Secure Serial-to-Ethernet Factory Application User's Manual

Supported Platforms:
CB34EX
NANO54415
PK70EX-232
PK70EX-485
PK70EX-MMS
SB70LC
SB700EX
SB800EX

Table of Contents

1. Overview

Your NetBurner device comes pre-programmed and ready to run with a Serial to Ethernet application supporting many features:

- Data transfers using TCP, UDP, SSH and SSL/TLS.
- Three methods of device configuration:
  1. The device's web server interface (HTTP or HTTPS).
  2. Through a serial port using an AT command set.
  3. PC utilities such as IPSetup.
- Server and client certificate management for HTTPS and SSL/TLS data connections.
- DHCP and static IP addressing.
- Two to five serial ports (device dependent).
- Support for the NetBurner virtual comm port driver (Windows only).
- SB70LC platform: support for Ethernet to I2C.
- SB800EX platform: Wifi option.

The NetBurner Network Development Kit (NNDK) enables you to create your own applications, or simply modify the Serial to Ethernet factory application. Using the NNDK you can program your NetBurner device to operate in any way you wish. It is essentially an embedded network computing platform that can do much more than Serial to Ethernet.

NNDK Features

- Provides everything you need to create network applications: RTOS, TCP/IP Stack, full featured security libraries, Eclipse-based development environment (command line capability as well), compiler, linker, debugger, and example applications.
- Access to peripherals such as: I2C, SPI, GPIO, timers and interrupts. For a complete list of peripherals available to each platform, please see their respective datasheets.

The remainder of this document will describe how to use your device with the factory Serial to Ethernet application.

2. Initial Configuration

Once you connect your device to your network, use the IPSetup utility to determine its IP address information. You can set IP values with IPSetup, or access the device's configuration web page. The web interface is the easiest way to configure serial port values.

Your device may have hardware jumpers to configure the serial port transceivers to RS-232, RS-485 half duplex, RS-485 full duplex or CAN bus. Please refer to your quick start guide to set them.

Important: If your device does have hardware jumpers, they must correspond to what is set in the Serial to Ethernet application.

All devices have the ability to assign a serial “debug port”. This port provides status information on the state of the serial and network connections. Only 1 serial port can be designated as a debug port.

The remainder of this section will describe specific device configuration.

2.1.1 CB34EX Device Platform

The CB34X supports 2 serial ports: one DB9 and one 5 pin terminal strip. Each can be configured with hardware jumpers for RS-232, RS-485 half or full duplex or CAN bus. Please refer to the quick start guide on the CB34EX product page for more details.

2.1.2 NANO54415 Device Platform

The NANO54415 supports five UART 3.3V serial ports. They can be used as 3.3V connections, or with the addition of level shifters, configured as RS-232 or RS-485 half or full duplex. Each serial port supports the following modes:

- UARTs 0, 1, and 2: RS-232, RS-485 half or full duplex, or Debug. Also supports hardware flow control with RTS/CTS.
- UARTs 3 and 4: RS-232 or Debug, without RTS/CTS hardware flow control.

Note that the serial ports are limited to the following mode settings when mounted on the NANO carrier board (NANO-DEV-100CR) due to hardware design restrictions:

- Ports 0 and 1 RS-232 or Debug.
- Port 2 RS-485 half or full duplex.
- Port 3 RX and TX 3.3V signals only.
- Port 4 RX and TX 3.3V signals only.

Please refer to the quick start guide on the NANO54415 product page for more details.

2.1.3 SB70LC Device Platform

The SB70LC has two asynchronous UART 3.3V serial ports. They can be used as 3.3V connections, or with the addition of level shifters, configured as RS-232 or RS-485 half or full duplex. Each serial port supports the following modes:

- UART 0 supports signals: RX, TX, RTS, and CTS. It can be configured for either RS-232 or RS-485 half or full duplex.
- UART 1 supports RX and TX signals only. It can be configured for RS-232.

If your application requires a single RS-232 connection, then we recommend using Port 1 as the data port and Port 0 as the debug port. If your application requires a single RS-485 connection, then we recommend configuring Port 1 as the debug port.

Important: For proper I2C bus operation, 4.7k Ohm pull-up resistors must installed on both the I2C clock (SCL) and data (SDA) signals.

Please refer to the quick start guide on the SB70LC product page for more details.

