SBL2eX Serial-to-Ethernet
User's Manual

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Revision History

Revision	Date	Description
1.0	9/1/2010	Initial release.
1.1	11/23/2010	Updated web page screen shots and accompanying content for the single/dual serial-to-Ethernet application; updated the AT command set options for the serial port configuration; updated the description of the LEDs
1.2	5/9/2014	Corrected error in AT command set: baud rate is BD, not BR.

1. Overview

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

- Two RS-232 serial ports
- 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

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	U0 TX	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

DB9 Connetor Pin-out

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 connector labeled "Port 1" with TX, RX, CTS, RTS, DTR, DSR, RI, and CD pins that pass through an RS-232 level converter and a ground pin.

Note: The SBL2eX is pre-programmed with a serial-to-Ethernet application that can be configured to use one serial port (UART 1) or two serial ports (UART 0 and 1). 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.
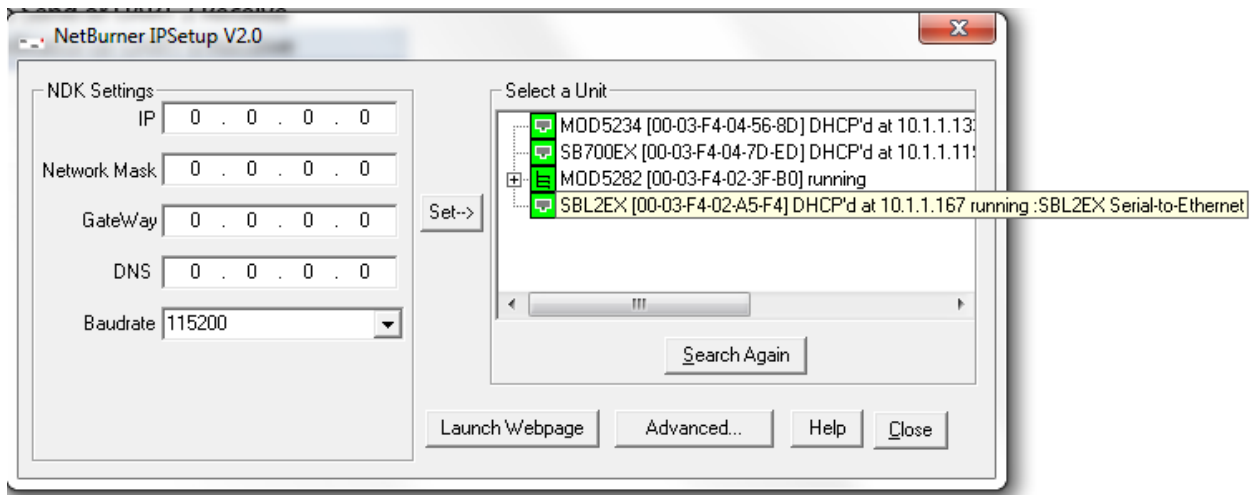

3.2 *Network Configuration*

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 speed and link LEDs are illuminated on the Ethernet jack, and then 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" and "Network Mask" address 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 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 (for example: 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 becomes available, or establish a network connection on 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.

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 100 Base-T modes can also be forced

4.2 Incoming Connections (Server Mode)

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

Incoming TCP Settings	PORT 0	PORT 1
Listen for incoming network connections:	☑	☑
Listening network port:	24	23
Timeout & disconnect after this many seconds of inactivity:	60	60
Allow new connection if existing connection has been idle for this many seconds:	30	30

Dual port mode shown above

Listen for incoming network connections	Check the box to enable the listening port to wait for incoming TCP connection requests or UDP packets. Note that checking the box will override the client mode
Listening network port	Listen for incoming connections on the given port. The default port is 23 (also the default Telnet port) on Port 1, and 24 on Port 0. The listening port numbers for Ports 0 and 1 must be different
Timeout and disconnect after this many seconds of inactivity	Terminate the connection if no incoming network data or outgoing serial data has passed for the number of given seconds since the last data pass. This is useful since 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	This is similar to the timeout-and-disconnect, but does not disconnect 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)*

Outgoing TCP Settings

Make outgoing connections:	Never ▼	Never ▼
Connect on network port:	1001	1000
Connect/send to this address:	(Enter IP address)	(Enter IP address)
Timeout & disconnect after this many seconds of inactivity:	60	60
Retry failed outgoing connection after this many seconds:	10	10

Dual port mode shown above

Make outgoing connections	Select between connecting on power-up for a permanent connection, or make a connection only when serial data becomes available. Port 1 includes the option of when the DSR pin becomes asserted. This feature has no effect on UDP
Connect on network port	Specify the destination TCP or UDP port number
Connect/send to this address	Specify the 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	Wait a number of seconds before retrying a failed 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" check box.

