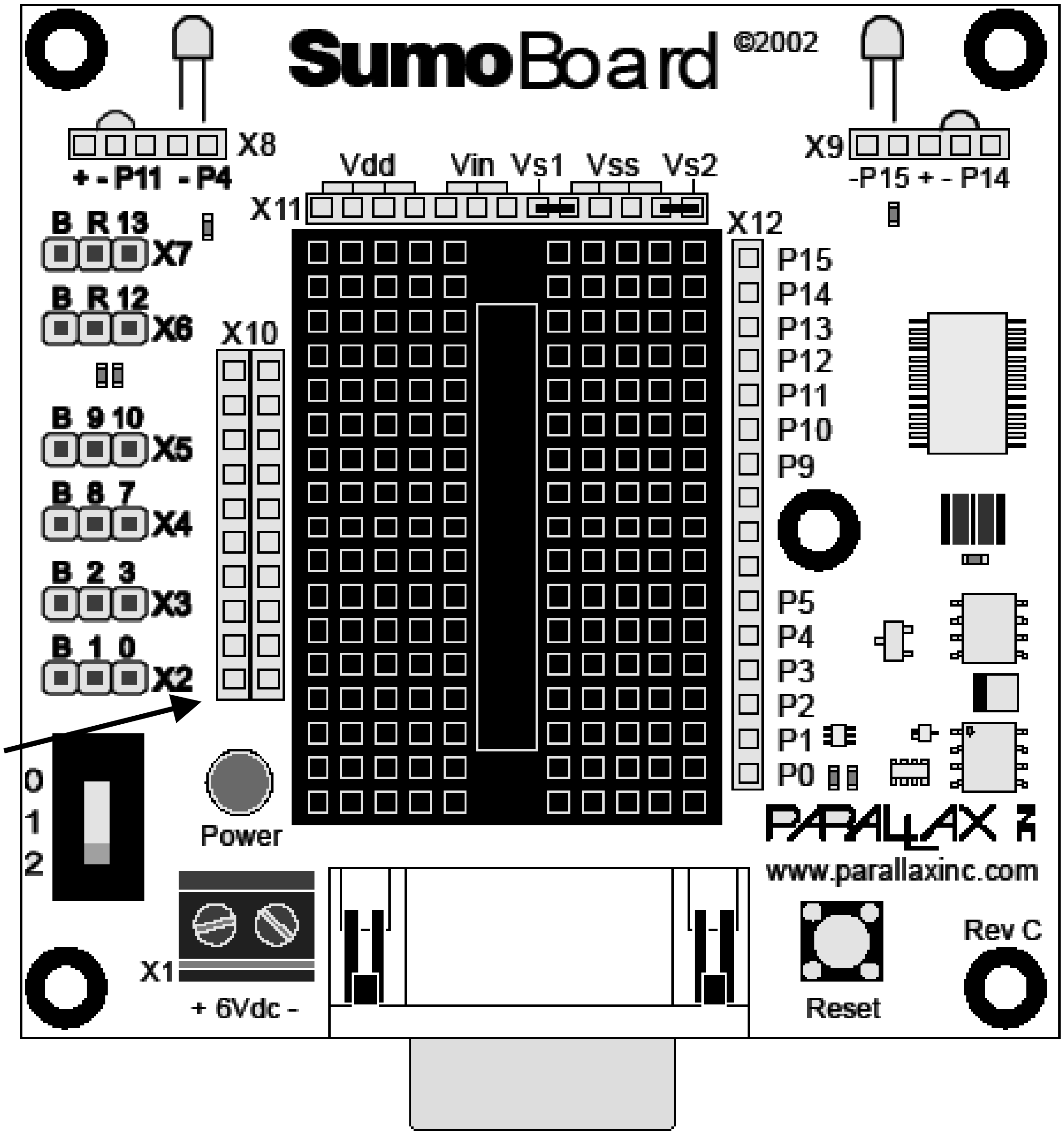

AppMod Header VSS Pins

Figure 5: Javelin Stamp Demo Board

## SumoBoard

The SumoBoard contains an AppMod header and supports a direct connection with the eb500 module. On the SumoBoard, the AppMod header is labeled X10 (Figure 6). When inserting the eb500 module into the SumoBoard AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin of the AppMod header.

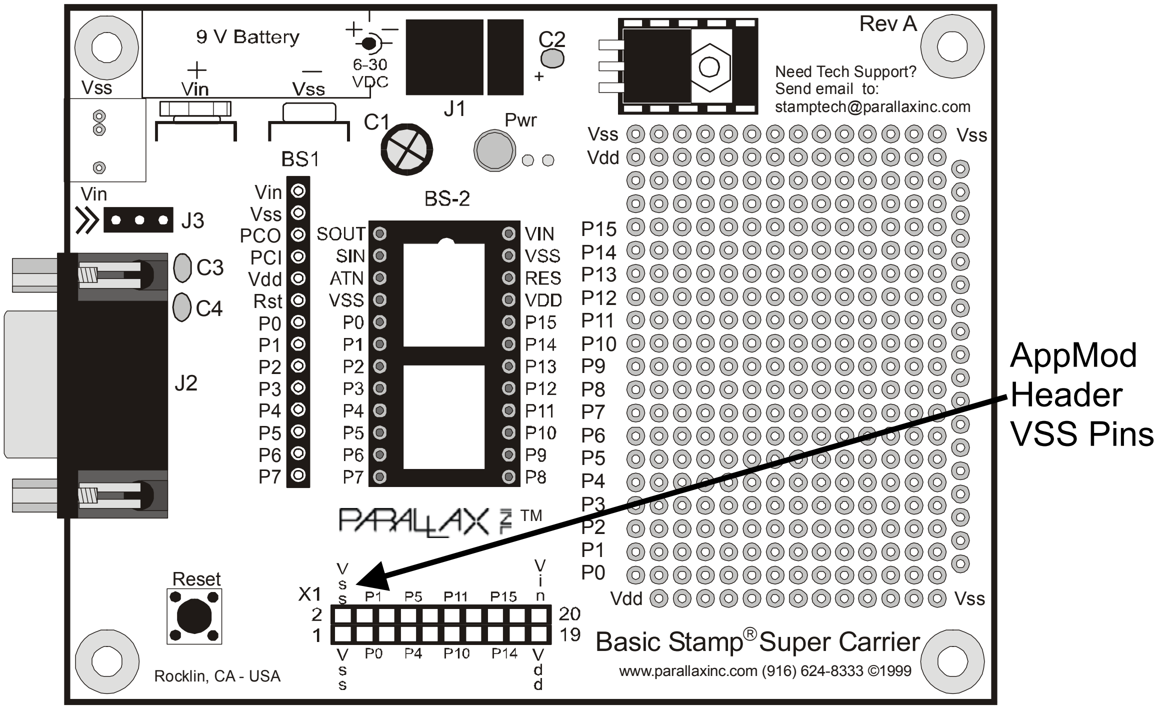


AppMod Header VSS Pins

**Figure 6: SumoBoard**

# Super Carrier Board

The Super Carrier Board contains an AppMod header and supports a direct connection with the eb500 module. On the Super Carrier Board, the AppMod header is labeled X1 (Figure 7). When inserting the eb500 module into the Super Carrier Board AppMod header, assure that you insert Pin 1 of the eb500 module, marked with a white dot and a square, into the VSS pin of the AppMod header.



AppMod Header VSS Pins

**Figure 7: Super Carrier Board**

# Establishing a Connection

This section contains a number of exercises that demonstrate methods of establishing Bluetooth wireless connections with the eb500. The scenarios described are not meant to form an exhaustive list, but rather illustrate a number of more common and useful configurations. All source code shown in these exercises is available in electronic form on the accompanying CD, in the Samples folder, using the filename used in this manual.

## Connecting two eb500 Modules

In this exercise we will step through the process of establishing a connection between an eb500 inserted into a Board of Education board and an eb500 inserted into a SumoBoard board.

To perform this exercise, as documented, you will need a Board of Education board, a SumoBoard board, and two eb500 modules. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

### Step 1: Write a BASIC Stamp Application to Get the eb500 Address

In this step we will write a BASIC Stamp application to interrogate an eb500 for its unique Bluetooth address.

1. Open the **Basic Stamp Editor**.
2. Enter the following **program code** into the editor.

```
'{$STAMP BS2}
szData VAR BYTE(20)
'Wait for the eb500 radio to be ready
PAUSE 1000
'Get the eb500 Bluetooth Address
SEROUT 1,84,["get addr",CR]
SERIN 0,84,[WAIT(“ACK”,CR)]
```

```
'Read the local address from the get command
SERIN 0,84,[STR szData\17]
SERIN 0,84,[WAIT(CR,”>”)]
szData(17) = 0
DEBUG STR szData\17,CR
```

The BASIC Stamp application issues an eb500 Get Address command and then reads and displays the response in the debug window. The response is the Bluetooth address of the local eb500 module.

3. On the **File** menu, click **Save As**.
4. In the **File name** box, enter a file name to which to save the program just created. For example, GetAddress.bs2.
5. Click **Save**.

## Step 2: Insert the eb500 Modules into the BOE and SumoBoard Boards

In this step we will insert the eb500 modules into the Board of Education (BOE) and SumoBoard boards.

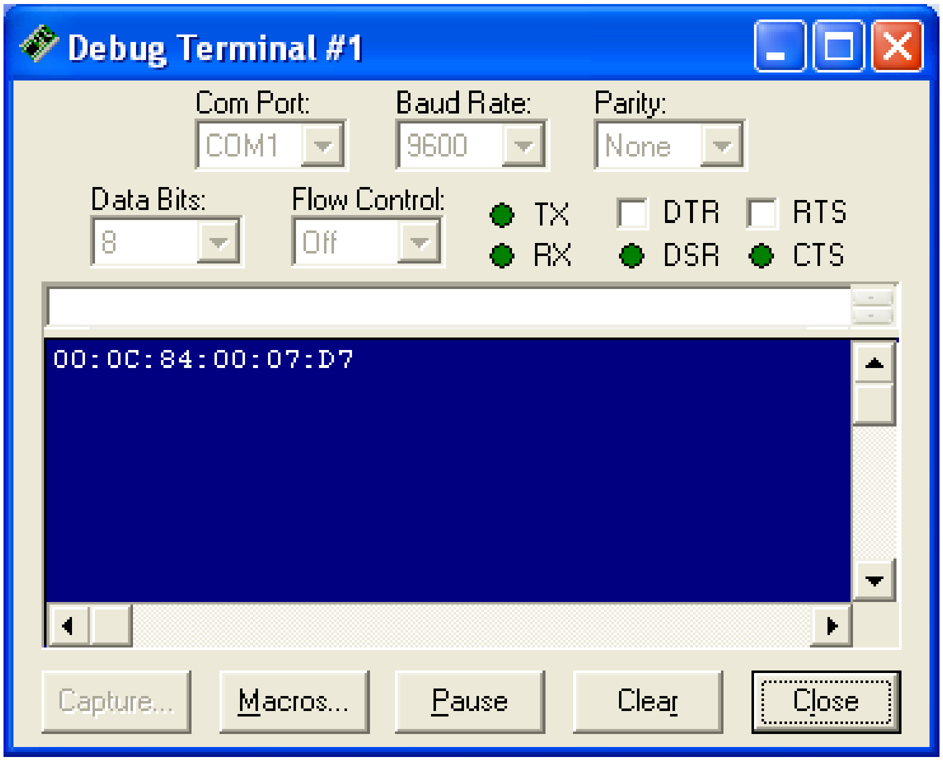
1. Insert an **eb500** module into the **AppMod header** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.
2. Insert an **eb500** module into the **AppMod header** of the SumoBoard board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.

## Step 3: Get the Address of the eb500 on the Board of Education Board

In this step we will get the Bluetooth address of the eb500 module on the Board of Education board. We will then use this address in the next step.

1. Connect the **Board of Education board serial port** to the **PC**.
2. Apply **power** to the Board of Education board.
3. On the **Run** menu, click **Run**.

   The Bluetooth address for the eb500 on the Board of Education board is shown in the debug window (Figure 8).
4. On the **Debug Terminal #1** dialog click **Close**.
5. Disconnect the **power** from the **Board of Education board**.
6. Disconnect the **Board of Education board serial port** from the **PC**.



