



SBL2eX Serial-to-Ethernet User's Manual

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Revision History

Revision	Date	Description
1.0	9/1/2010	Initial release

1. Overview

The NetBurner SBL2eX is a serial-to-Ethernet device that will enable communication on an Ethernet network using TCP or UDP.

- RS-232 serial port
- 10/100 Mbps Ethernet
- Serial-to-Ethernet capability through TCP or UDP
- DHCP and static IP addressing
- Custom data packetization options
- Web page configuration
- AT command set configuration and operation
- 5-24 Volts DC input power

DB9 Connector Pinout

Pin	Function	Alt. Func.	Description
1	U1CD		UART 1 Carrier Detect
2	U1 RX		UART 1 Receive
3	U1 TX		UART 1 Transmit
4	U1 DTR	U0TX	UART 1 Data Terminal Ready or UART 0 Transmit
5	GND		Ground
6	U1 DSR		UART 1 Data Set Ready
7	U1 RTS	U2 TX	UART 1 Request To Send or UART 2 Transmit
8	U1 CTS	U2 RX	UART 1 Clear To Send or UART 2 Receive
9	U1 RI	U0 RX	UART 1 Ring Indicator or UART 0 Receive

2. IPSetup Software Utility

Setup and configuration of your SBL2eX requires the "IPSetup" application tool available for download at www.netburner.com, in the "Support > Public Downloads" section:

http://www.netburner.com/support/public_downloads.html

3. Initial Configuration

Before using the SBL2eX, three areas of configuration are needed for the device: what type of serial interface will be used, the network IP address and port number, and the serial data baud rate.

1. Serial port hardware configuration
2. Network configuration
3. Operational configuration

3.1 Serial Port Hardware

The SBL2eX has one asynchronous UART serial port with an RS-232 level converter labeled as port 1, with RTS, CTS, DTR, DSR, RI, TX, RX, CD and GND pins.

Note: The SBL2eX is pre-programmed with the single port serial-to-Ethernet application. With a NetBurner SBL2eX development kit, the device can be configured to have up to three serial ports, although each serial port will only have RX and TX signals made available.

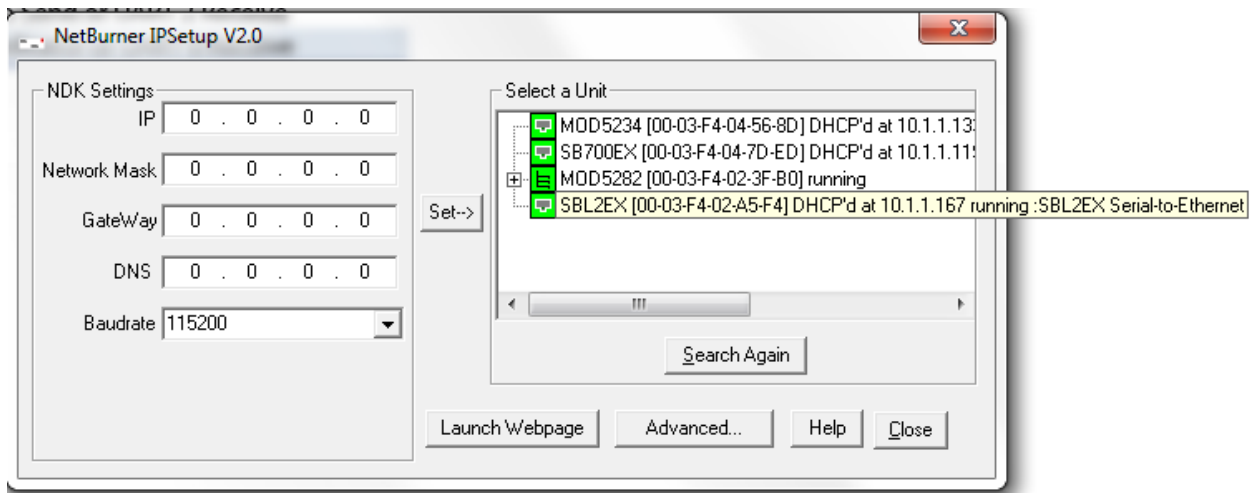
3.2 Network Configuration

1. Run the "IPSetup" tool by double-clicking its icon. This application is available for download on the NetBurner resource page at www.netburner.com/resources. To view the advanced settings, click on the "Advanced..." button (the button name will then change to "Basic <<").
2. Locate the SBL2eX in the "Select a Unit" pane by matching its MAC address. The MAC address is located on the bottom of your SBL2eX. If the device does not appear in the list box, verify that the power, speed, and link LEDs are illuminated, and click the "Search Again" button. If you are still unable to see the SBL2eX, remove power, correct any cabling errors, re-apply power, and click the "Search Again" button. Note: "IPSetup" uses a UDP broadcast protocol; it will not operate through a router.

