

Communicating Between RobotBASIC and BasicStamp

To make RobotBASIC communicate with the BS2 we would need a serial communication medium and programs on the BS2 and PC to send data back and forth. The communication medium can be a direct wire or a wireless one.

The various setups for carrying out the project should be:

1. A PC connected to the BS2 to program it and debug it using the PBasic IDE. The connection to the BS2 can be either:
 - a. A serial port with the standard 9 pin connector on the PC and on the BS2 carrier board, such as the Education Board or the Professional Development Board.
 - b. A USB port connection on the PC side with drivers to set up a virtual comm. port and a converter on the BS2 side to connect to the BS2 carrier board's standard 9 pin connector.
 - c. A USB connection on both the PC and BS2 carrier board with the required drivers provided by Parallax Inc. The carrier board provided with the BoeBot kit has this setup. Also the Professional Development Board has this setup.

2. A PC with RobotBASIC running on it that will communicate with the BS2 via either:
 - a. A serial wire which can be either:
 - i. A USB connector on the PC side with virtual serial comm. port drivers. The other side has a converter to be able to connect to a pin on the BS2. Conversion might be required to allow for inverted voltage levels etc. This conversion is described in the BS2's manual, which can be downloaded as a PDF file from the www.Parallax.Com web site.
 - ii. A standard 9 pin serial port on the PC connected to the BS2 as described in option 2.a.i above.
 - b. A wireless serial connection which can be either:
 - i. A Bluetooth device that sets up a virtual comm. port on the PC which will connect with the EB500 Bluetooth transceiver connected to the BS2.
 - ii. A 940 MHz transceiver with a board to power it and to enable communication to a serial port on the PC, and a compatible transceiver connected to the BS2.

3. The PC in step 2 above can be the same as the PC in step 1 above. But the PC will need a second 9 pin serial port or USB port if you are not using option 2.b.i.

If you happen to own Parallax's Professional Development Board, your best option would be 2.a.ii (can be one PC). This board has a USB connector as well as a 9 pin serial connector for programming the BS2 and also it has a 9 pin connector which can be used to communicate with the onboard BS2 via any pin. Additionally this board has pushbuttons, dipswitches, LEDs and many other devices with which you can carry out

many experiments without the drudgery of wiring. Also there is a Piezo speaker that can be used for this project with ease. Furthermore, with this option you do not need to buy the Bluetooth devices for the BS2 and PC. Of course if you will be using this methodology to control a robot some time later you would still need to have some kind of wireless connection for more effective projects.

We will use Option 2.b.i with the two PCs being one PC. Also the Education Carrier board will be used for the BS2. The EB500 BT transceiver is available from Parallax Inc (WWW.Parallax.Com). This device communicates with any other BT transceiver and makes the data received available to the BS2 via a serial link. Also data from the BS2 can be sent via a serial link to the BT transceiver to be sent to any BT transceiver ready for receiving it.

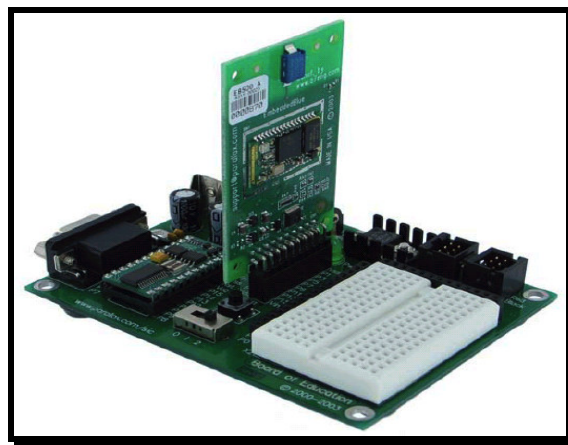


Figure 2: The Board Of Education carrier board with the EB500 connected.

The Education Carrier board accepts the EB500 as shown in Figure 2. The connector on the education board provides the necessary power connections and also connects the various pins on the EB500 to pins P0, P1, P2, P3, P5 and P6 on the BS2. P0 will be the receive pin and P1 will be the transmit pin. P2 and P3 will connect to the RTS and CTS hardware handshaking pins on the EB500, but will not be used in this project. Also P5 and P6 will connect to the Status and Mode pins on the EB500 and will not be used in this project. There is a warning in the EB500 manual that pin P5 on the BS2 must not be an output pin. So before you connect the EB500 to the BS2 make sure that you have programmed the BS2 previously ensuring that P5 is set up as an input. This can be achieved by programming the BS2 with nothing more than with the command END as a program. This makes sure that any previous programs in the BS2's memory are erased and that the BS2 is reset to all pins being inputs. We will develop programs on the BS2 later on.