Com Port: COM1

Baud Rate: 9600

Parity: None

Data Bits: 8

Flow Control: Off

```
00:0C:84:00:07:D7
```

**Figure 8: eb500 Bluetooth Address Output**

## Step 4: Connect the eb500 on the SumoBoard to the eb500 on the BOE

In this step we will develop and run a BASIC Stamp application on the SumoBoard to establish a connection with the Board of Education.

1. Using the BASIC Stamp Editor; on the **File** menu, click **New**.

   This will create a new project window within the BASIC Stamp Editor.

2. Enter the following **program code** into the editor, replacing the Bluetooth device address with the device address of the eb500 on the Board of Education board, which we obtained in the previous step.

```
‘{$STAMP BS2}
‘I/O Line 5 provides the connection status
INPUT 5
 ‘Wait for the eb500 radio to be ready
PAUSE 1000
‘Connect to the remote device
SEROUT 1,84,[“con 00:0C:84:00:07:D7”,CR]
SERIN 0,84,[WAIT(“ACK”,CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
DEBUG “Connected”,CR
‘Wait for 20 seconds
PAUSE 20000
‘I/O Line 6 allows us to switch to Command Mode
OUTPUT 6
‘Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,”>”)]
‘Disconnect from the remote device
SEROUT 1,84,[“dis”,CR]
SERIN 0,84,[WAIT(CR,”>”)]
DEBUG “Disconnected”,CR
```

The BASIC Stamp application establishes a connection with the remote Bluetooth device, waits twenty seconds, switches back to command mode and then disconnects from the remote device.

3. On the **File** menu, click **Save As**.
4. In the **File name** box, enter a file name to which to save the program just created. For example, Connect.bs2.
5. Click **Save**.
6. Apply **power** to the **Board of Education board**.
7. Apply **power** to the **SumoBoard board**.
8. On the **Run** menu, click **Run**.

   The Connection Status LED (Figure 1) on both eb500 modules will turn on when a connection is established between the two eb500 modules.
9. Disconnect the **power** from the **Board of Education board**.
10. Disconnect **power** from the **SumoBoard board**.

# Connecting a PC with an eb600 to a Board of Education

In this exercise we will step through the process of establishing a connection between a PC that has an eb600 PC Adapter to an eb500 inserted into a Board of Education board.

To perform this exercise, as documented, you will need an eb600 PC Adapter, a Board of Education board and two eb500 modules. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

## Step 1: eb600 PC Adapter Setup

In this step we will attach an eb500 module to the eb600 PC Adapter and apply power to the device.

1. Insert an **eb500** module into the **eb600 PC Adapter** header; assuring that Pin 1 of the eb500 module is inserted into Pin 1 of the header on the eb600 PC Adapter.
2. Connect the **eb600 PC Adapter** to a serial port on the PC using the **provided straight through serial cable**.

   The PC serial port must be available for HyperTerminal use.
3. Apply **power** to the **eb600 PC Adapter**.

## Step 2: HyperTerminal Setup

In this step we will setup the Windows HyperTerminal application to establish a connection with the eb500 attached to the eb600 PC Adapter.

1. Open **HyperTerminal**.

   This will display the Connection Description dialog.
2. In the **Name** box, type the name of your connection. For example, EB600.
3. Click **OK**.

   This will display the Connect To dialog.
4. In the **Connect using** dropdown, select the **serial port** to which you have connected the eb600 PC Adapter.
5. Click **OK**.

   This will display the Properties dialog.
6. In the **Bits per second** dropdown, select **9600**.
7. In the **Data bits** dropdown, select **8**.
8. In the **Parity** dropdown, select **None**.
9. In the **Stop bits** dropdown, select **1**.

10. In the **Flow control** dropdown, select **None**.

11. Click **OK**.

    This will establish a connection with the serial port.

12. On the **Call** menu, click **Disconnect**.

    This will disconnect the connection just established, so that we can modify the connection properties in the following actions.

13. On the **File** menu, click **Properties**.

    This will display the Properties dialog.

14. On the **Settings** tab, click **ASCII Setup**.

    This will display the ASCII Setup dialog.

15. Check the **Send line ends with line feeds** checkbox.

16. Check the **Echo typed characters locally** checkbox.

17. Check the **Append line feeds to incoming line ends** checkbox.

18. Check the **Wrap lines that exceed terminal width** checkbox.

19. Click **OK**.

    This will return to the Properties dialog.

20. Click **OK**.

21. On the **Call** menu, click **Call**.

    This will establish a connection with the serial port.

### Step 3: Board of Education – eb500 Setup

In this step we will attach an eb500 module to the Board of Education board and apply power to the device.

1. Insert an **eb500** module into the **AppMod header** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.

2. Apply **power** to the **Board of Education board**.

   Power can be applied by attaching a 9 Volt battery, or the AC-Adapter provided by Parallax.

## Step 4: Establish a Connection

In this step we will establish a connection between the PC and the Board of Education.

1. Using HyperTerminal, get the address of the **eb500** module that is connected to the Board of Education board by using the eb500 **LST** serial command.

   By issuing the LST command, the eb500 connected to the eb600 lists other Bluetooth devices that are in range and visible. Please note that this operation will take 30 seconds to complete.

   To obtain the address, type `lst` at the “`>`” prompt and press the return key.

   Example:

   ```
   >lst
   ACK
   00:0C:84:00:07:D7
   >
   ```

2. Using HyperTerminal, establish a connection with the **eb500** that is connected to the Board of Education board by using the eb500 **CON** serial command.

   To establish a connection, type `con` followed by a space, followed by the address returned in the previous action, followed by a carriage-return. The Connection Status LED (Figure 1) on both eb500 modules will turn on when a connection is established.

   Example:

   ```
   >con 00:0C:84:00:07:D7
   ACK
   >
   ```

3. Disconnect **power** from both the **eb600 PC Adapter** and the **Board of Education boards**.

   The removal of power resets the eb500 so that when power is restored the eb500 will boot into command mode.

# Connecting a PC with a DBT-120 to a BOE

In this exercise we will step through the process of establishing a connection from a PC that has a D-Link® DBT-120 Bluetooth USB Adapter to an eb500 module inserted into a Board of Education (BOE) board.

To perform this exercise, as documented, you will need a D-Link DBT-120, a Board of Education board, and an eb500 module. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

On the PC, the DBT-120 Bluetooth Software associates a COM port for establishing a connection from the PC to a remote Bluetooth device and a separate COM port for connections that are established from a remote Bluetooth device to the PC. This exercise demonstrates establishing a connection from the PC to a remote eb500. The next exercise will demonstrate establishing a connection from a remote eb500 to the PC.

The D-Link DBT-120 Bluetooth USB Adapter software must be fully installed prior to establishing a connection. The PC settings shown in this exercise are based upon the software provided with the D-Link DBT-120 Bluetooth USB Adapter.

## Step 1: DBT-120 Setup

In this step we will attach the DBT-120 USB Adapter to the PC. The software for the DBT-120 should already be setup.

1. Connect the **DBT-120** to an available **USB port** on the PC, following the instructions provided with the DBT-120 Bluetooth USB Adapter.

## Step 2: Board of Education – eb500 Setup

In this step we will attach an eb500 module to the Board of Education board and apply power to the device.

1. Insert an **eb500** module into the **AppMod connector** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.
2. Apply **power** to the **Board of Education board**.

   Power can be applied by attaching a 9 Volt battery, or the AC-Adapter provided by Parallax.

## Step 3: Establish a Connection Using the DBT-120 Bluetooth Software

In this step we will establish a connection from the PC to the eb500 module inserted into the Board of Education board.

The actions in this step need to be performed only once for the eb500. After performing the actions in this step, the connection details will be stored on the PC. Therefore, future connections can be established to an eb500 by simply opening the associated COM port.

**1.** Open **My Bluetooth Places** by double-clicking on the desktop icon.

This will display the My Bluetooth Places dialog.

**2.** Click **View devices in range** to locate the **eb500 module** connected to the Board of Education.

Provided the eb500 on the Board of Education is within range, eb500 will be shown in the window.

**3.** Select **eb500** and click **Discover services**.

The A7 Serial Port service will be shown in the window.

**4.** Select **A7 Serial Port** and click **Connect to this service**.

This will establish a connection from the PC to the eb500 on the Board of Education board and associate this connection with a specific COM port.

**5.** If the **A7 Serial Port** dialog is shown, click **OK**.

**6.** Select **A7 Serial Port** and click **Display service properties**.

This will display the Bluetooth Properties dialog.

**7.** In the **Port** dropdown, which is disabled, please note the **COM port** shown.

The DBT-120 Bluetooth software associates a specific COM port for a connection from the PC to an eb500. Applications, such as HyperTerminal, use this COM port to establish a connection and communicate with an eb500 from the PC. Remember, this COM port is used to establish a connection from the PC to the eb500. A different COM port is used when a connection is established from the eb500 to the PC.

**8.** Click **OK**.

**9.** Select **A7 Serial Port** and click **Disconnect from this service**.

This will disconnect the connection to the eb500 on the Board of Education board.

## Step 4: HyperTerminal Setup

In this step we will setup the Windows HyperTerminal application to establish a connection with the eb500 on the Board of Education board.

**1.** Open **HyperTerminal**.

This will display the Connection Description dialog.

**2.** In the **Name** box, type the name of your connection. For example, eb500-BOE.

**3.** Click **OK**.

This will display the Connect To dialog.

**4.** In the **Connect using** dropdown, select the **serial port** to which the DBT-120 Bluetooth software associated with the connection from the PC to the eb500 on the Board of Education board.

The COM port associated with the connection was discovered in the previous step.

**5.** Click **OK**.

This will display the Properties dialog.

**6.** In the **Bits per second** dropdown, select **9600**.

**7.** In the **Data bits** dropdown, select **8**.

**8.** In the **Parity** dropdown, select **None**.

**9.** In the **Stop bits** dropdown, select **1**.

**10.** In the **Flow control** dropdown, select **None**.

**11.** Click **OK**.

This will establish a connection with the eb500 on the Board of Education board.

**12.** On the **Call** menu, click **Disconnect**.

This will disconnect the connection just established, so that we can modify the connection properties in the following actions.

**13.** On the **File** menu, click **Properties**.

This will display the Properties dialog.

**14.** On the **Settings** tab, click **ASCII Setup**.

This will display the ASCII Setup dialog.

**15.** Check the **Send line ends with line feeds** checkbox.

**16.** Check the **Echo typed characters locally** checkbox.

**17.** Check the **Append line feeds to incoming line ends** checkbox.

**18.** Check the **Wrap lines that exceed terminal width** checkbox.

**19.** Click **OK**.

This will return to the Properties dialog.

**20.** Click **OK**.

## Step 5: Establish a Connection Using HyperTerminal

In this step we will establish a connection from the PC to the eb500 on the Board of Education, using HyperTerminal. This step relies on the connection information created previously in Step 3.

**1.** On the **Call** menu, click **Call**.

This will establish a connection with the eb500 on the Board of Education board. The Connection Status LED (Figure 1) on the eb500 module will turn on when a connection is established.

**2.** On the **Call** menu, click **Disconnect**.

This will close the connection with the eb500 on the Board of Education.

# Connecting a BOE to a PC with a DBT-120

In this exercise we will step through the process of establishing a connection from an eb500 module inserted into a Board of Education (BOE) board to a PC that has a D-Link® DBT-120 Bluetooth USB Adapter.

To perform this exercise, as documented, you will need a D-Link DBT-120, a Board of Education board, and an eb500 module. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

On the PC, the DBT-120 Bluetooth Software associates a COM port for establishing a connection from the PC to a remote Bluetooth device and a separate COM port for connections that are established from a remote Bluetooth device to the PC. This exercise demonstrates establishing a connection from a remote eb500 to the PC. When a remote Bluetooth device establishes a connection with the PC, the connection is established with the DBT-120 Bluetooth USB Adapter software running on the PC. To gain access to the data, an application, such as HyperTerminal, must open the COM port associated with the connection established from the remote device. In the Communications section, we will step through this process.