Firewalls: "IPSetup" uses UDP and TCP port number 20034. If your computer's firewall is blocking this port number, then the firewall will need to be disabled, or add a rule to the firewall to allow communication on this port number.

3. If the network supports DHCP (factory default): the assigned IP Address will appear in the "Select a Unit" pane. Write down this address. If the network does not support DHCP, then configure the "IP" Address and "Network Mask" fields as shown in the screen shot below. If you need help selecting values, then please read the "Network IP Address Configuration" section near the end of this guide. After you have entered all of your values, click the "Set-->" button at the center of the "IPSetup" window to configure your SBL2eX with its new parameters. Note: If you do not click the "Set-->" button, then the new values will not be saved. If there are multiple NetBurner devices, then make sure the correct SBL2eX device is selected in the "Select a Unit" pane (as shown in the screen shot) before inputting and setting information.

A screenshot of "IPSetup" is shown below:



3.3 Operational Configuration

Once the network parameters are set, the web server interface or serial AT commands can be used to modify the settings of the SBL2eX device. Using the web interface first to become familiar with the operation of the SBL2eX is recommended. To access the web page, click on the "Launch Webpage" button in "IPSetup" or open a web browser and enter the numeric IP address of the device in the address bar (e.g., <http://10.1.1.110>).

4. Web Page Configuration

Once the IP address for the device is set, the SBL2eX web server becomes accessible to set the serial and network settings. The SBL2eX is configurable in one of three modes:

1. **TCP server:** Listen for incoming TCP connections.
2. **TCP client:** Connect to a target network address when serial data is available, or establish a network connection on SBL2eX power-up.
3. **UDP:** Send and receive using UDP packets.

4.1 Network IP Settings Configuration

The first section of the "Network" configuration page is used to select DHCP or static IP addressing. If there is a DHCP server on the network and DHCP mode is selected, then the DHCP-assigned values will be displayed. To select a static IP address, change the address mode to "Static" and enter the desired values manually in the "Static Settings" fields.



[Network](#) | [Serial](#) | [Password](#)

Network		
Device Name for DHCP:	<input type="text" value="SBL2EX-A5F4"/>	
Addressing Mode:	DHCP ▾	
IP Settings	Static Settings	DHCP Values
Device IP address:	<input type="text" value="0.0.0.0"/>	10.1.1.167
Device subnet mask:	<input type="text" value="0.0.0.0"/>	255.255.255.0
Device gateway:	<input type="text" value="0.0.0.0"/>	10.1.1.1
DNS server:	<input type="text" value="0.0.0.0"/>	66.75.160.15
Ethernet link:	Normal ▾	Power cycle required after changing

Device name	Specifies the device name to send to the DHCP server
Addressing mode	Select between DHCP and static IP address modes
Device IP address Device subnet mask Device gateway DNS server	If address mode is set to DHCP, then the DHCP server will provide these values and will be displayed in the "DHCP Values" column. If one wants to specify values manually, set the address mode to "Static" and enter the values in the appropriate fields. Note that if a gateway and DNS server are not specified, then communication outside the LAN is not possible
Ethernet link	Normal = Auto-negotiate. 10 or 100MB modes can also be forced

4.2 Incoming Connections (Server Mode)

This section describes how to configure the SBL2eX as a server device in which it listens for incoming TCP connections (or UDP packets if enabled) for each serial port.