The EB500 defaults to serial communications mode of 9600 Baud, 8 Data bits, no parity, 1 stop-bit and no flow control. This mode is very suitable for communicating with the BS2. You can change these settings; refer to the manual provided in PDF format on the Parallax site. Also the manual provides many configurations with which to connect to the BS2.

On the PC side we will use the D-Link BT120 USB connector (you can use any equivalent device you can obtain). This BT device connects to any available USB port and comes with software that enables the device to search and connect to any active BT device within range. Once you have established a connection to the EB500 on the BS2 the PC will have a virtual port that acts for all intents and purposes as if it were a real RS-232 port connected directly to the BS2.

By far the easiest procedure to establish communications is:

- I. Turn on the power to the carrier board with the BS2 and EB500 connected as shown in Figure 2.
- II. Go to the PC and start the Bluetooth Settings program. This can be done by double clicking on the Bluetooth icon in the system tray or through the Start menu.
- III. You only need to do this step one time only for the first time. Later you can use the icon that will be established to carry out the rest of the procedure skipping to step 4. (See the next section for more details on this and step by step pictures showing the procedure in action (Figures 2 to 11)).
 - a. Let the BT manager search for the EB500 using the “New Connection” button.
 - b. Once found accept all the options as provided.
 - c. You will need to establish trust by giving the Passkey (or PIN) “0000”. That is four zeros.
 - d. Note the virtual comm. port number assigned to this device. It may be 40 or 41. Accept the suggested default.
 - e. Continue the process accepting all defaults.
 - f. Finally you will be back to the original Bluetooth Settings Screen.
- IV. Double click on the EB500 icon to connect to the EB500. If you do not remember what port it is connected to, right click the mouse on the icon and choose the Detail menu option from the dropdown menu. This will open up a window that shows the comm. port number (see the next section for testing the connection using Hyper Terminal).

Procedure for setting up the PC and testing a connection from the PC to the Basic Stamp with a connected EB500 Bluetooth transceiver board

The required steps are:

- 1) Establish a link From the PC to the EB500 connected to a Basic Stamp.
- 2) Send data from the PC to the EB500.
- 3) Send Data from the Eb500 to the PC.

The requirement in most cases is to:

- 1) Connect the EB500 to any of the Basic Stamp Carrier Boards as described in the EB500 manual obtainable from www.Parallax.Com.
- 2) Switch on the power to the carrier board.
- 3) Establish a connection from the PC to the Eb500 (see Figures 2 to 11).

- 4) Run Hyper Terminal (Use Hyper Terminal for testing, this can be substituted with programs written in RobotBASIC or any other programming language that will do useful communications later) (see Figures 12 to 15).
- 5) Write a program to do communications (see Figure 1) in PBasic and download it to the Basic Stamp. This does not need to be done if the program has already been downloaded before, just use the reset button to start the program again.

Here is a sample PBasic program for step 5 above:

```
' {$STAMP BS2}
' {$PBASIC 2.5}

tt VAR Byte(4)
DEBUG "Outputting a string to PC",CR
SEROUT 1,84,[CR,"High there.... Please Enter 4 letters",CR]
DEBUG "Waiting for input from PC",CR
SERIN 0,84,[STR tt\4]
DEBUG "Got 4 characters from PC here they are...",STR tt\4,CR
SEROUT 1,84,[CR,"Thank you....Bye....",CR]
```

Figure 1: Program on the Basic Stamp to test the Eb500

Step 3 above is achieved through the Bluetooth manager program following this procedure:

- V. Go to the PC and start the Bluetooth Settings program. This can be done by double clicking on the Bluetooth icon in the system tray or through the Start menu (Figure 2).
- VI. You only need to do this step one time only for the first time. Later you can use the icon that will be established to carry out the rest of the procedure skipping to step III.
 - a. Let the BT manager search for the EB500 using the “New Connection” button (Figures 3 & 4).
 - b. Once found accept all the options as provided (Figure 5).
 - c. You will need to establish trust by giving the Passkey (or PIN) “0000”. That is four zeros (Figure 6).
 - d. Note the virtual comm. port number assigned to this device. It may be 40 or 41. Accept the suggested default (Figure 7).
 - e. Continue the process accepting all defaults (Figures 8 and 9).
 - f. Finally you will be back to the original Bluetooth Settings Screen. But now you have a new icon that allows for connecting to the EB500 without having to do all the above steps (a to b). See Figure 10.
- VII. Double click on the EB500 icon to connect to the EB500. If you do not remember what port it is connected to, right click the mouse on the icon and choose the **Detail** menu option from the dropdown menu. This will open up a window that shows the comm. port number (Figure 11).

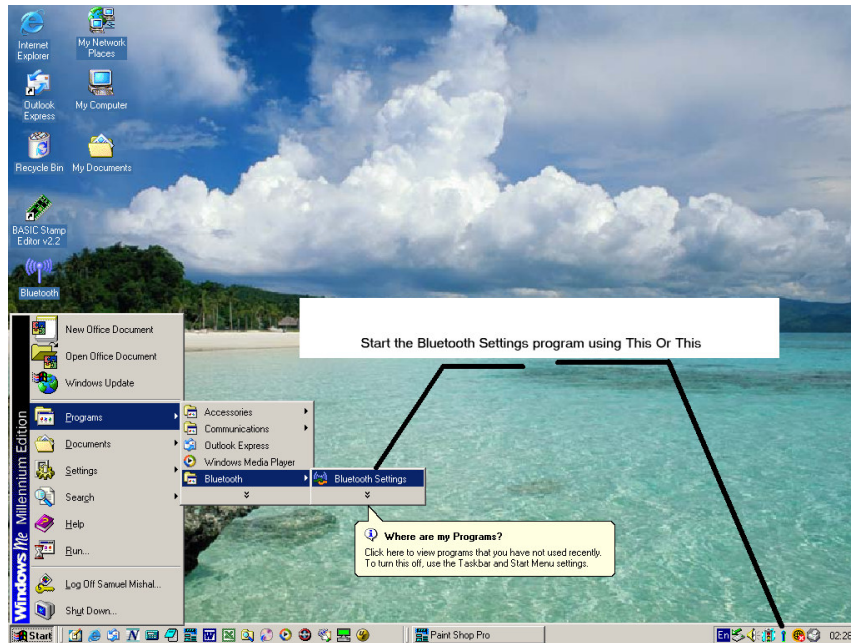


Figure 2



Figure 3

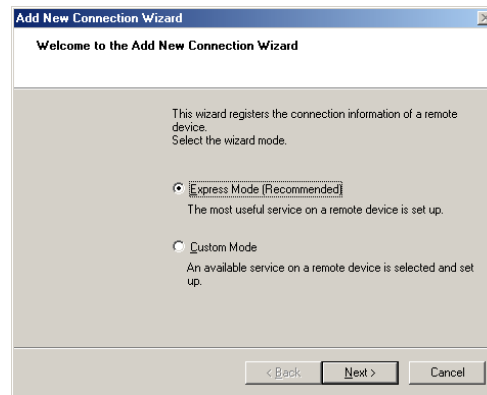


Figure 4

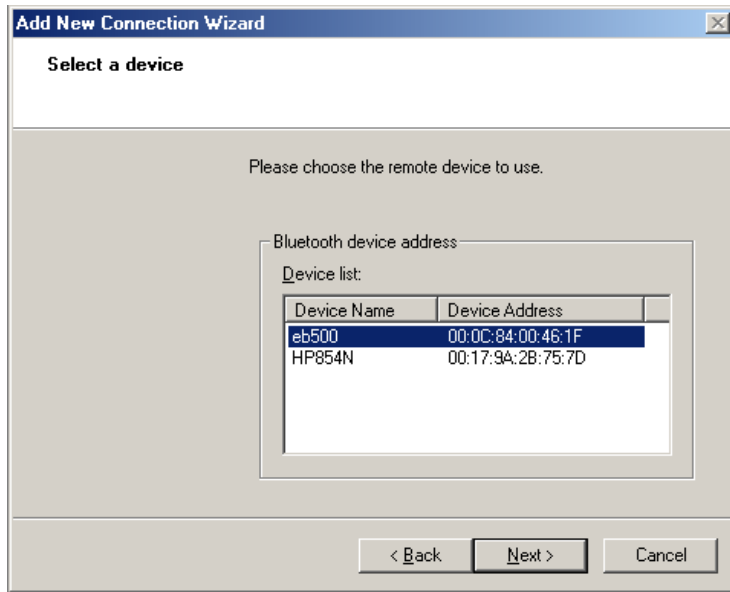


Figure 5

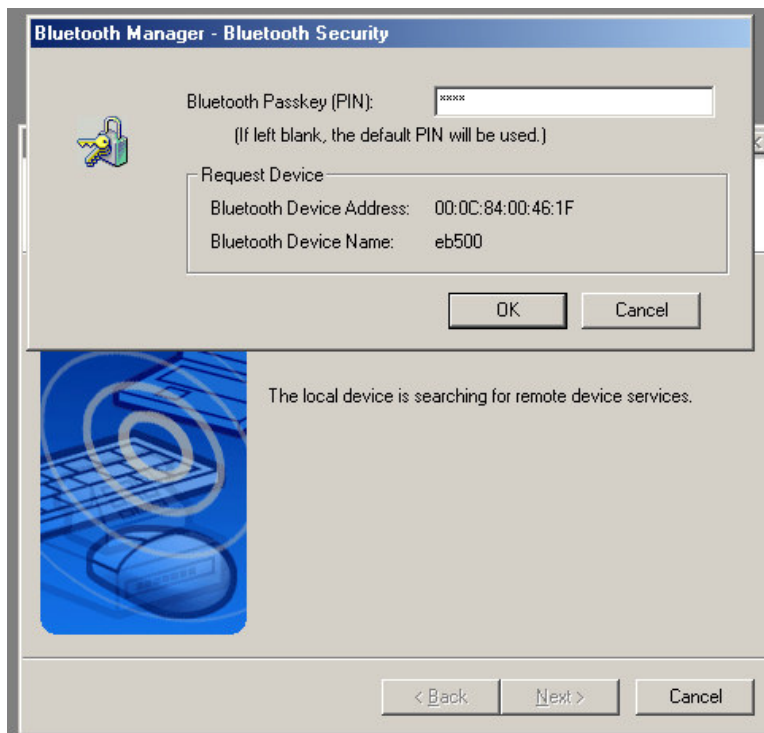


Figure 6

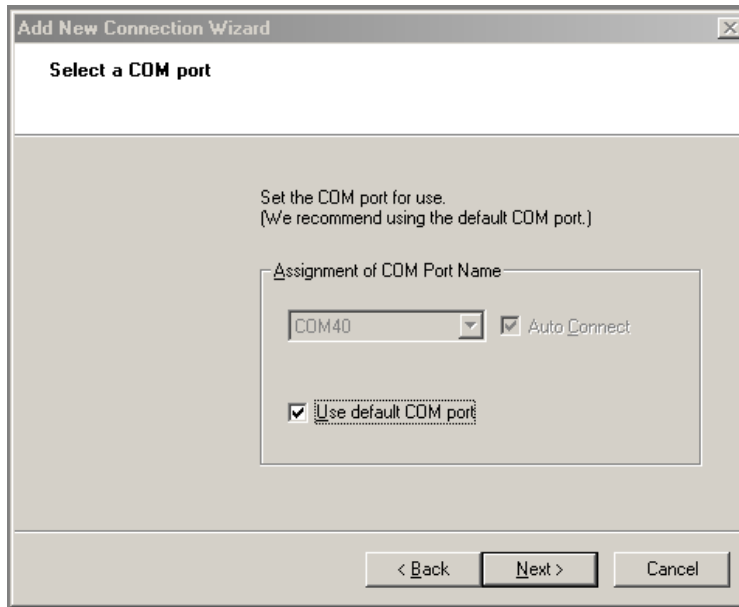


Figure 7

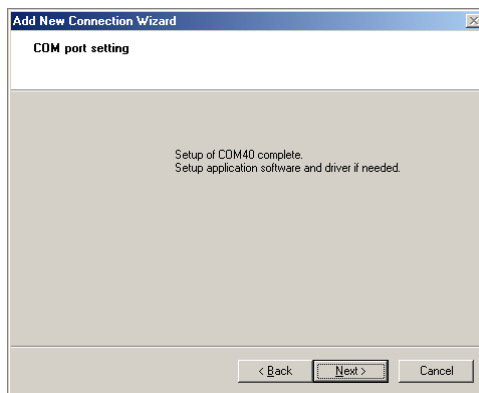


Figure 8

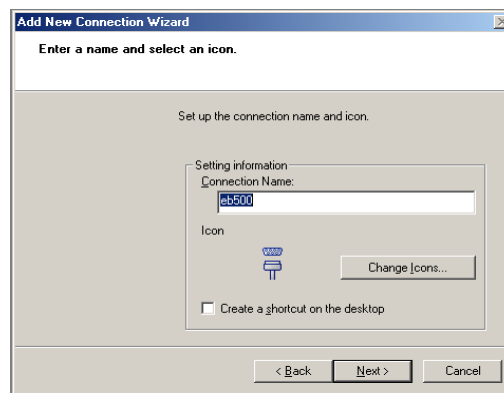


Figure 9

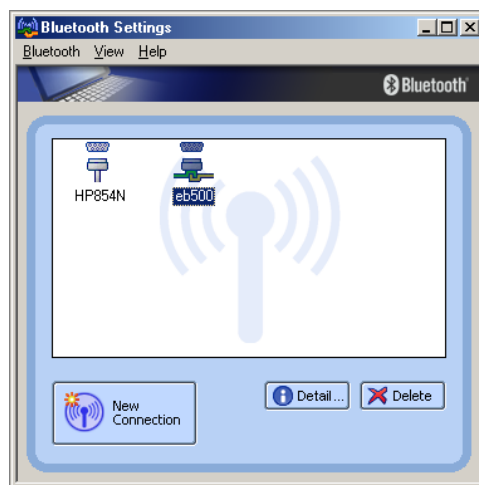


Figure 10

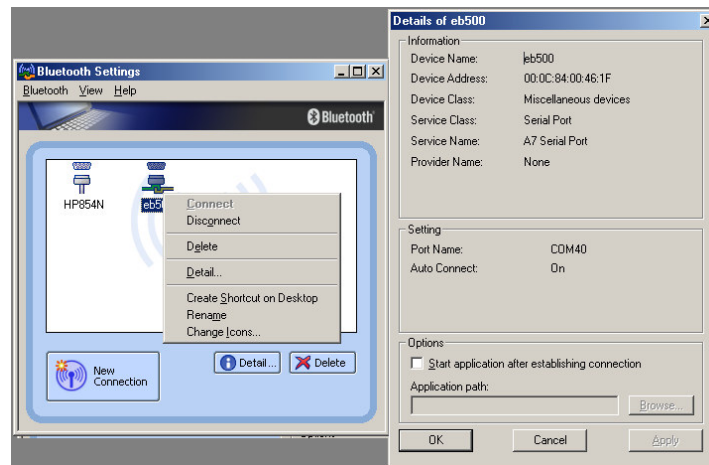


Figure 11

In step 4 above you can use the Hyper Terminal program that comes standard with all Windows systems to test the connection. However, to do any useful work such as controlling devices you may need to use a program written in a programming language such as RobotBASIC (or any other language). If you program the Basic stamp correctly you can still use the Hyper Terminal to communicate data back and forth with the Basic Stamp. See the program in Figure 1.

To use the Hyper Terminal you need to set it up to be able to use the comm. port that was established in the steps I to III above. Also you need to setup the comm. port parameters and also the ASCII communications parameters. The following steps show the procedure:

- I) Start the Hyper Terminal program from the Accessories menu in the Start menu.
- II) If this is not the first time and you have already created and saved a session file for the Eb500 skip to step VII.
- III) Create a name for the session (e.g. Eb500) and choose an icon (Figure 12)
- IV) Select the comm. port number to be used for the connection. This is the port number you have noted in Figures 11 and 7 above (see Figure 13).
- V) Set the parameters for the comm. port 9600,8,N,1,N (Figure 14).
- VI) You will need to set the ASCII parameters. From the File Menu choose the Properties sub menu and then the ASCII settings button from the dialog box and set the parameters as shown in Figure 15.
- VII) Now you can start the session by clicking the connect speed button or the connect menu option.

Now if you run the program in the Basic Stamp (push the reset button) you will see the communication going on and would be able to interact with the Stamp.