UDP Mode Settings

Use UDP instead of TCP:	☐
Learn UDP reply address:	☐

Single port mode shown above

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):	50
Number of milliseconds to wait for accumulated characters (0 waits forever):	100
Flush TCP/UDP frame when this character is received (enter "NA" to disable):	NA

Single port mode shown above

Use custom packetization logic	Enable or disable custom packetization settings
Number of characters to accumulate before sending TCP/UDP packet	This is the number of incoming characters to accumulate from the serial port before sending them out through the network port. This setting is overridden if the accumulation wait time setting is used and expires (next option below)
Number of milliseconds to wait for accumulated characters (0 waits forever)	This is the maximum time in milliseconds to wait for received serial characters before sending the accumulated data, if any, out the network port
Flush TCP/UDP frame when this character is received (enter "NA" to disable)	Send all accumulated serial data upon receipt of the given character from the serial port. Enter the decimal value of the character to be recognized. For example, the decimal representation for the "LF" (line feed) character is 10

5. Serial Settings

Data port setting	Select the serial communication mode. Port 0 supports RS-232, debug, or disabled (default); Port 1 supports only RS-232
Data baud rate	Set the serial baud rate in bits per second
Custom baud rate	Use for non-standard baud rates by typing in the baud rate value as a decimal number (in bits per second). "Custom" must be selected in the "Data baud rate" field in order for this custom baud rate to take effect
Data bits	Number of data bits (5, 6, 7, or 8)
Stop bits	Number of stop bits (1 or 2)
Parity mode	Set the serial parity (odd, even, or none)
Flow control mode	Set to "None" for no flow control. Flow control is valid only for RS-232 mode, where both serial ports support XON/XOFF software flow control, but only Port 1 supports RTS/CTS hardware flow control
DTR pin 4	• Asserted: always stays asserted/active, regardless of connection • Not asserted: always stays de-asserted, regardless of connection • Asserted only when a valid network connection is established
Allow AT commands	Enable/disable the use of serial AT commands
AT attention command character	Specifies the decimal representation of the character to use enter AT command mode. The default is the industry standard '+' character (its decimal value is 43)

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:		
Password:		Leave blank for no password
Repeat password:		
		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                    // n = 0 (Serial Port 0), or n = 1 (Serial Port 1)

    NP=<T|U|L>           // Network protocol:  T = TCP, U = UDP, L = UDP learning

    SM=<R|D|O>           // Serial mode:  R = RS-232, D = Debug, O = Disabled/Off
                         //    (Note:  Options 'D' and 'O' are only available on Port 0)

    LN=<0|1>             // Listening port:  0 = Don't listen, 1 = Listen

    BD=<Baud rate>       // Serial baud rate value in bits per second (e.g., "115200" for
                         //    115,200 bps)

    DB=<data bits>       // Data bits:  5, 6, 7, 8
    ST=<stop bits>       // Stop bits:  1, 2
    PR=<N|O|E>           // Parity mode:  N = None, O = Odd, E = Even
    FL=<N|S|H>           // Flow control:  N = None, S = Software, H = Hardware
                         //    (Note:  Option 'H' is only available on Port 1)

    SP=<Listening network port number>
    SD=<Disconnect time-out in seconds>
    SO=<Override time-out in seconds>

    CM=<N|P|R|D>         // When to make outgoing connections:  N = Never (listen mode
                         //    only), P = On power-up, R = Upon received serial data, D = When
                         //    the DSR pin is asserted
                         //    (Note:  Option 'D' is only available on Port 1)

    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 on when serial data is converted into TCP/UDP packets and then sent to the destination network host. You can configure the SBL2eX to send serial data after a certain number of characters have been received, after a certain amount of time has expired, or upon receipt of a specific character.

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

`PE=<0|1>`   0 = disable packetization, 1 = enable

`PN=<1-128>`   Number of serial characters to accumulate before sending a packet.

`PT=<0-32768>`   Number of milliseconds to wait since last character before sending a packet. A value of '0' waits forever.

`PC=<hex char>`   Sends all accumulated serial data upon receipt of a 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 current 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 of commands sent and replies received to and from the SBL2eX. 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#SER0SP?24
OK>AT#SER0SP=30
OK>AT&P2,Returning to listening connection
```

7.5.3   Configure Outgoing Network Client Connection

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