The D-Link DBT-120 Bluetooth USB Adapter software must be fully installed prior to establishing a connection. The PC settings shown in this exercise are based upon the software provided with the D-Link DBT-120 Bluetooth USB Adapter.

## Step 1: DBT-120 Setup

In this step we will attach the DBT-120 USB Adapter to the PC. The software for the DBT-120 should already be setup.

1. Connect the **DBT-120** to an available **USB port** on the PC, following the instructions provided with the DBT-120 Bluetooth USB Adapter.

## Step 2: Obtain the Bluetooth Address of the PC

In this step we will obtain the Bluetooth address of the DBT-120 USB Adapter attached to the PC.

1. Open **My Bluetooth Places** by double-clicking on the desktop icon.

   This will display the My Bluetooth Places dialog.

2. Click **View or modify configuration**.

   This will display the Bluetooth Configuration dialog.

3. Select the **Hardware** tab and note the **Device Address** shown in the Device Properties section of the dialog.

   The device address will be used in the BASIC Stamp application developed in the next step.

4. Click **Cancel**

   This will close the Bluetooth Configuration dialog.

## Step 3: Write a BASIC Stamp Application to Connect to the PC

In this step we will attach an eb500 module to the Board of Education board and develop a BASIC Stamp application to establish a connection with the PC.

1. Insert an **eb500** module into the **AppMod connector** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.
2. Connect the **Board of Education board serial port** to the **PC**.
3. Open the **BASIC Stamp Editor**.
4. Enter the following **program code** into the editor, replacing the Bluetooth device address with the device address of the PC, which we obtained from the Hardware tab of the Device Properties section of the Bluetooth Configuration dialog in the previous step.

```
‘{$STAMP BS2}
‘I/O Line 5 provides the connection status
INPUT 5
‘Wait for the eb500 radio to be ready
PAUSE 1000
‘Connect to the remote device
SEROUT 1,84,[“con 00:80:C8:35:2C:B8”,CR]
SERIN 0,84,[WAIT(“ACK”,CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
DEBUG “Connected”,CR
‘Wait for 20 seconds
PAUSE 20000
‘I/O Line 6 allows us to switch to Command Mode
OUTPUT 6
‘Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,”>”)]
‘Disconnect from the remote device
SEROUT 1,84,[“dis”,CR]
```

```
SERIN 0,84,[WAIT(CR,”>”)]
DEBUG “Disconnected”,CR
```

The BASIC Stamp application establishes a connection with the remote Bluetooth device, waits twenty seconds, switches back to command mode and then disconnects from the remote device.

5. On the **File** menu, click **Save As**.
6. In the **File name** box, enter a file name to which to save the program just created. For example, ConnectPC.bs2.
7. Click **Save**.

## Step 4: Connect the eb500 on the Board of Education to the PC

1. Apply **power** to the **Board of Education board**.

   Power can be applied by attaching a 9 Volt battery, or the AC-Adapter provided by Parallax.

2. On the **Run** menu, click **Run**.

   The Connection Status LED (Figure 1) on the eb500 module will turn on when a connection is established. Additionally, on the My Bluetooth Places window, in the Additional Information column, the text “Connected” will be shown while a connection exists between the eb500 and the PC.

# Connecting an iPAQ h1940 to a Board of Education

In this exercise we will step through the process of establishing a connection from an iPAQ h1940, which has integrated Bluetooth, to an eb500 module inserted into a Board of Education board.

To perform this exercise, as documented, you will need an iPAQ h1940, a Board of Education board, and an eb500 module. If you are using a different model of Pocket PC, with integrated Bluetooth, or any of the other supported Parallax boards, you may need to make adjustments to this exercise.

## Step 1: Board of Education – eb500 Setup

In this step we will attach an eb500 module to the Board of Education board and apply power to the device.

1. Insert an **eb500** module into the **AppMod connector** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.
2. Apply **power** to the **Board of Education board**.

   Power can be applied by attaching a 9 Volt battery, or the AC-Adapter provided by Parallax.

## Step 2: iPAQ h1940 Setup

In this step we will setup the iPAQ for connecting to the eb500.

1. Tap the **Bluetooth icon** in the system tray on the Today screen and select **Bluetooth Manager**.

   This will display the Bluetooth Manager dialog.
2. On the **New** menu, select **Connect**.

   This will display the first page of the Connection Wizard.
3. Select **Explore a Bluetooth device** and tap **Next**.

   This will display the next page of the Connection Wizard.
4. Tap in the **Device** box.

   This will display the Connection Wizard Bluetooth Browser dialog containing a list of found devices.
5. Tap **eb500**.

   This will display the next page of the Connection Wizard.
6. In the **Service Selection** box, select **A7 Serial Port**.

7. Tap **Next**.

   This will create a shortcut for the service.

8. Tap **Finish**.

   This will display the Bluetooth Manager dialog with the shortcut created in the window, eb500: A7 Serial Port.

## Step 3: Establish a Connection

In this step we will establish a connection from the iPAQ to the Board of Education.

1. Tap-and-hold the shortcut created in the previous step, **eb500: A7 Serial Port**.

2. Select **Connect**.

   This will establish a connection with the eb500 on the Board of Education board. The Connection Status LED (Figure 1) on the eb500 module will turn on when a connection is established.

3. Tap **Active Connections**.

   This will display the Bluetooth Manager Active Connections page showing the status of your active Bluetooth connections.

4. Tap **My Shortcuts**.

5. Tap-and-hold the shortcut created in the previous step, **eb500: A7 Serial Port**.

6. Select **Disconnect**.

   This will close the connection with the eb500 on the Board of Education board. The Connection Status LED on the eb500 module will turn off.

# Connecting a Board of Education to an iPAQ h1940

In this exercise we will step through the process of establishing a connection from an eb500 module inserted into a Board of Education board to an iPAQ h1940, which has integrated Bluetooth.

To perform this exercise, as documented, you will need an iPAQ h1940, a Board of Education board, and an eb500 module. If you are using a different model of Pocket PC, with integrated Bluetooth, or any of the other supported Parallax boards, you may need to make adjustments to this exercise.

## Step 1: Obtain the Bluetooth Address of the iPAQ

In this step we will obtain the Bluetooth address of the iPAQ.

1. Tap the **Bluetooth icon** in the system tray on the Today screen and select **Bluetooth Settings**.

   This will display the Settings dialog.

2. Tap the **Accessibility** tab and note the **Address** shown in the Device Identification section of the dialog.

   The device address will be used in the BASIC Stamp application developed in the next step.

3. Tap **OK** to close the dialog.

## Step 2: Write a BASIC Stamp Application to Connect to the iPAQ

In this step we will attach an eb500 module to the Board of Education board and develop a BASIC Stamp application to establish a connection with the iPAQ.

1. Insert an **eb500** module into the **AppMod connector** of the Board of Education board; assuring that Pin 1 of the eb500 module is inserted into the VSS pin of the AppMod header.

2. Connect the **Board of Education board serial port** to the **PC**.

3. Open the **BASIC Stamp Editor**.

4. Enter the following **program code** into the editor, replacing the Bluetooth device address with the device address of the iPAQ, which we obtained from the iPAQ in the previous step.

```
‘{$STAMP BS2}
‘I/O Line 5 provides the connection status
INPUT 5
‘Wait for the eb500 radio to be ready
```

```
PAUSE 1000
‘Connect to the remote device
SEROUT 1,84,[“con 00:04:3E:62:FE:01”,CR]
SERIN 0,84,[WAIT(“ACK”,CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
DEBUG “Connected”,CR
‘Wait for 20 seconds
PAUSE 20000
‘If there is no connection just exit
IF in5 = 0 THEN Exit
‘I/O Line 6 allows us to switch to Command Mode
OUTPUT 6
‘Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,”>”)]
‘Disconnect from the remote device
SEROUT 1,84,[“dis”,CR]
SERIN 0,84,[WAIT(CR,”>”)]
Exit:
      DEBUG “Disconnected”,CR
```

The BASIC Stamp application establishes a connection with the remote Bluetooth device, waits twenty seconds, switches back to command mode and then disconnects from the remote device.

On the h1940 model of the iPAQ, the Bluetooth software closes the connection after a short period of time if there is not an application running on the iPAQ to receive the data over the connection. Therefore, after the twenty second wait, the BASIC Stamp application checks if there is still a valid connection before switching to Command Mode. If there is no connection, the eb500 is already in Command Mode.

5. On the **File** menu, click **Save As**.
6. In the **File name** box, enter a file name to which to save the program just created. For example, ConnectPPC.bs2.
7. Click **Save**.

## Step 3: Establish a Connection

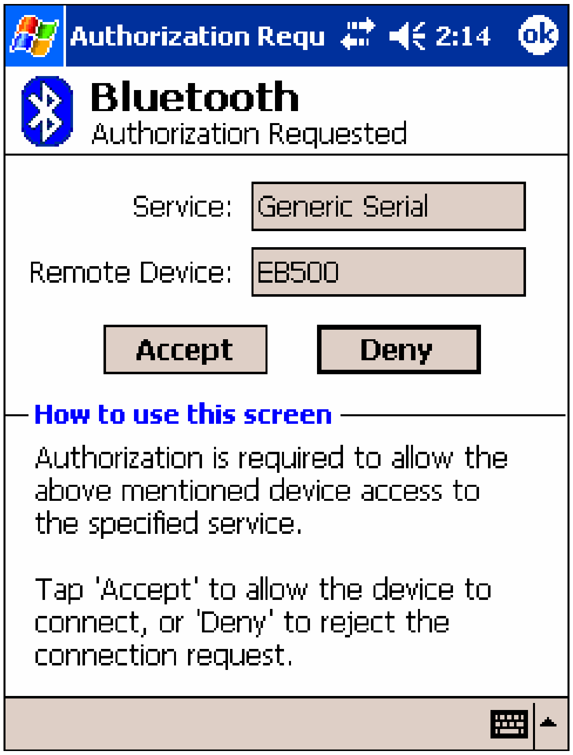
In this step we will establish a connection from the Board of Education to the iPAQ.

1. Turn on the **iPAQ**.
2. Tap the **Bluetooth icon** and select **Bluetooth Manager**.

   This will display the Bluetooth Manager dialog.
3. Tap the **Active Connections** tab.
4. Apply **power** to the **Board of Education board**.

   Power can be applied by attaching a 9 Volt battery, or the AC-Adapter provided by Parallax.
5. Using the Basic Stamp Editor, on the **Run** menu, click **Run**.

   Depending on your current iPAQ Bluetooth configuration, the Authorization Requested Dialog may appear (Figure 9). If this dialog appears, tap Accept to accept the connection. The Connection Status LED (Figure 1) on the eb500 module will turn on when a connection is established. On the iPAQ the connection will be shown in the Incoming Connections section of the Active Connections tab on the Bluetooth Active Connections dialog.



Bluetooth
Authorization Requested

Service: Generic Serial

Remote Device: EB500

How to use this screen

Authorization is required to allow the above mentioned device access to the specified service.

Tap 'Accept' to allow the device to connect, or 'Deny' to reject the connection request.

**Figure 9: iPAQ Bluetooth Authorization Request Dialog**

# Communications

This section contains a number of exercises that demonstrate methods of communicating over a Bluetooth wireless connection with the eb500. The scenarios described are not meant to form an exhaustive list, but rather illustrate a number of more common and useful configurations. All source code shown in these exercises are available in electronic form on the accompanying CD, in the Samples folder, using the filename used in this manual.

## Communicating between Two eb500 Modules

In this exercise we will step through the process of communicating between two eb500 modules, one inserted into a Boe-Bot robot and the other inserted into a SumoBot robot. We will program the SumoBot to use its infrared sensors to follow an object and then transmit its movements to the Boe-Bot. The Boe-Bot will use the received information to mimic the movements of the SumoBot.

To perform this exercise, as documented, you will need a Boe-Bot, a SumoBot, and two eb500 modules. If you are using any of the other supported Parallax robots, you may need to make adjustments to this exercise.

### Step 1: Create a Monkey-See Application for the SumoBot

In this step we will create a BASIC Stamp application that will use the infrared sensors of the SumoBot to follow an object and transmit its movements to a remote eb500.