<u>Incoming TCP Settings</u>		PORT 1
Listen for incoming network connections:	<input checked="" type="checkbox"/>	
Listening network port:	<input type="text" value="23"/>	
Timeout & disconnect after this many seconds of inactivity:	<input type="text" value="60"/>	
Allow new connection if existing connection has been idle for this many seconds:	<input type="text" value="30"/>	

Listen for incoming network connections	Select checkbox to enable the port to listen for incoming TCP connecting requests or UDP packets. Enabling this will also override the TCP client mode
Listening network port	The port number to listen on. The default port is 23 (Telnet port)
Timeout and disconnect after this many seconds of inactivity	Terminate TCP connection if no incoming network data or outgoing serial data has occurred. This is useful because there is no way to detect if a client has crashed or abnormally terminated unless unacknowledged data exists and times out. A value of '0' disables this feature. This field has no effect in UDP mode
Allow new connection if the existing connection has been idle for this many seconds	Similar to the disconnect timeout, but does not disconnect a connection until a new connection is requested. A value of '0' disables this feature. This field has no effect in UDP mode

4.3 Outgoing Connections (Client Mode)

<u>Outgoing TCP Settings</u>	
Make outgoing connections:	Never ▾
Connect on network port:	1000
Connect/send to this address:	(Enter IP address)
Timeout & disconnect after this many seconds of inactivity:	60
Retry failed outgoing connection after this many seconds:	10

Make outgoing connections	Selects between connecting on power-up for a permanent TCP connection, or making a TCP connection only when serial data becomes available. This feature has no effect on UDP
Connect on network port	Specifies destination TCP or UDP port number
Connect or send to this address	Specifies destination IP address for TCP or UDP. When using UDP, an address and port number must be specified in this section, or enable the "Learn UDP reply address" option in the "UDP Mode Settings" section
Timeout and disconnect after this many seconds of inactivity	Terminate TCP connection if no incoming network data or outgoing serial data has occurred. This is useful because there is no way to detect if a client has crashed or abnormally terminated unless unacknowledged data exists and times out. A value of '0' disables this feature. This feature has no effect on UDP
Retry failed outgoing connection after this many seconds	Number of seconds to wait before retrying an outgoing connection. This feature has no effect on UDP

4.4 UDP Mode Settings

Unlike TCP, UDP is a connectionless protocol. The SBL2eX provides two methods to determine the destination network IP address: you can either specify a static IP address, or use the source IP address of the last received UDP packet by selecting the "Learn UDP reply address" checkbox.



UDP Mode Settings

Use UDP instead of TCP:

Learn UDP reply address:

Use UDP instead of TCP	Check to enable UDP communication mode
Learn UDP reply address	Check to send outbound serial data to the source IP address that sent the last received UDP packet. This is useful for clients that may have changing IP addresses. If not using this feature, then the destination IP address and port number must be specified in the "Outgoing TCP Settings" section

4.5 Custom Packetization

Custom packetization can apply to TCP or UDP communication.

Custom Packetization

Enable custom packetization logic:

Number of characters to accumulate before sending TCP/UDP packet (128 max):

Number of milliseconds to wait for accumulated characters (0 waits forever):

Flush TCP/UDP frame when this character is received (enter "NA" to disable):

Use custom packetization logic	Enables/disables custom packetization settings
Number of characters to accumulate before sending TCP/UDP packet	Maximum number of characters to accumulate from the serial port before sending them out the network port. This setting is overridden if the accumulation delay time setting is used and expires
Number of milliseconds to wait for accumulated characters (0 waits forever)	Maximum wait time in milliseconds to receive serial characters before sending them out the network port
Flush TCP/UDP frame when this character is received (enter "NA" to disable)	Send all accumulated serial data out the network port upon receipt of this character from the serial port. Enter the decimal value of the character. For example, a line feed (LF) is 10

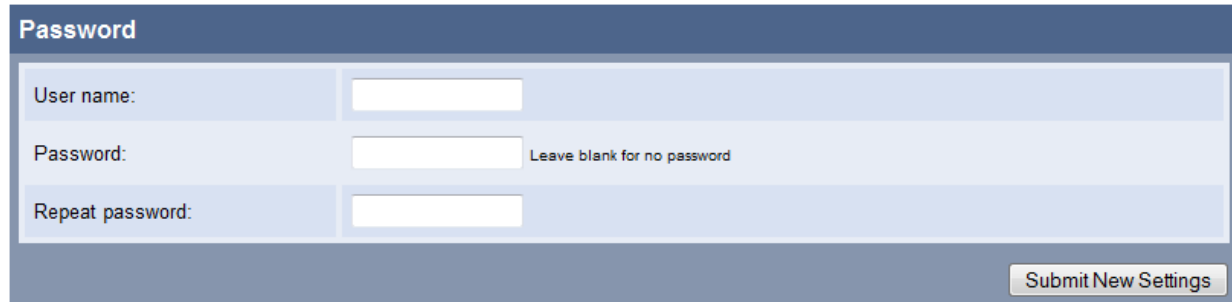
5. Serial Settings

Serial	
	PORT 1
Data port setting:	RS-232 ▾
Data baud rate:	115200 ▾
Custom baud rate:	0
Data bits:	8 ▾
Stop bits:	1 ▾
Parity mode:	None ▾
Flow control mode:	None ▾
DTR pin (4):	Asserted ▾
Allow AT commands:	<input checked="" type="checkbox"/>
AT attention command char:	43 (+)