```
+++
OK>AT#SER0CI=10.1.1.78
OK>AT#SER0CP=30
OK>AT&P2,Returning to listening connection
```

8. LEDs

- Ethernet speed LED on RJ-45: 10 Mbps (off) or 100 Mbps (on) – shown as the left LED from the oriented image shown below.
- Link/activity LED on RJ-45: Lights up to indicate link established; blinks to indicate traffic activity – shown as the right LED from the oriented image shown below.

Speed   Link/Activity
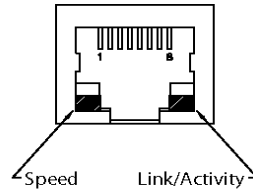
9. RS-232 NULL Modem Wiring

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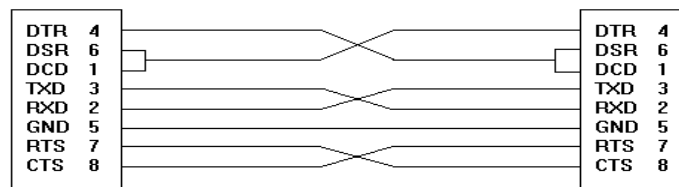
10. Network IP Address Configuration

If you are part of a network that does not have a DHCP server present, then you will need to specify a static IP and network mask address. IP addresses are required to route packets from one point to another on an Intranet or Internet. If you are on your own local area network (LAN), then you can use some standard private address ranges:

    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

11. 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 the SBL2eX in your web browser's proxy server settings or 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".

12. Testing with a Telnet Connection

A quick way to test the functionality of your serial-to-Ethernet connection is with the Telnet application made available in the Windows operating system and a serial terminal program, such as the NetBurner MTTTY terminal application 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 of a network hub or switch. The blue Ethernet cable is a standard straight-through Ethernet cable that should be used if you have a network hub or switch.
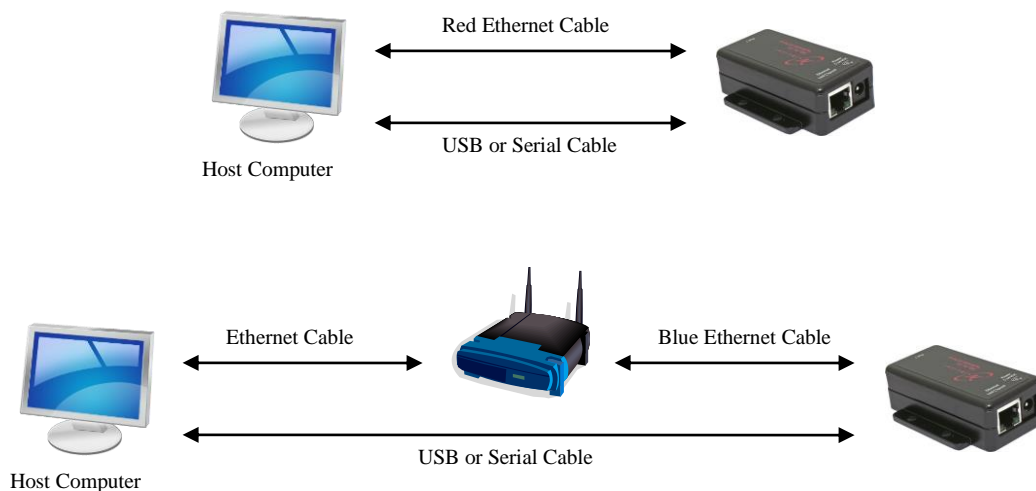

The objective of this example is to use a single host computer running Telnet and a serial terminal program to send data in either direction. When you type text in the Telnet window, it should appear in the serial terminal window and vice versa.

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

13. 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 then press the <Enter> key on your keyboard (remember to substitute your actual IP address).

4. Run either HyperTerminal or MTTTY. Set the baud rate to the value you assigned to the SBL2eX during configuration (default is 115,200 bps). To use MTTTY:

   - Run "MTTTY.exe" – you should see the screen below. The port setting is the PC serial communication port of your host computer.
   - Click the MTTTY "Connect" button.
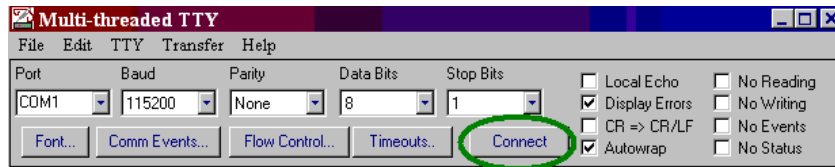
5. In your command prompt window, run Telnet by typing: "telnet 10.1.1.79 23" after the prompt, and press the <Enter> key. The value "23" is the network port number of the SBL2eX that is listening for incoming connections. This example syntax uses the default value of 23 for SBL2eX serial port 1, which 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.
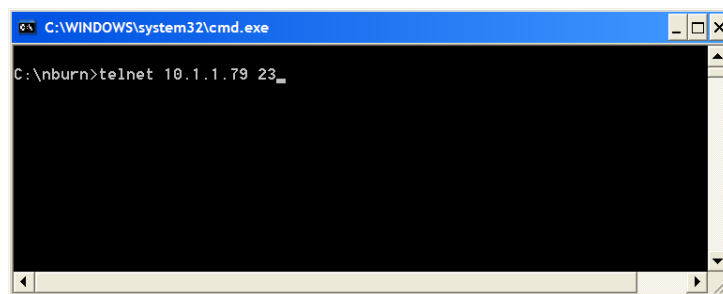
6. At this point, anything you type in the Telnet window should appear in the serial terminal window and vice versa.