1. Open the **BASIC Stamp Editor**.
2. Enter the following **program code** into the editor, replacing the Bluetooth device address with the device address of the eb500 inserted into the Boe-Bot robot.

```
'{$STAMP BS2}
‘I/O Line 5 provides the connection status
INPUT 5
'-----[I/O Definitions]------------------------------------------
```

```
LMotor      CON   13
RMotor      CON   12
LfIrOut     CON   4
LfIrIn      VAR   In11
RtIrOut     CON   15
RtIrIn      VAR   In14

'-----[Constants]----------------------------------------------
LFwdFast    CON   1000
LRevFast    CON   500
RFwdFast    CON   500
RRevFast    CON   1000

'-----[Variables]-----------------------------------------------
irBits      VAR   NIB
irLeft      VAR   irBits.Bit1
irRight     VAR   irBits.Bit0
lastIr      VAR   NIB
bBuffer     VAR   BYTE(4)
bErrorCode  VAR   BYTE

'-----[Initialization]------------------------------------------
'Wait for the eb500 radio to be ready
PAUSE 1000

Connect:
      'Connect to Monkey-Do
      SEROUT 1,84,["con 00:0C:84:00:07:D7",CR]
      SERIN 0,84,[WAIT(“ACK”,CR)]
      ‘Either an Err #<CR> or a ">" will be received
      SERIN 0,84,[STR bBuffer\6\”>”]
      IF bBuffer(0) = “E” THEN ErrorCode

WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
```

```
'-----[Main Code]-----------------------------------------------
Main:
      'Verify the connection is still up before each loop
      IF in5 = 0 THEN Connect
      GOSUB Read_IR_Sensors
      BRANCH irBits,[Hold, Turn_Right, Turn_left, Move_Fwd]

Move_Fwd:
      SEROUT 1,84,["3"]
      PULSOUT LMotor,LFwdFast
      PULSOUT RMotor,RFwdFast
      GOTO Main

Turn_Right:
      SEROUT 1,84,["1"]
      PULSOUT LMotor,LFwdFast
      PULSOUT RMotor,RRevFast
      GOTO Main

Turn_Left:
      SEROUT 1,84,["2"]
      PULSOUT LMotor,LRevFast
      PULSOUT RMotor,RFwdFast
      GOTO Main

Hold:
      GOTO Main

'-----[Subroutines]---------------------------------------------
Read_IR_Sensors:
      FREQOUT LfIrOut,1,38500
      irLeft = ~LfIrIn
      FREQOUT RtIrOut,1,38500
      irRight = ~RtIrIn
      RETURN

BadCommand:
      DEBUG "A bad command was received."
      END

ErrorCode:
      bErrorCode = bBuffer(4)
      DEBUG "An error was received: ",STR bErrorCode,CR
      END
```

3. On the **File** menu, click **Save As**.
4. In the **File name** box, enter a file name to which to save the program just created. For example, MonkeySee.bs2.
5. Click **Save**.

## Step 2: Create a Monkey-Do Application for the Boe-Bot

In this step we will create a BASIC Stamp application that will receive information from the remote SumoBot and perform movements based on that information.

1. On the **File** menu, click **New**.

   This will create a new project window within the BASIC Stamp Editor.

2. Enter the following **program code** into the editor.

```
'{$STAMP BS2}
'-----[I/O Definitions]-----------------------------------------
LMotor      CON   15
RMotor      CON   14

'-----[Constants]-----------------------------------------------
LFwdFast    CON   1000
LRevFast    CON   500
RFwdFast    CON   500
RRevFast    CON   1000

'-----[Variables]-----------------------------------------------
CmdData     VAR   BYTE
```

```
'-----[Initialization]------------------------------------------
Initialize:
      'Wait for the eb500 radio to be ready
      PAUSE 1000
      'Set the initial state to hold
      CmdData = 3

'-----[Main Code]-----------------------------------------------
Main:
      'Wait for a command
      SERIN 0,84,[DEC1 CmdData]

      'Process the command
      BRANCH CmdData,[Hold, Turn_Right, Turn_left, Move_Fwd]

      'If the command was invalid just loop again
      GOTO Main

Move_Fwd:
      PULSOUT LMotor,LFwdFast
      PULSOUT RMotor,RFwdFast
      GOTO Main

Turn_Right:
      PULSOUT LMotor,LFwdFast
      PULSOUT RMotor,RRevFast
      GOTO Main

Turn_Left:
      PULSOUT LMotor,LRevFast
      PULSOUT RMotor,RFwdFast
      GOTO Main

Hold:
        GOTO Main
```

3. On the **File** menu, click **Save As**.
4. In the **File name** box, enter a file name to which to save the program just created. For example, MonkeyDo.bs2.
5. Click **Save**.

## Step 3: Download the Applications to the Robots

In this step we will download the applications we just created to the respective robots.

1. Click the **MonkeySee.bs2** tab in the BASIC Stamp Editor.
2. Connect the **SumoBoard board serial port** to the **PC**.
3. Apply **power** to the **SumoBoard board**.
4. On the **Run** menu, click **Run**.
5. On the **Debug Terminal #1** dialog click **Close**.
6. Disconnect the **power** from the **SumoBoard board**.
7. Disconnect the **SumoBoard board serial port** from the **PC**.
8. Click the **MonkeyDo.bs2 tab** in the BASIC Stamp Editor.
9. Connect the **Board of Education board serial port** to the **PC**.
10. Apply **power** to the **Board of Education board**.
11. On the **Run** menu, click **Run**.
12. Disconnect the **Board of Education board serial port** from the **PC**.

## Step 4: Run the Monkey-See / Monkey-Do Applications

In this step we will run the Monkey-See / Monkey-Do applications.

1. Apply **power** to the **SumoBoard board**.
2. Make the **Boe-Bot** robot **mimic the movements** of the SumoBot by putting your hand in front of the SumoBot IR sensors.

   As you move your hand left, right and forward, the SumoBot will follow your hand and the Boe-Bot will mimic the same movements.

# Communicating between a PC with an eb600 and a BOE

In this exercise we will step through the process of communicating between an eb500 module inserted into a Board of Education (BOE) board and a PC that has an eb600 PC Adapter.

To perform this exercise, as documented, you will need to have two serial ports available on your PC, an eb600 PC Adapter, a Board of Education board, and two eb500 moduels. One serial port will be used to connect the PC to the Board of Education serial port. The other serial port will be used to connect to the eb600 PC Adapter. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

## Step 1: Transmit Data from the PC to the BASIC Stamp

In this step we will create a BASIC Stamp application to read data from the eb500 and display the data in the BASIC Stamp Editor Debug window. We will then download and run the application.

1. Connect the **Board of Education board serial port** to the **PC**.
2. Open the **BASIC Stamp Editor**.
3. Enter the following **program code** into the editor.

```
‘{$STAMP BS2}
bData VAR BYTE
‘Wait for the eb500 radio to be ready
PAUSE 1000
Main:
      SERIN 0,84,[STR bData\1]
      DEBUG STR bData\1
      GOTO Main
```

The application waits for an individual byte of data to arrive and then displays the byte in the debug window and then repeats this process.

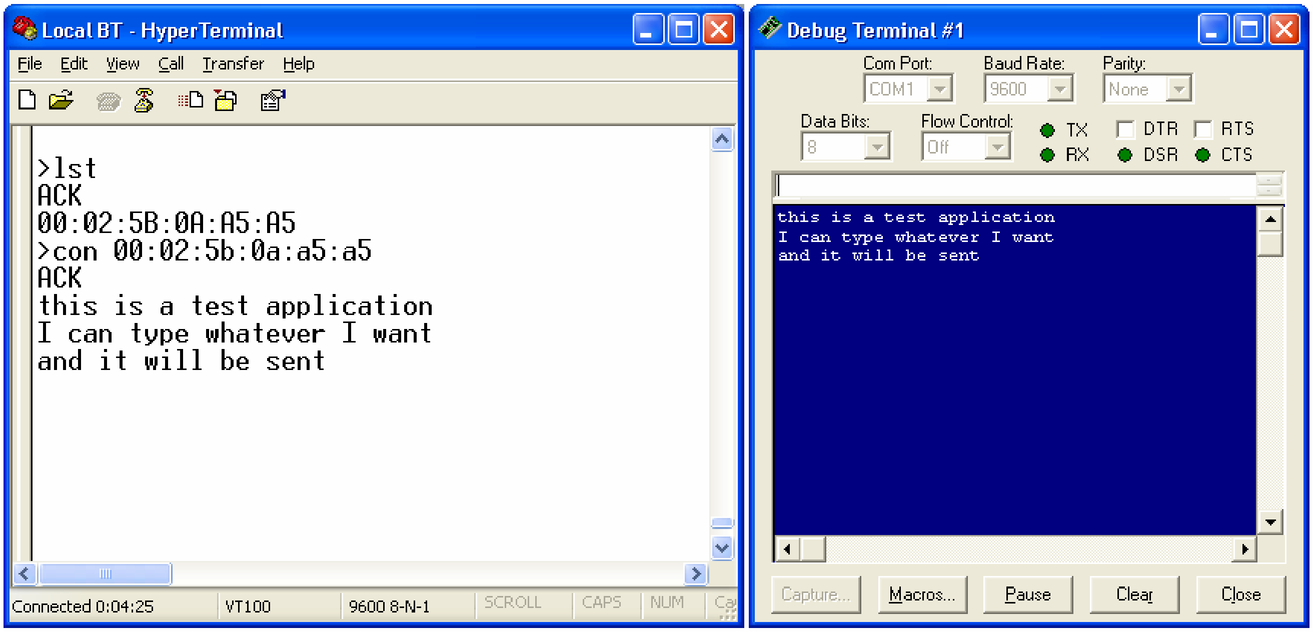
4. On the **File** menu, click **Save As**.
5. In the **File name** box, enter a file name to which to save the program just created. For example, Receive.bs2.
6. Click **Save**.
7. Apply **power** to the **Board of Education board**.
8. On the **Run** menu, click **Run**.

9. Establish a connection from the **PC** to the **Board of Education**.

   Please see the section titled Connecting a PC with an eb600 to a Board of Education for information on establishing the connection.

10. Using HyperTerminal, type a series of **characters**.

    These characters will be transmitted over the wireless link, read by the BASIC Stamp application, and then displayed in the debug window (Figure 10).



```
>lst
ACK
00:02:5B:0A:A5:A5
>con 00:02:5b:0a:a5:a5
ACK
this is a test application
I can type whatever I want
and it will be sent
```

Connected 0:04:25 | VT100 | 9600 8-N-1 | SCROLL | CAPS | NUM | Ca

Com Port: COM1 Baud Rate: 9600 Parity: None

Data Bits: 8 Flow Control: Off

```
this is a test application
I can type whatever I want
and it will be sent
```

**Figure 10: HyperTerminal Input and Debug Output**

## Step 2: Transmit Data from the BASIC Stamp to the PC

In this step we will create a BASIC Stamp application to send data out the eb500 to the PC where we will use HyperTerminal to display the data received by the eb500 module attached to the eb600 on the PC.

1. Reset the **eb500** attached to the **eb600 PC Adapter** to place the eb500 into command mode.

   To reset the eb500 attached to the eb600 PC Adapter, disconnect the power, wait a couple of seconds, and then reconnect the power.

2. Reset the **eb500** attached to the **Board of Education board** to place the eb500 into command mode.

   To reset the eb500 attached to the Board of Education board, disconnect the power, wait a couple of seconds, and then reconnect the power. The Reset push button on the Board of Education board will NOT reset the eb500.

3. Using HyperTerminal, acquire the **device address** of the **eb500** connected to the eb600 PC Adapter by using the eb500 GET ADDR serial command.

   Please note the device address as it will be used in the BASIC Stamp application developed in the following actions.

   By issuing the GET ADDR command, the eb500 connected to the eb600 will return its own device address.

   To obtain the device address, type `get addr` at the “>” prompt and press the return key.

   Example:

   ```
   >get addr
   ACK
   00:0C:84:00:07:D8
   >
   ```

4. Using the BASIC Stamp Editor, on the **File** menu, click **New**.

   This will create a new project window within the BASIC Stamp Editor.