Data port setting	Select communication mode for Port 1 (only RS-232 is available)
Data baud rate	Set serial baud rate
Custom baud rate	Used for non-standard baud rates by typing in the baud rate value as a decimal number, no commas. "Custom" must be selected in the "Data baud rate" field in order for the custom baud rate to apply.
Data bits	Number of data bits (5, 6, 7, or 8)
Stop bits	Number of stop bits (1 or 2)
Parity mode	Serial parity (odd, even, or none)
Flow control	Set to "None" for no flow control. For RS-232 mode, valid selections are XON/XOFF software flow control, RTS/CTS hardware flow control, and none.
DTR pin (4)	<ul style="list-style-type: none"> Asserted: always stays asserted/active, regardless of connection Not Asserted: always stays de-asserted, regardless of connection Asserted on valid network connection Debug RS-232 TX enable: configures pin to display debug messages
Allow AT commands	Enable/disable use of serial AT commands
AT attention command character	Specifies character to use to enter AT command mode. The default is the industry standard '+' character

6. Password Settings

Use the "Password" settings web page to enable, disable, or change an existing password. Only one password is allowed. To clear a password, leave the fields blank and click on submit.



Password	
User name:	<input type="text"/>
Password:	<input type="text"/> Leave blank for no password
Repeat password:	<input type="text"/>

Submit New Settings

7. AT Commands

As an alternative to the web page configuration, you can configure the SBL2eX over a serial port using an AT command format. The configuration sequence is:

1. Enter command mode
2. Send configuration change commands
3. Save changes and exit

7.1 *Enter and Exit Command Mode*

The AT configuration commands can only be processed when the SBL2eX is in "AT command mode".

To enter AT command mode:

1. Pause for one second (send no data).
2. Send "+++".
3. Wait for one second.
4. The device will respond with "\r\nOK>".

To exit AT command mode:

1. Wait 30 seconds for timeout; any changes will be lost.
2. Send "AT&X" or "ATO" to exit and discard any changes.
3. Send "AT&P" to exit and save new settings.
4. Send "AT&F" to reset all settings to factory default (does not save).

Returns:

- 1 – Returning to active connection
- 2 – Returning to listening connection
- 3 – Returning to active UDP mode
- 0 – Returning to idle

Exiting command mode with any changes will terminate all existing TCP connections.

7.2 *Command Syntax*

The format of an AT command is:

```
AT#<command>=<parameter>,<parameter>, ... <cr>
```

The format of an AT query is:

```
AT#<command>?<cr>
```

Syntax rules:

- All white space outside quotations are ignored.
- All commands and queries are terminated by a carriage return '<cr>' (decimal value 13). If a line feed '<lf>' follows a '<cr>', then it will be ignored.

7.3 System/Network Configuration

Example: AT#SYSIP=10.1.1.100<cr>

```
#SYS
  IP=<IP address>
  MK=<mask IP>
  GW=<gateway IP>
  DN=<DNS IP>
  DH=1                      // To enable DHCP, set IP to 0.0.0.0
  NB=<device name>

  UN=<string>
  PW=<string>

  GS=<enable/disable GPIO server>    // 0 = disable, 1 = enable
  GP=<GPIO server listening port>

#CUR // Get current active values
  IP?
  MK?
  GW?
  DN?
  ST? // Return port status for current port
  S1? // Return port status for port 1
```

Return values:

- Connected to IP X.X.X.X
- Listening on port XX
- UDP mode with learned send-to IP Address: X.X.X.X
- UDP mode send-to address: X.X.X.X
- Idle