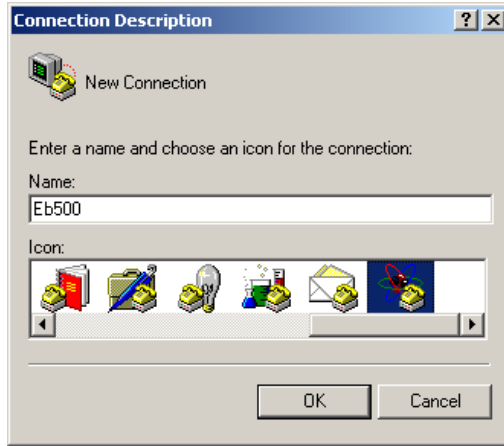


Figure 12



Figure 13

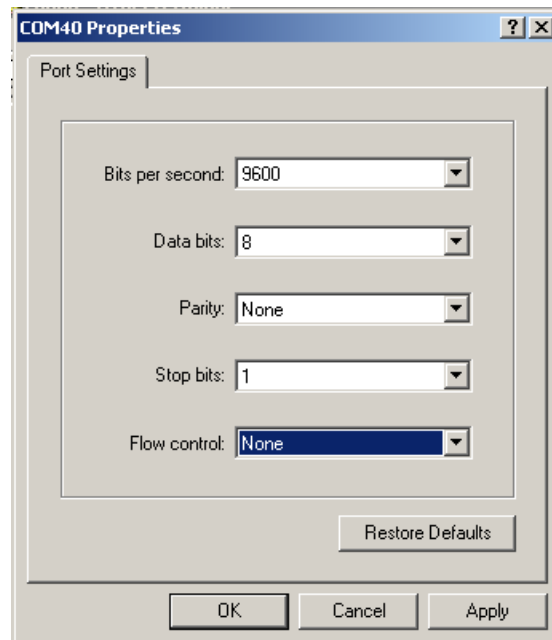


Figure 14

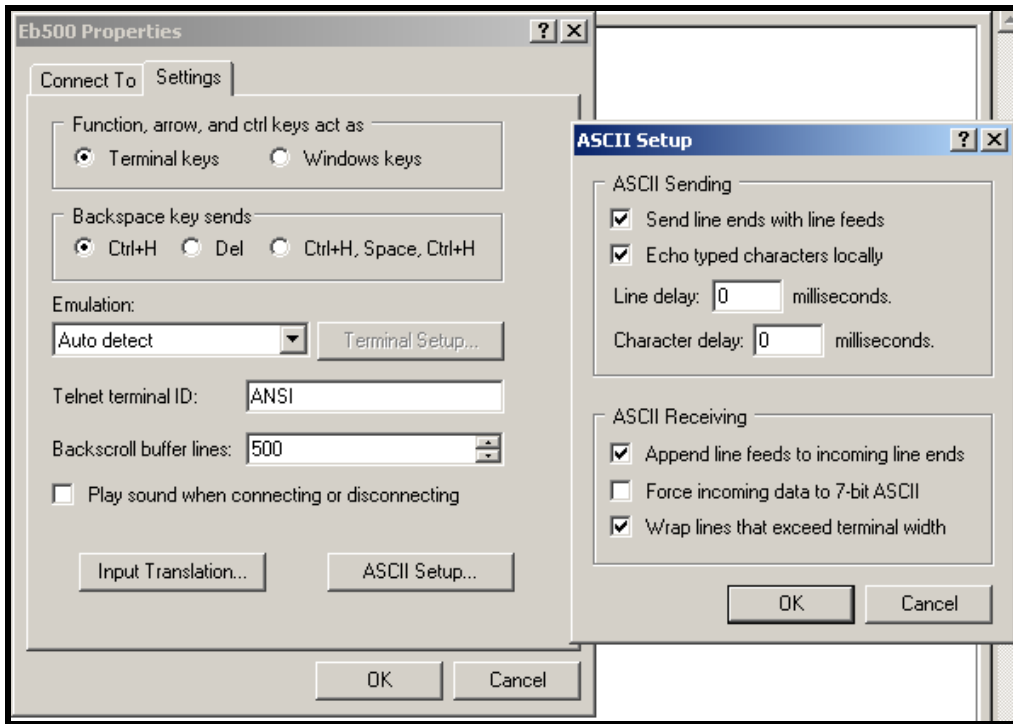


Figure 15