5. Enter the following **program code** into the editor, replacing the device address with the device address obtained from the GET ADDR command issued above.

```
‘{$STAMP BS2}
nCount VAR BYTE
‘I/O Line 5 provides the connection status
INPUT 5
‘Wait for the eb500 radio to be ready
PAUSE 1000
‘Connect to the remote device
SEROUT 1,84,[“con 00:0C:84:00:07:D8”,CR]
SERIN 0,84,[WAIT(“ACK”,CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
DEBUG “Connected”,CR
FOR nCount = 1 to 10
      SEROUT 1,84,[“Hello World”,CR]      ‘sending data
      PAUSE 1000                          ‘wait for 1 second
NEXT
‘I/O Line 6 allows us to switch to command mode.
```

```
OUTPUT 6
‘Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,”>”)]
‘Disconnect from the remote device
SEROUT 1,84,[“dis”,CR]
SERIN 0,84,[wait(CR,”>”)]
DEBUG “Disconnected”,CR
```

The application establishes a connection with the remote eb500 device, transmits “Hello World” ten times, switches back to command mode and then disconnects from the remote device.

The first call to SEROUT is used when the eb500 is in command mode and instructs the eb500 to establish a connection with the device specified. Once a connection is established the eb500 is in data mode, which causes further calls to SEROUT to be sent to the remote device.

6. On the **File** menu, click **Save As**.

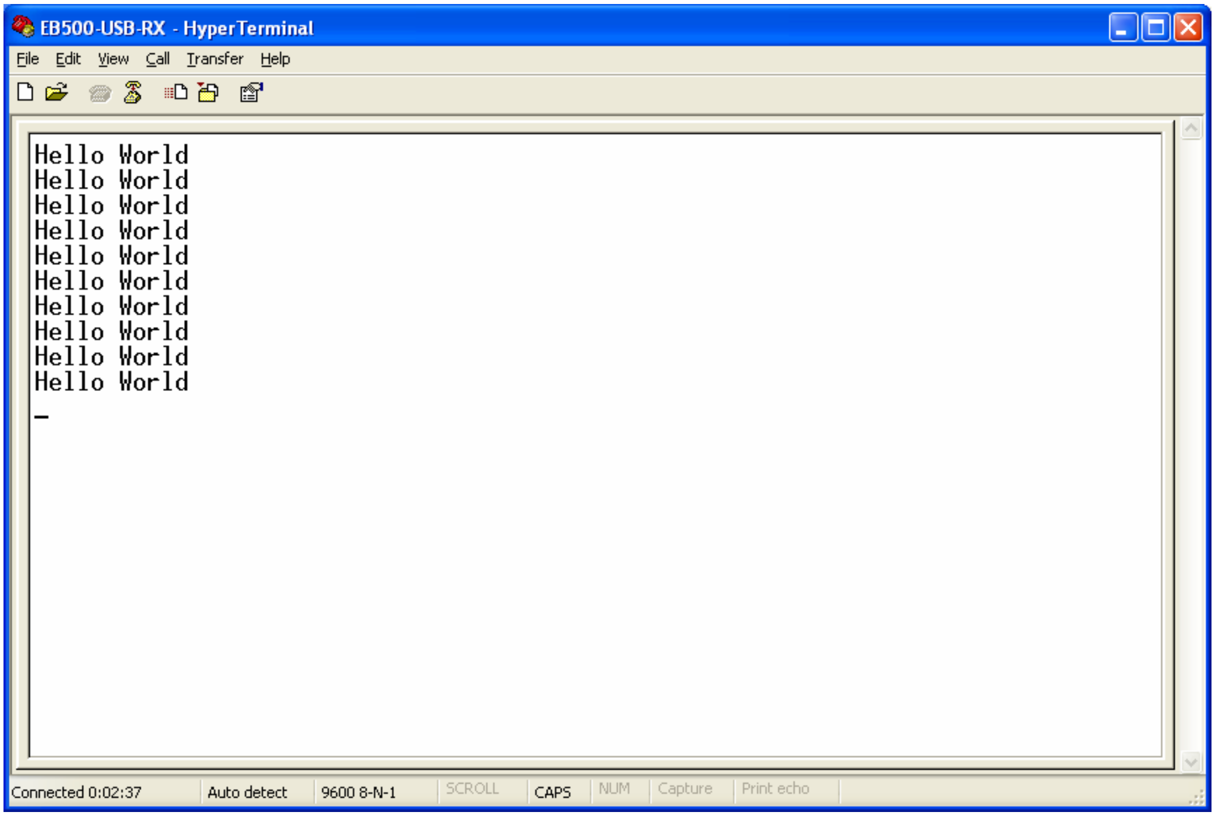
   This will display the Save As dialog.

7. In the **File name** box, enter a file name to which to save the program just created. For example, HelloWorld.bs2.

8. Click **Save**.

9. On the **Run** menu, click **Run**.

   This will display the Download Program dialog while downloading the program to the BASIC Stamp. After the download is complete the BASIC Stamp application will transmit “Hello World” over the wireless link, and HyperTerminal will display the received data (Figure 11).



```
Hello World
Hello World
Hello World
Hello World
Hello World
Hello World
Hello World
Hello World
Hello World
Hello World
_
```

**Figure 11: HyperTerminal Output - Hello World**

# Communicating between a PC with a DBT-120 and a BOE

In this exercise we will step through the process of communicating between a PC that has a D-Link® DBT-120 Bluetooth USP Adapter and an eb500 module inserted into a Board of Education board.

To perform this exercise, as documented, you will need a D-Link DBT-120, a Board of Education board, and an eb500 module. If you are using any of the other supported Parallax boards, you may need to make adjustments to this exercise.

On the PC, the DBT-120 Bluetooth Software associates a COM port for establishing a connection from the PC to a remote Bluetooth device and a separate COM port for connections that are established from a remote Bluetooth device to the PC. Step 1 of this exercise demonstrates establishing a connection from the PC to the eb500 on the Board of Education and then transmitting data over the connection. Step 2 of this exercise demonstrates establishing a connection from the eb500 on the Board of Education to the PC and then transmitting data over the connection.

The D-Link DBT-120 Bluetooth USB Adapter software must be fully installed prior to establishing a connection. The PC settings shown in this exercise are based upon the software provided with the D-Link DBT-120 Bluetooth USB Adapter.

## Step 1: Transmit Data from the PC to the BASIC Stamp

In this step we will create a BASIC Stamp application to read data from the eb500 and display the data in the BASIC Stamp Editor Debug window. We will then download and run the application.

1. Connect the **Board of Education board serial port** to the **PC**.
2. Open the **BASIC Stamp Editor**.
3. Enter the following **program code** into the editor.

```
‘{$STAMP BS2}
bData VAR BYTE
‘Wait for the eb500 radio to be ready
PAUSE 1000
Main:
      SERIN 0,84,[STR bData\1]
      DEBUG STR bData\1
      GOTO Main
```

The application waits for an individual byte of data to arrive and then displays the byte in the debug window and then repeats this process.

4. On the **File** menu, click **Save As**.

**5.** In the **File name** box, enter a file name to which to save the program just created. For example, Receive.bs2.

**6.** Click **Save**.

**7.** Apply **power** to the **Board of Education board**.

**8.** On the **Run** menu, click **Run**.

This will display the Download Progress dialog while downloading the program to the BASIC Stamp. After the download is complete, the Debug Terminal #1 dialog will be shown.

**9.** Establish a connection from the **PC** to the **Board of Education**.

Please see the section titled Connecting a PC with a DBT-120 to a BOE for information on establishing a connection.

**10.** Using HyperTerminal, type a series of **characters**.

These characters will be transmitted over the wireless link, read by the BASIC Stamp application, and then displayed in the debug window.

## Step 2: Transmit Data from the BASIC Stamp to the PC

In this step we will create a BASIC Stamp application to send data out the eb500 to the PC where we will use HyperTerminal to display the data received by the DBT-120 Bluetooth USB Adapter.

**1.** Reset the **eb500** attached to the **Board of Education board** to place the eb500 into command mode.

To reset the eb500 attached to the Board of Education board, disconnect the power, wait a couple of seconds, and then reconnect the power. The Reset push button on the Board of Education board will NOT reset the eb500.

**2.** Close **HyperTerminal**.

**3.** Close the **BASIC Stamp Editor Debug** dialog.

**4.** Open **My Bluetooth Places** by double-clicking on the desktop icon.

This will display the My Bluetooth Places dialog.

**5.** Click **View or modify configuration**.

This will display the Bluetooth Configuration dialog.

6. Select the **Local Services** tab and note the **COM Port** for the Bluetooth Serial Port service. You may have to scroll to the right to see the COM Port column of the table.

   This COM port is the serial communications port that the DBT-120 Bluetooth software has associated for connections that are established from a remote Bluetooth device. This COM port can be used to communicate with the eb500 from applications, such as HyperTerminal, when connections are established from remote Bluetooth devices to the PC.

7. Select the **Hardware** tab and note the **Device Address** shown in the Device Properties section of the dialog.

   The device address will be used in the BASIC Stamp application developed in later actions.

8. On the **Bluetooth Configuration** dialog, click **Cancel**.

   This will close the Bluetooth Configuration dialog.

9. Close the **My Bluetooth Places** window.

10. Open **HyperTerminal**.

    This will display the Connection Description dialog.

11. In the **Name** box, type the name of your connection. For example, EB500-USB-RX.

12. Click **OK**.

    This will display the Connect To dialog.

13. In the **Connect using** dropdown, select the **serial port** to which the DBT-120 Bluetooth software associated with the connection from the eb500 on the Board of Education board to the PC.

    This is the COM port that we previously noted as being the COM port that is used to communicate with the eb500 when connections are established from remote Bluetooth devices to the PC.

14. Click **OK**.

    This will display the Properties dialog.

15. In the **Bits per second** dropdown, select **9600**.

16. In the **Data bits** dropdown, select **8**.

17. In the **Parity** dropdown, select **None**.

18. In the **Stop bits** dropdown, select **1**.

19. In the **Flow control** dropdown, select **None**.

**20.** Click **OK**.

This will establish a connection with the DBT-120 Bluetooth USB Adapter software. This does NOT establish a connection with the remote Bluetooth device. The remote Bluetooth device establishes a connection with the DBT-120 Bluetooth USB Adapter software and applications, such as HyperTerminal, establish a connection to the DBT-120 Bluetooth USB Adapter software using the COM port that is used when connections are established from remote Bluetooth devices to the PC to gain access to the data being transmitted from the remote device.

**21.** On the **Call** menu, click **Disconnect**.

This will disconnect the connection just established, so that we can modify the connection properties in the following actions.

**22.** On the **File** menu, click **Properties**.

This will display the Properties dialog.

**23.** On the **Settings** tab, click **ASCII Setup**.

This will display the ASCII Setup dialog.

**24.** Check the **Send line ends with line feeds** checkbox.

**25.** Check the **Echo typed characters locally** checkbox.

**26.** Check the **Append line feeds to incoming line ends** checkbox.

**27.** Check the **Wrap lines that exceed terminal width** checkbox.

**28.** Click **OK**.

This will return to the Properties dialog.

**29.** Click **OK**.

**30.** On the **Call** menu, click **Call**.

This will establish a connection with the DBT-120 Bluetooth USB Adapter Software.

**31.** Using the BASIC Stamp Editor, on the **File** menu, click **New**.

This will create a new project window within the BASCIC Stamp Editor.