7.4 Serial Port Configuration

Example: AT#SER1LN=0<cr>

```
#SERn                // Serial port number: n = 1
NP=<T|U|L>          // Network protocol: T = TCP, U = UDP, L = UDP learning
SM=<R|D|H|F>        // R = RS232, D = Debug, H = RS485 half, F = RS485 full duplex
LN=<0|1>             // 1 = listen for connection, 0 = don't listen
BR=<baud rate>
DB=<data bits>      // 5, 6, 7, or 8
PR=<N|O|E>          // None, odd, or even
ST=<stop bits>      // 1 or 2
FL=<N|S|H>          // None, software, or hardware flow control

SP=<listening network port number>
SD=<disconnect timeout in seconds>
SO=<override timeout in seconds>

CM=<N|P|R>          // Outgoing connection mode: never (listen mode only),
                    // on power-up, or upon received serial data

CI=<Destination IP name/address>
CP=<Destination port number>
CD=<Disconnect timeout in seconds>
CR=<Retry timeout in seconds>
```

7.4.1 Custom Packetization

The custom packetization settings provide control over when serial data is packetized and sent to the destination network host. You can configure the SBL2eX to send serial data after a certain number of characters have been received, a certain amount of time has expired, or upon receipt of a specific character.

Example: `AT#SER1LNPE=1<cr>` // Enable packetization options

<code>PE=<0 1></code>	0 = disable packetization, 1 = enable
<code>PN=<1-128></code>	Number of serial characters to accumulate before sending a packet
<code>PT=<0-32768></code>	Number of milliseconds since last character to wait before sending a packet; a value of 0 waits forever
<code>PC=<hex char></code>	Sends all accumulated serial data upon receipt of the specified ASCII character. The character value must be entered as a hexadecimal number

Return values:

A '?' at the end of the command will return the setting. For example, "AT#PE?<cr>" will return a value of 0 or 1.

7.5 AT Command Examples

The following examples display the full transcript of serial communication including commands sent and replies from the SBL2eX. The commands are marked in **red**, and responses are marked in **blue**.

7.5.1 Changing the System IP Address

This example first queries the current IP address, and then changes the current IP to "10.1.1.79". Once the IP address change request is made, the settings are saved, and the device reboots.

```
+++  
OK>AT#CURIP?10.1.1.99  
OK>AT#SYSIP=10.1.1.79  
OK>AT&PIP Address Changed Rebooting  
  
Waiting 2sec(s) to start 'A' to abort
```

7.5.2 Configuring the Serial Server Listen Port

This example first queries the current TCP serial server listening port number, and then changes the current port number to 30. Once the port number change request is made, the settings are saved. No system restart is required.

```
+++  
OK>AT#SEROSP?23  
OK>AT#SEROSP=30  
OK>AT&P2,Returning to listening connection
```

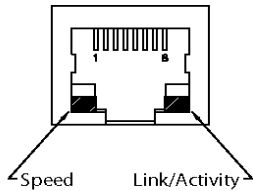
7.5.3 Configure Outgoing Network Client Connection

This example changes the client connection's IP and port. Once the changes are made, the settings are saved. No system restart is required.

```
+++  
OK>AT#SEROCI=10.1.1.78  
OK>AT#SEROCP=30  
OK>AT&P2,Returning to listening connection
```

LEDs

- Power LED: Illuminated while power is applied
- LED1 on RJ-45: Ethernet speed – 10 (off) or 100 (on) Mbps
- LED2 on RJ-45: Link and data activity



8. RS-232 NULL Modem Wiring

The following table and diagram shows how to create a null modem cable/adapter for RS-232 connections.

9. Network IP Address Configuration

If you are part of an existing network, and are not using DHCP, then you need to specify a static IP address and network mask. IP addresses are required to route packets from place to place on an Intranet/Internet. If you are on your own LAN, then some standard private address ranges can be used:

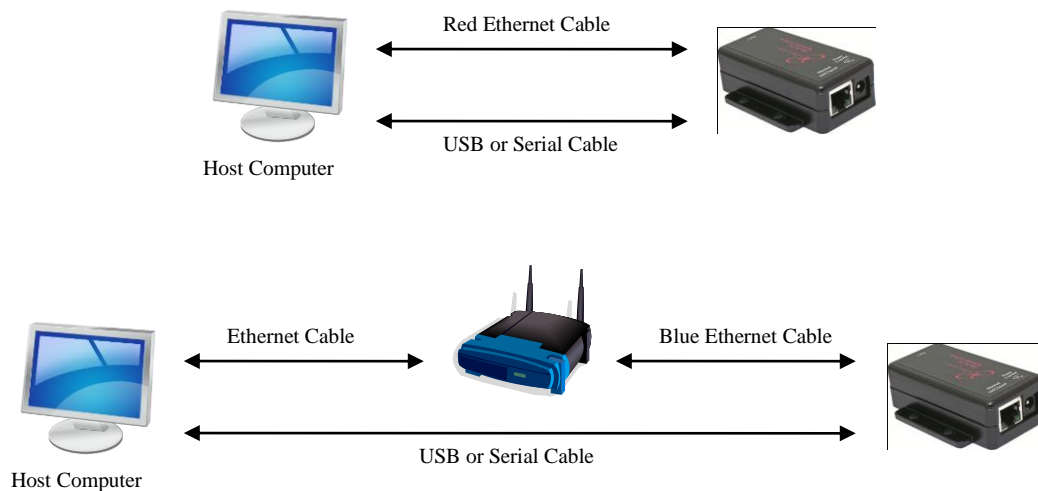
- Class A: 10.0.0.0 to 10.255.255.255
- Class B: 172.16.0.0 to 172.31.255.255
- Class C: 192.168.0.0 to 192.168.255.255