**32.** Enter the following **program code** into the editor, replacing the device Bluetooth address with the device address obtained from the Hardware tab of the Device Properties section of the Bluetooth Configuration dialog on the PC.

```
‘{$STAMP BS2}

nCount VAR BYTE

‘I/O Line 5 provides the connection status

INPUT 5
```

```
'Wait for the eb500 radio to be ready
PAUSE 1000
'Connect to the remote device
SEROUT 1,84,["con 00:80:C8:35:2C:B8",CR]
SERIN 0,84,[WAIT("ACK",CR)]
WaitForConnection:
      IF in5 = 0 THEN WaitForConnection
DEBUG "Connected",CR
FOR nCount = 1 to 10
      SEROUT 1,84,["Hello World",13]      'sending data
      PAUSE 1000                          'wait for 1 second
NEXT
'I/O Line 6 allows us to switch to command mode
OUTPUT 6
'Switch to Command Mode
LOW 6
SERIN 0,84,[WAIT(CR,">")]
'Disconnect from the remote device
SEROUT 1,84,["dis",CR]
SERIN 0,84,[WAIT(CR, ">")]
DEBUG "Disconnected",CR
```

The BASIC Stamp application establishes a connection with the remote eb500 device, waits for the connection to be established, then transmits "Hello World" ten times, switches back to command mode, and then disconnects from the remote device.

The first call to SEROUT is used when the eb500 is in command mode and instructs the eb500 to establish a connection with the device specified. Once a connection is established the eb500 is in data mode, which causes further calls to SEROUT to be sent to the remote device.

**33.** On the **File** menu, click **Save As**.

This will display the Save As dialog.

**34.** In the **File name** box, enter a file name to which to save the program just created. For example, HelloWorld.bs2.

**35.** Click **Save**.

**36.** On the **Run** menu, click **Run**.

This will display the Download Program dialog while downloading the program to the BASIC Stamp.  After the download is complete the BASIC Stamp application will transmit “Hello World” over the wireless link, and HyperTerminal will display the received data (Figure 11).

# Communicating between an iPAQ h1940 an a BOE

In this exercise we will step through the process of communicating between an iPAQ h1940, which has integrated Bluetooth, and an eb500 module inserted into a Board of Education board.

To perform this exercise, as documented, you will need an iPAQ h1940, a Board of Education board, and an eb500 module. If you are using a different model of Pocket PC, with integrated Bluetooth, or any of the other supported Parallax boards, you may need to make adjustments to this exercise.

## Step 1: Transmit Data from the iPAQ to the BASIC Stamp

In this step we will create a BASIC Stamp application to read data from the eb500 and display the data in the BASIC Stamp Editor Debug window. We will then download and run the application. The application for the iPAQ is too verbose to include in this manual; therefore, the application, along with the source code, is available on the accompanying CD in the Samples folder. To modify the Pocket PC application you will need eMbedded Visual C++ 4.0 with Service Pack 2 and the SDK for Windows Mobile™ 2003-based Pocket PCs.

1. Connect the **Board of Education board serial port** to the **PC**.
2. Open the **BASIC Stamp Editor**.
3. Enter the following **program code** into the editor.

```
'{$STAMP BS2}
szData VAR BYTE(20)
'Wait for the eb500 radio to be ready
PAUSE 1000
Main:
      SERIN 0,84,[STR szData\20\CR]
      DEBUG STR szData,CR
      GOTO Main
```

4. On the **File** menu, click **Save As**.
5. In the **File name** box, enter a file name to which to save the program just created. For example, ReceivePPC.bs2.
6. Click **Save**.
7. Apply **power** to the **Board of Education board**.

8. On the **Run** menu, click **Run**.

   This will display the Download Progress dialog while downloading the program to the BASIC Stamp. After the download is complete, the Debug Terminal #1 dialog will be shown.

9. On the iPAQ, tap the **Bluetooth icon** in the system tray on the Today screen and select **Bluetooth Settings**.

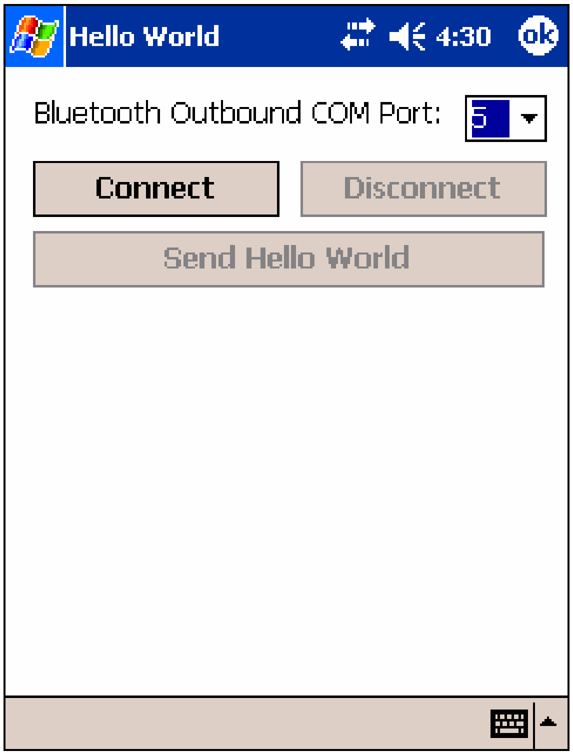
   This will display the Settings dialog.

10. Scroll to the right, tap the **Serial Port** tab and note the **Outbound COM port**.

    The Outbound COM port will be used in the iPAQ application later in this step.

11. Download the **Hello World** Pocket PC application to the **iPAQ**.

12. Run the **Hello World** Application (Figure 12).



Bluetooth Outbound COM Port: 5

**Figure 12: Hello World Pocket PC Application**

13. In the **Bluetooth Outbound COM Port** dropdown, select the **COM port number** that matches the Bluetooth Outbound COM Port, which we discovered in a previous action.

14. Tap the **Connect** button.

    This will display the Bluetooth Browser dialog (Figure 13).

15. Tap **eb500** in the Bluetooth Browser dialog to establish a connection with the eb500 on the Board of Education.

    If there are no devices shown in the Bluetooth Browser dialog, tap the refresh icon to search for your Bluetooth device.

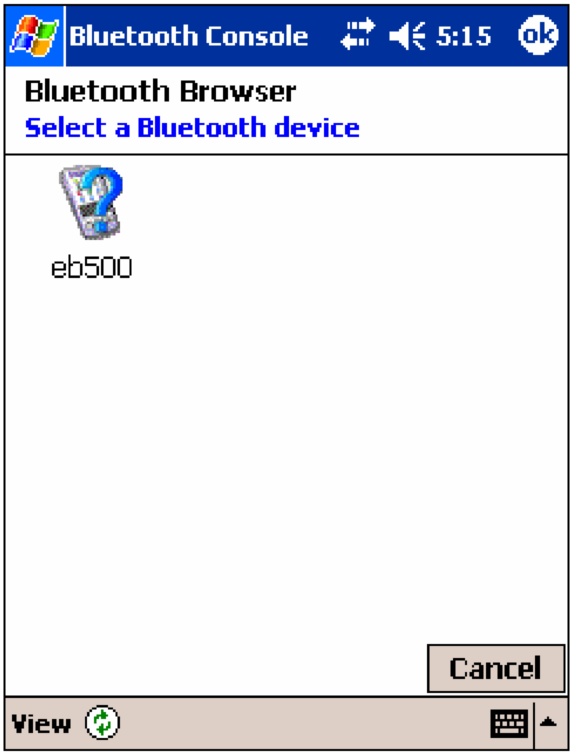


**Figure 13: iPAQ Bluetooth Brower Dialog**

16. Tap the **Send Hello World** button.

    This will transmit the ASCII text “Hello World” over the wireless link.  The BASIC Stamp application will then receive these characters and display them in the BASIC Stamp Editor Debug window.

17. Tap the **Disconnect** button to close the Bluetooth connection.

## Step 2: Transmit Data from the BASIC Stamp to the iPAQ

In this step we will create a BASIC Stamp application to send data out the eb500 to the iPAQ. We will then download and run the application. The application for the iPAQ is too verbose to include in this manual; therefore, the application, along with the source code, is available on the accompanying CD in the Samples folder. To modify the Pocket PC application you will need eMbedded Visual C++ 4.0 with Service Pack 2 and the SDK for Windows Mobile™ 2003-based Pocket PCs.

1. Using the BASIC Stamp Editor, on the **File** menu, click **New**.

   This will create a new project window within the BASIC Stamp Editor.

2. Enter the following **program code** into the editor, replacing the device address with the device address obtained from the iPAQ.

   ```
   ‘{$STAMP BS2}
   nCount VAR BYTE
   ‘I/O Line 5 provides the connection status
   INPUT 5
   ‘Wait for the eb500 radio to be ready
   PAUSE 1000
   ‘Connect to the remote device
   SEROUT 1,84,[“con 00:04:3E:62:FE:01”,CR]
   SERIN 0,84,[WAIT(“ACK”,CR)]
   WaitForConnection:
         IF in5 = 0 THEN WaitForConnection
   DEBUG “Connected”,CR
   FOR nCount = 1 to 10
         SEROUT 1,84,[“Hello World”,CR]      ‘sending data
         PAUSE 1000                          ‘wait for 1 second
   NEXT
   ‘I/O Line 6 allows us to switch to Command Mode
   OUTPUT 6
   ‘Switch to Command Mode
   LOW 6
   SERIN 0,84,[WAIT(CR,”>”)]
   ‘Disconnect from the remote device
   SEROUT 1,84,[“dis”,CR]
   SERIN 0,84,[WAIT(CR,”>”)]
   DEBUG “Disconnected”,CR
   ```

   The BASIC Stamp application establishes a connection with the iPAQ, transmits “Hello World” ten times, switches back to command mode, and then disconnects from the remote device.

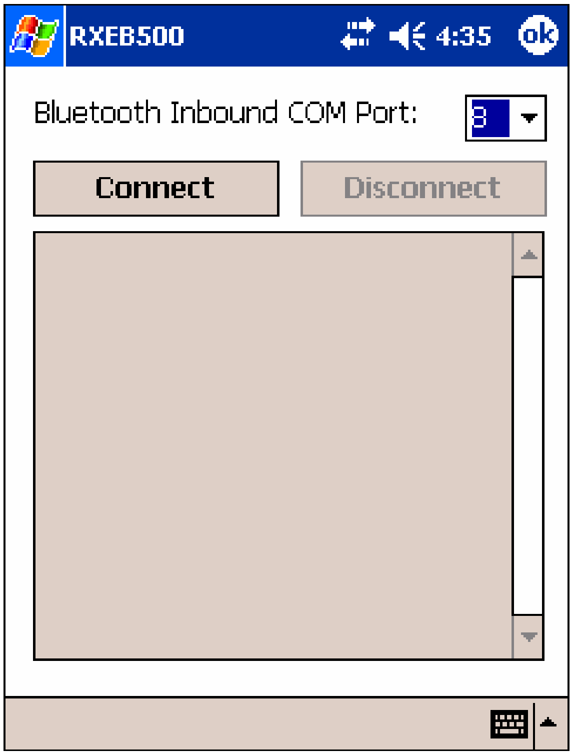
   The first call to SEROUT is used when the eb500 is in command mode and instructs the eb500 to establish a connection with the device specified. Once a connection is established the eb500 is in data mode, which causes further calls to SEROUT to be sent to the remote device.

3. On the **File** menu, click **Save As**.

4. In the **File name** box, enter a file name to which to save the program just created. For Example, HelloWorld.bs2.
5. Click **Save**.
6. On the iPAQ, tap the **Bluetooth icon** in the system tray on the Today screen and select **Bluetooth Settings**.

   This will display the Settings dialog.
7. Scroll to the right, tap the **Serial Port** tab and note the **Inbound COM port**.

   The Inbound COM port will be used in the iPAQ application later in this step.
8. Download the **RXEB500** Pocket PC application to the **iPAQ**.
9. Run the **RXEB500** Application (Figure 14).



Bluetooth Inbound COM Port: 8

**Figure 14: RXEB500 Pocket PC Application**

10. In the **Bluetooth Inbound COM Port** dropdown, select the **COM port number** that matches the Bluetooth Inbound COM Port, which we discovered in a previous action.
11. Tap the **Connect** button.
12. Apply **power** to the Board of Education board.

**13.** Using the BASIC Stamp Editor, on the **Run** menu, click **Run**.

This will display the Download Progress dialog while downloading the program to the BASIC Stamp. After the download is complete the BASIC Stamp application will establish a connection with the iPAQ. Depending on your current iPAQ Bluetooth configuration, the Authorization Request Dialog may appear (Figure 9). If this dialog appears, tap Accept to accept the connection. Once the connection is established, the BASIC Stamp application will transmit “Hello World” over the wireless link, and the iPAQ Pocket PC application will display the received data.

**14.** On the iPAQ, tap the **Disconnect** button to close the connection.

# eb500 Commands

The eb500 command set is comprised of visible ASCII characters. Therefore, a command can be issued from a terminal application, such as HyperTerminal, or directly from a custom application program, written in a programming language such as C++ or Visual Basic, running on a PC, using the eb600 PC Adapter. From a BASIC Stamp application, these commands can be issued by using the PBASIC™ SERIN and SEROUT commands.

## Command Basics

Commands may only be sent to the eb500 when the module is in Command Mode. White spaces are used to separate parameters of the command and a carriage-return is used to mark the end of the command. Upon receipt of a command the eb500 begins to parse the parameters. If the syntax of the command is correct the eb500 returns an ACK string, not the ACK character (0x06); otherwise, a NAK string is returned. Following the ACK or NAK string is a carriage-return (0x0D) character. If an error occurs while processing the command an error string is returned followed by a carriage-return followed by the prompt (>) character. If the command executed successfully the eb500 will issue the prompt (>) character. Please see the eb500 Error Codes section for a description of the error codes.

The following example shows the basic structure of a command. A prompt (>) is issued by the eb500. A command followed by a carriage-return is sent to the eb500. The eb500 responds with either an ACK or NAK string followed by a carriage-return. If an error occurs, the eb500 responds with an Err string followed by a space followed by an ASCII string numeric value followed by a carriage-return. A prompt (>) is then issued by the eb500.

```
>command<CR>

ACK | NAK<CR>

Err number<CR>

>
```

## BASIC Stamp Application eb500 Command Error Handling

The BASIC Stamp has a software based UART; meaning it does not buffer incoming serial data. Therefore, the checking of errors from the issuing of an eb500 command must be performed immediately after the issuing of the command; otherwise, the data may be lost. Below is a sample of BASIC Stamp code that issues an eb500 Connect command, waits for the ACK<CR> response from the eb500, then waits for the error string or the prompt (>) to be returned from the eb500. It then checks the first bye of the data returned to determine if an error has occurred. If an error has occurred, the code jumps to the error handler code, where an error string along with the error number is shown in the debug window of the Basic Stamp Editor.

```
          'Connect to remote Bluetooth device
          SEROUT 1,84,["con 00:0C:84:00:07:D8",CR]
          SERIN 0,84,[WAIT(“ACK”,CR)]
          ‘Either an Err #<CR> or a ">" will be received
          SERIN 0,84,[STR bBuffer\6\”>”]
          IF bBuffer(0) = “E” THEN ErrorCode
          … Progam Logic …
    ErrorCode:
          bErrorCode = bBuffer(4)
          DEBUG “Error: “,STR bErrorCode,CR
          END
```

# Connect

The *connect* command establishes a connection to another Bluetooth device. The *connect* command may be canceled before a connection is established by issuing a carriage-return to the eb500. The *connect* command may be canceled before the timeout is reached by issuing a carriage-return to the eb500. It can take up to four seconds to cancel the connection request.

Syntax

**con** *address* [*timeout*]<CR>

Parameters

*address* The Bluetooth address of the remote device. The Bluetooth device address is the 48-bit IEEE address which is unique for each Bluetooth unit. The format of a Bluetooth device address is a series of six hexadecimal byte values separated by colons, i.e., 00:0C:84:00:07:D7.

*timeout* An optional parameter used to abort the connection request after the specified number of seconds. The maximum value is 120 seconds.

Example

```
>con 00:0C:84:00:07:D7<CR>

ACK<CR>

>
```

# Disconnect

The *disconnect* command closes the connection with the remote Bluetooth device.

Syntax

**dis**<CR>

Example

```
>dis<CR>
ACK<CR>
>
```

# Get Address

The *get address* command returns the address of the local eb500 module.

Syntax

**get** addr<CR>

Returns

The unique address of the local eb500 module used to identify the module when making connections. In Bluetooth terminology this is the Bluetooth Device Address.

Example

```
>get addr<CR>

ACK<CR>

00:0C:84:00:07:D7<CR>

>
```

# Get Connectable Mode

The *get connectable mode* command returns the connectable mode setting of the local eb500 module.

Syntax

**get** con<CR>

Returns

The current connectable mode setting of the local eb500 module. In Bluetooth terminology, the returned value reflects the current setting for page scan.

on The eb500 will accept connections.

off The eb500 will NOT accept connections.

Example

```
>get con<CR>
ACK<CR>
on<CR>
>
```

# Get Discoverable Mode

The *get discoverable mode* command returns the discoverable mode setting of the local eb500 module.

Syntax

**get** dis<CR>

Returns

The current discoverable mode setting of the local eb500 module. In Bluetooth terminology, the returned value reflects the current setting for inquiry scan.

| | |
|---|---|
| on | The eb500 is visible to other devices. |
| off | The eb500 is NOT visible to other devices. |

Example

```
>get dis<CR>

ACK<CR>

on<CR>

>
```

## Get Escape Character

The *get escape character* command returns the current character used in the Switch to Command Mode command to instruct the eb500 to leave Data Mode and enter Command Mode.

Syntax

```
get escchar<CR>
```

Example

```
>get escchar<CR>
ACK<CR>
+<CR>
>
```

# Get Flow Control

The *get flow control* command returns the flow control setting of the local eb500 module.

Syntax

**get** flow<CR>

Returns

none — The eb500 is configured for no flow control and both the RTS and CTS lines are configured as high Z inputs. A BASIC Stamp application is free to use these lines as normal I/O without regard to the eb500.

hardware — The eb500 is configured for hardware flow control and the RTS line is used for receive flow control and the CTS line is used for transmit flow control.

Example

```
>get flow<CR>

ACK<CR>

none<CR>

>
```

# Get Link Timeout

The *get link timeout* command returns the amount of time it takes for the local eb500 module to notice that the connection has been broken, if the remote device disappears. This timeout also has an effect on how robust the communications link is to interference. If this value is set very low, the link may be lost if interference picks up for several seconds, such as when a heavy burst of 802.11 traffic is encountered.

Syntax

**get** linktimeout<CR>

Example

```
>get linktimeout<CR>

ACK<CR>

5<CR>

>
```

# Help

The *help* command returns a listing of the eb500 commands and a brief description of each command.

Syntax

**hlp** [*command*]<CR>

Parameters

*command* The eb500 command name (con, dis, get, lst, set and ver) for which to return help.

Examples

```
>hlp<CR>
ACK<CR>
… Help Information …
<CR>
>

>hlp con<CR>
ACK<CR>
… Help Information on the Connect Command …
<CR>
>
```

# List

The *list* command returns a listing of other Bluetooth devices that are in range and visible. The *list* command may be canceled before the timeout is reached by sending an additional carriage-return to the eb500.

Syntax

**lst** [*timeout*]<CR>

Parameters

*timeout* An optional parameter used to abort the list request after the specified number of seconds. The default value is 30. The maximum value is 120 seconds.

Returns

The addresses of the Bluetooth devices that are in range and visible.

Example

```
>lst<CR>

ACK<CR>

00:0C:84:00:07:D7<CR>

00:80:C8:35:2C:B8<CR>

>
```

# Return to Data Mode

The *return to data mode* command instructs the eb500 to enter Data Mode when there is an active connection.

Syntax

**ret**<CR>

Example

```
>ret<CR>

ACK<CR>

>
```

# Set Baud Rate

The *set baud rate* command sets the baud rate for communications with the local eb500 module.

Syntax

**set** baud rate [*]<CR>

Parameters

*rate* The baud rate value. Valid baud rates are 9600 (default), 19200, 38400, 57600, 115200, and 230400. Once the baud rate has been set, applications, such as HyperTerminal, must also be configured to the same baud rate to continue communicating with the eb500.

* An optional parameter used to persist the new setting when the module is powered down.

Example

```
>set baud 19200<CR>

ACK<CR>

>
```

# Set Connectable Mode

The *set connectable mode* command provides control over whether the local eb500 module will accept connections from other Bluetooth devices. In Bluetooth terminology, this command controls the setting for page scan.

Syntax

**set** con on | off [*]<CR>

Parameters

on Configures the eb500 so that other Bluetooth devices may establish a connection.

off Configures the eb500 so that other Bluetooth devices may not establish a connection.

* An optional parameter used to persist the new setting when the module is powered down.

Example

```
>set con off<CR>

ACK<CR>

>
```

# Set Discoverable Mode

The *set discoverable mode* command provides control over whether the local eb500 module is visible to other Bluetooth devices. In Bluetooth terminology, this command controls the setting for inquiry scan.

Syntax

**set** dis on | off [*]<CR>

Parameters

on Configures the eb500 so that other Bluetooth devices may detect the presence of this eb500.

off Configures the eb500 so that other Bluetooth devices may not detect the presence of this eb500.

* An optional parameter used to persist the new setting when the module is powered down.

Example

```
>set dis on<CR>

ACK<CR>

>
```

# Set Escape Character

The *set escape character* command provides control over the character used in the Switch to Command Mode command to instruct the eb500 to leave Data Mode and enter Command Mode. The factory default escape character is the plus sign (+).

Syntax

**set** escchar character [*]<CR>

Parameters

*character* The character the eb500 should recognize as the escape character used in the Switch to Command Mode command.

Example

```
>set escchar & *<CR>

ACK<CR>

>
```

# Set Flow Control

The *set flow control* command provides control over the flow control setting of the local eb500 module.

Syntax

**set** flow none | hardware [*] <CR>

Parameters

none — Configures the eb500 for no flow control and both the RTS and CTS lines are configured as high Z inputs. This allows a BASIC Stamp application to use these lines a normal I/O without regard to the eb500.

hardware — Configures the eb500 for hardware flow control. The RTS line is used for receive flow control and the CTS line is used for transmit flow control.

* — An optional parameter used to persist the new setting when the module is powered down.

Example

```
>set flow none<CR>

ACK<CR>

>
```

# Set Link Timeout

The *set link timeout* command sets the amount of time it takes for the local eb500 module to notice that the connection has been broken, if the remote device disappears. This timeout also has an effect on how robust the communications link is to interference. If this value is set very low, the link may be lost if interference picks up for several seconds, such as when a heavy burst of 802.11 traffic is encountered. In Bluetooth terminology, this command controls the setting for link supervisor timeout.

Syntax

**set** linktimeout timeout [*]<CR>

Parameters

*timeout* The time it takes for the eb500 to notice that a connection has been broken. The default value is 5. The maximum value is 40 seconds.

* An optional parameter used to persist the new setting when the module is powered down.

Example

```
>set linktimeout 10<CR>

ACK<CR>

>
```

# Switch to Command Mode

The *switch to command mode* command instructs the eb500 to enter Command Mode.