10. Web Browsers and Proxy Servers

If you are working on a corporate LAN that uses a proxy server for Internet web browsing, then you will need to exclude the IP address of your SBL2eX in your web browser's proxy server settings/preferences. Otherwise, an attempt to connect to a web page on the LAN will fail because the proxy server will attempt to route the request outside the LAN. For most web browsers, this can be accomplished in the advanced settings for the proxy server configuration. Set the network mask for your host computer's network adapter and your SBL2eX to "255.255.255.0".

11. Testing with a Telnet Connection

A quick way to test the functionality of your serial-to-Ethernet connection is with a Telnet application and a serial terminal application, such as the NetBurner MTTY program tool included on the CD-ROM. To run this test, configure your system as one of the two examples shown below. The red Ethernet cable is a cross-wired cable that can be used for a direct connection without the need for a network hub/switch. The blue Ethernet cable is a standard straight-through network cable that should be used if you have a network hub/switch.

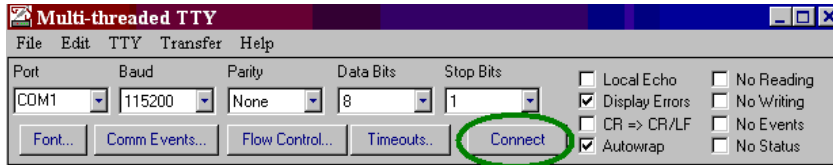


The objective of this example is to use a single host computer running Telnet and a serial terminal program to send data in either direction. When you type text in the Telnet window, it should appear in the serial terminal window and visa versa.

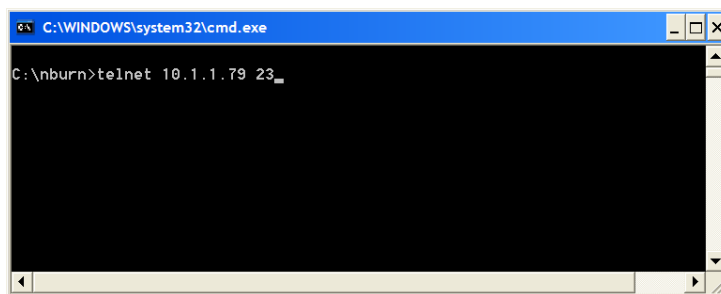
In the following example, an IP Address of "10.1.1.79" is used for the SBL2eX. Replace this IP address with the actual IP Address of your SBL2eX.

12. Telnet to Serial Test Procedure

1. Connect your hardware in one of the above configurations.
2. Open a command prompt window on your host computer.
3. Verify everything is connected correctly by executing the command "ping 10.1.1.79" and pressing the Enter key on your keyboard (remember to substitute your actual IP Address in place of "10.1.1.79").
4. Run either HyperTerminal or MTTY. Set the baud rate to the value you assigned to the SBL2eX during configuration (default is 115,200 bps). To use MTTY:
 - Run "MTTTY.exe" - you should then see the screen below. The port setting is the PC serial communication port of your host computer.
 - Click the MTTY "Connect" button.



5. In your command prompt window, run Telnet by typing: "telnet 10.1.1.79 23" after the prompt, and press the <Enter> key. The value "23" is the network port number of the SBL2eX that is listening for incoming connections. This example syntax uses the default value of 23 for SBL2eX serial port 1, which is the DB9 serial connection port. If you have modified the listening network port number in the SBL2eX web interface, then replace this port number with the listening port number that you assigned.



6. At this point, anything you type in the Telnet window should appear in the serial terminal window and vice versa.