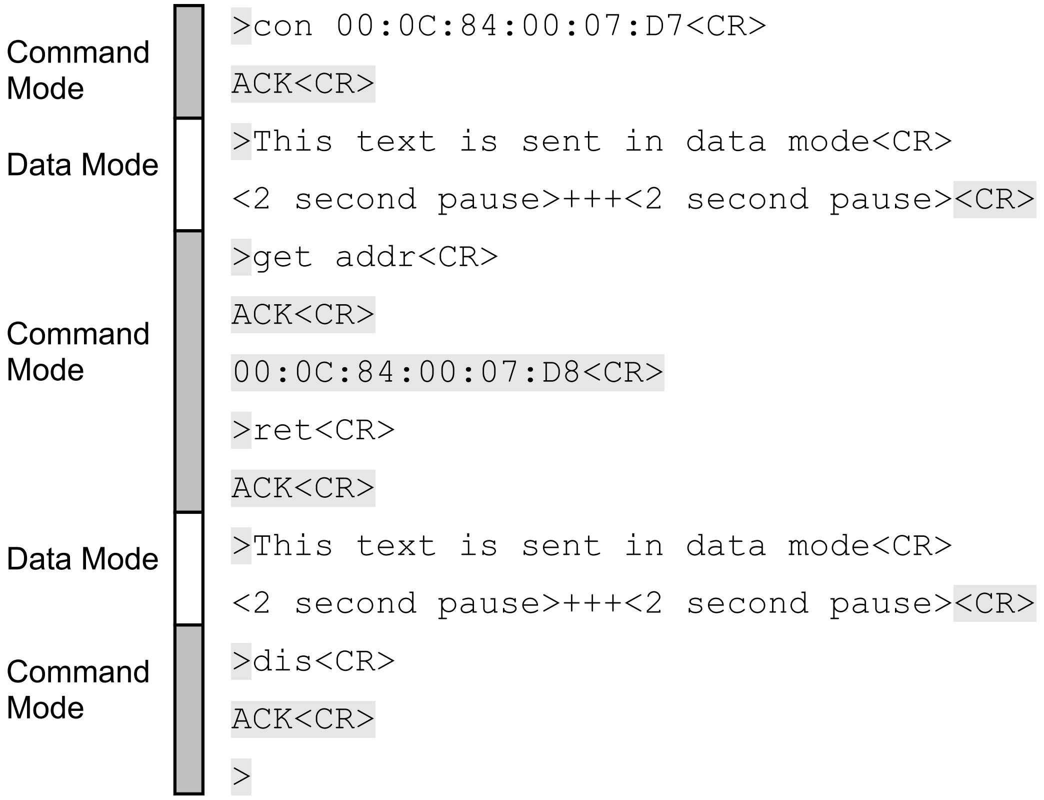
Syntax

<2 second pause>*esc sequence*<2 second pause>

Parameters

*esc sequence* Three consecutive instances of the escape character. The factory default escape character is the plus sign (+). A different escape character can be set in the eb500 by using the Set Escape Character command.

Example



```
>con 00:0C:84:00:07:D7<CR>
ACK<CR>
>This text is sent in data mode<CR>
<2 second pause>+++<2 second pause><CR>
>get addr<CR>
ACK<CR>
00:0C:84:00:07:D8<CR>
>ret<CR>
ACK<CR>
>This text is sent in data mode<CR>
<2 second pause>+++<2 second pause><CR>
>dis<CR>
ACK<CR>
>
```

# Version

The *version* command returns the current firmware version of the local eb500 module.

Syntax

**ver** [all] <CR>

Parameters

all

An optional parameter used to return the build number, model number, serial number, and manufacturer.

Example

```
>ver all<CR>
ACK<CR>
Firmware Version: 1.0<CR>
Firmware Build: 189<CR>
Model Number: eb500<CR>
Serial Number: 8<CR>
Manufacturer: A7 Engineering<CR>
>
```

# eb500 Error Codes

While using the eb500 you may encounter an error. Below is a listing of all eb500 error codes with a description of what causes the error to occur.

| Error Code | Description |
|---|---|
| 1 | General connection failure. This error occurs if the remote Bluetooth device is not configured properly. For example, this error may occur if the remove device requires Bluetooth security for a serial port connection. |
| 2 | Connection attempt failed. This error occurs when attempting to connect with an invalid Bluetooth address or a device that is not available. |
| 3 | Command not valid while active. This error occurs when there is an active connection and a command is issued that is not valid while connected with a remote device. |
| 4 | Command only valid while active. This error occurs when there is not an active connection and a command is issued that is only valid while connected with a remote device. |

**Table 1: eb500 Error Codes**

# Technical Specifications

## Operating Parameters

The operating parameters of the eb500 are shown below in Table 2.

| | |
|---|---|
| Transmit Power | 4dBm (max) class 2 operation |
| Open Field Range | More than 100 meters (328 feet) |
| Receiver Sensitivity | -85dBm |
| Operating Temperature | 0° to 70°C |
| Supply Power | 5 to 12VDC |
| Current Consumption | 115.2kbps data transfer: 35mA<br>38.4kbps data transfer: 30mA<br>9.6kbps data transfer: 25mA<br>connected and idle: 8mA<br>no connection: 3mA |
| Interfaces | 5V logic level UART or RS232 serial w/ optional eb600 adapter<br>Baud rate 9.6k – 230.4k<br>Flow control: RTS/CTS or none |
| Connector | 10x2 AppMod compatible 20 pin header with 0.1" spacing |
| Antenna | Matched internal surface mount |
| Bluetooth Support | Version 1.1 compliant with profiles L2CAP, RFCOMM, SDP, SPP |
| Firmware | Upgradeable with optional eb600 adapter |

**Table 2: eb500 Operating Parameters**

## Dimensions

The dimensions of the eb500 are shown below in Table 3. Please reference Figure 15 to locate the referenced dimension on the eb500.

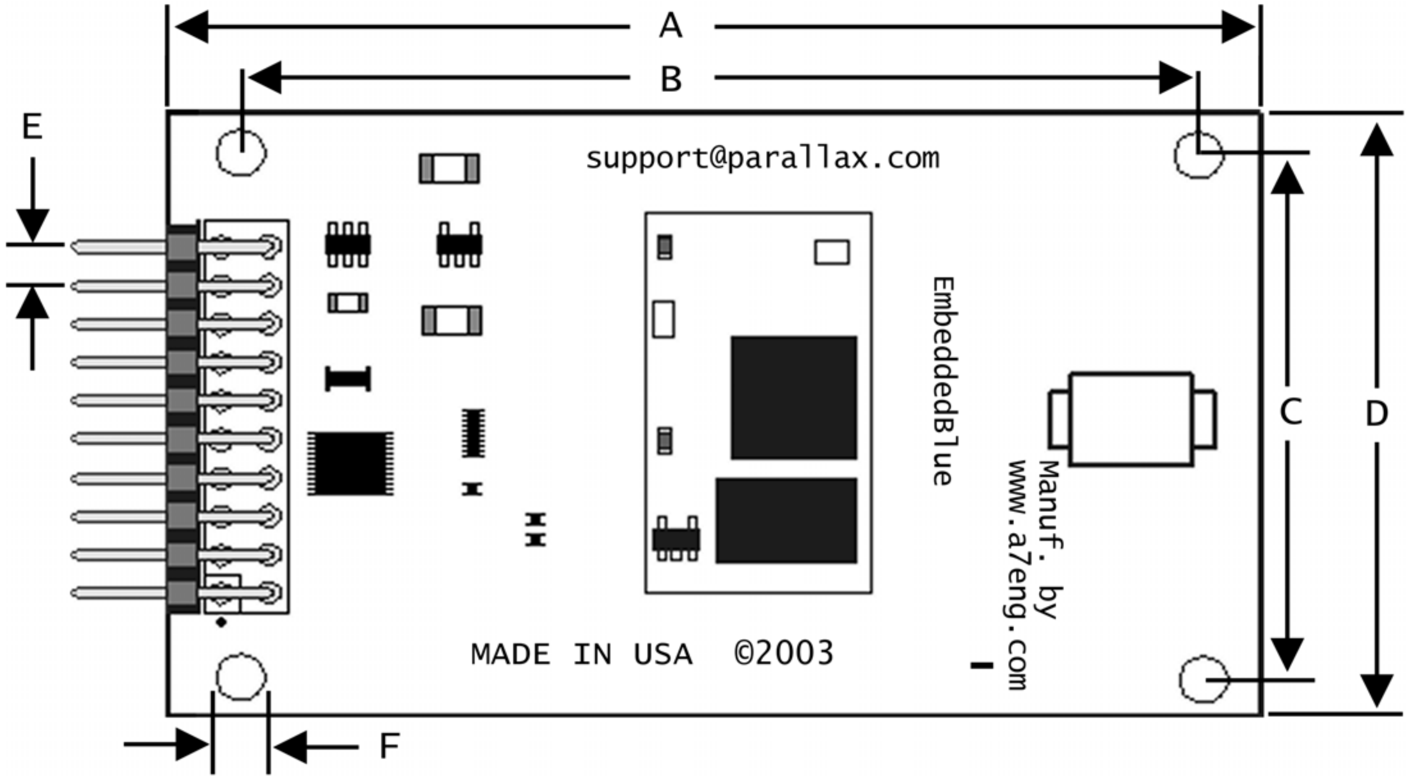


**Figure 15: eb500 Dimensions**

| Dimension | inches | mm |
|---|---|---|
| A | 2.7 | 68 |
| B | 2.4 | 61 |
| C | 1.3 | 33 |
| D | 1.6 | 40.2 |
| E | 0.1 | 2.5 |
| F | 0.125 | 3.2 |

**Table 3: eb500 Dimensions**

# Pinout Diagram

The eb500 module features a 20 pin header with 0.1” spacing for connection to the AppMod header. Currently, nine of the pins are in use (seven when flow control is set to none). The other pins are reserved for future use.

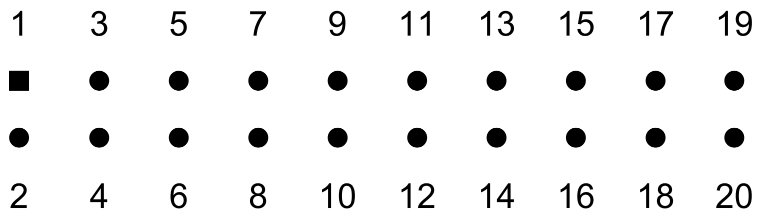


**Figure 16: eb500 Pinout Diagram**

| Pin Name | Pin | Type | Description |
|---|---|---|---|
| VSS | 1, 2 | GND | Ground |
| RX | 3 | TTL output | UART data output |
| TX | 4 | CMOS/TTL input | UART data input |
| RX Flow (RTS) | 5 | CMOS/TTL input, weak pull down | Signaled high to stop module data transmission |
| TX Flow (CTS) | 6 | TTL output | Signaled high to stop host data transmission |
|  | 7 | Reserved | Reserved for future use. |
| Connection Status | 8 | TTL output | High when there is an active wireless connection |
| Mode Control | 9 | CMOS/TTL input, weak pulled down | Low for command mode / High for data mode |
|  | 10 - 19 | Reserved | Reserved for future use. |
| VIN | 20 | VCC | Module supply, 5 to 12V DC |

**Table 4: eb500 Pinout Description**

# Frequently Asked Questions

**Question:** My robots appear to be operating normally, but why will my eb500 not connect?

**Answer:** Check the battery power to the robot. Although the motors may still run, the voltage from the batteries may have fallen well below 5V preventing the eb500 from operating normally.

**Question:** I changed the baud rate on my eb500 to 115200 and persisted the setting. I am unable to communicate at that speed from my BASIC Stamp. How can I reset the value to 9600 baud?

**Answer:** You can reset the eb500 module to its factory default settings by shorting Pin 8 and Pin 9 and applying power to the eb500 module. Alternatively, if you have an eb600 PC Adapter you can modify and persist a new setting using your PC, since the PC is capable of communicating at 115200 baud.

**Question:** How do I obtain eMbedded Visual C++ 4.0 to develop Pocket PC applications?

**Answer:** The eMbedded Visual C++ 4.0 development tool is available from Microsoft. In addition, you will need eMbedded Visual C++ 4.0 SP2 and the SDK for Windows Mobile™ 2003-based Pocket PCs. These tools can be downloaded free of charge from the Microsoft Windows Mobile web site: http://www.microsoft.com/windowsmobile.

**Question:** Why is my eb500 not displayed when I try to discover it from my PC or iPAQ?

**Answer:** Verify that the eb500 module is properly powered. Check the battery power to the robot. It is likely you will discover the eb500 on the first attempt; however, because Bluetooth discovery is not deterministic, discovery on the first attempt is not guaranteed. On the PC or iPAQ, use the refresh option to search for devices again. Verify that the discoverable mode setting in the eb500 is set to on.

**Question:** I can discover my eb500, but why am I unable to establish a connection?

**Answer:** Verify that the connectable mode setting in the eb500 is set to on.

**Question:** I have Bluetooth Authentication Security enabled on my iPAQ. Why am I unable to connect my iPAQ to the eb500 on my Board of Education board?

**Answer:** Currently, the eb500 does not support Bluetooth Authentication Security. However, you can achieve a measure of security for receiving connections on your iPAQ by enabling Bluetooth Authorization.

# Contact Information

Parallax provides technical support both through email, an online newsgroup, and by telephone. It is recommended that you use email as the first line of questioning because common questions can be answered quickly and in greater detail in this manner

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