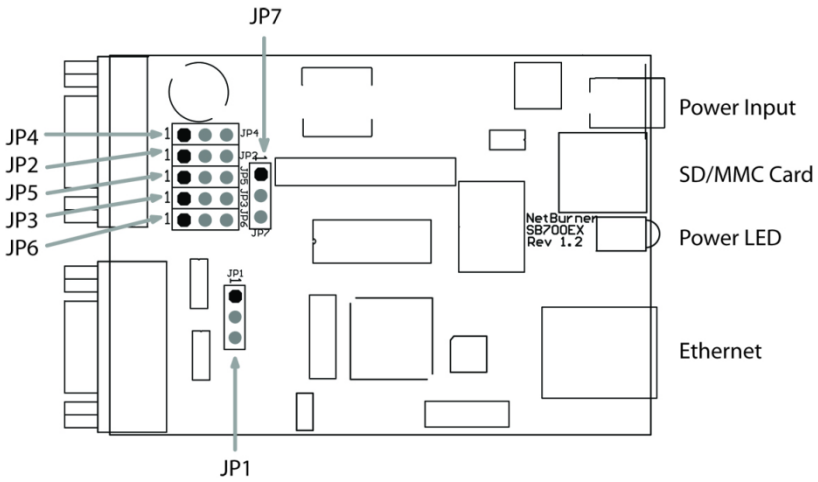
2.1.4 SB700EX Device Platform

The SB700EX has two asynchronous serial ports, referred to as Port 0 and Port 1. The ports can be configured with hardware jumpers as:

- Two RS-232 ports
- One RS-232 port and One RS-485 port (half or full duplex).
- Port 0 can be configured for either RS-232 or RS-485 (the factory default is RS-232)
- Port 1 can only be used as RS-232.

If your application requires a single serial connection, we recommend using Port 1 as the data port. Please refer to the quick start guide on the SB700 product page for more details.

2.1.4.1 SB700EX Jumper Configuration



Mode	JP1	JP2	JP3	JP4	JP5	JP6
RS-232	[1 – 2]	[1 – 2]	[1 – 2]	[1 – 2]	[1 – 2]	---
RS-485 Half or Full Duplex	[2 – 3]	[2 – 3]	[2 – 3]	[2 – 3]	[2 – 3]	---
Enable RS-485 HD Echo	---	---	---	---	---	[2 – 3]
Disable RS-485 HD Echo	---	---	---	---	---	[1 – 2]

- JP6[2-3] should be used when using RS-485 full duplex mode.
- JP7 selects the slew-rate limit and has three configurations:
  [1-2] = 500 kbps communication rate
  [2-3] = 16 Mbps communication rate
  [No Jumper] = 250 kbps communication rate (default)

2.1.4.2 SB700EX DB9 Connector Pinouts

NetBurner SB700EX Port 0-1 Signal Descriptions

	Port 0		Port 1
Pin	RS-232[1]	RS-485[1]	RS-232
1	CD	-	CD
2	RX	HD- / FD TX-	RX
3	TX	HD+ / FD TX+	TX
4	DTR	-	DTR
5	GND	GND	GND
6	DSR	FD RX-	DSR
7	RTS	FD RX+	RTS
8	CTS	-	CTS
9	RI	-	RI

Note:

1. Port 0 can be configured as either RS-232 or RS-485

2.1.5 SB800EX Device Platform

The SB800EX has two asynchronous serial ports, referred to as Port 0 and Port 1. The ports can be configured as RS-232 (default) or RS-485 half or full duplex. The SB800EX features jumper-less configuration, so the serial port mode is set by software configuration through the web page or serial AT command set.

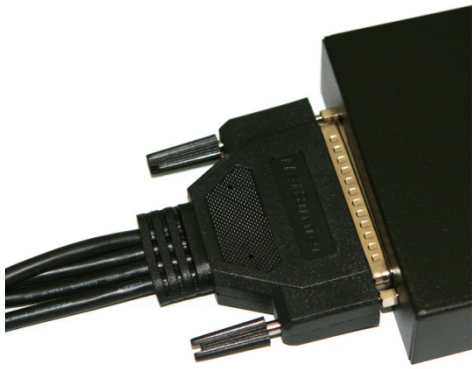
For detailed information on the connector signals please refer to the data sheet on the SB800EX product page.

2.1.6 NBPK70EX with Quad-UART Blade Board (NBPKBU-XXXCR)

The NBPK70EX with the 4-port Serial-to-Ethernet option can network-enable up to four RS-232 or RS-485 half or full duplex serial devices, depending on the type of quad-UART blade board selected (or 5 if you include the debug console port which can operate in RS-232 mode only).

NBPK70EX (Front)
The device has 5 connectors on the front panel:

- One 10/100 Ethernet port
- Two 7-24 V DC power connectors
- One SD Card reader slot
- One debug serial console port (RS-232 via UART 0)



NBPK70EX (Rear & Side)

The device has one DB37 receptacle port on the rear panel and two LEDs on the side panel:

- NetBurner DB37-to-4xDB9 UART cable adapter for serial ports 1 to 4
- Two dual-color LEDs (not shown) on side near Ethernet jack

2.1.6.1 DB37-to-Quad-DB9 Serial Cable Pin-out for NBPKBU-100/232CR and -MMSCR Blade Boards

The following table lists the functions of the pins on each side of the DB37-to-quad-DB9 serial cable when the cable is connected to the NBPKBU-100/232CR or NBPKBU-MMSCR blade boards. Note that the quad RS-485 function column only applies when the NBPKBU-MMSCR blade board is used.

DB37	DB9-1	DB9-2	DB9-3	DB9-4	Quad RS-232 Function	Quad RS-485 Function
1				1	Raw Port 4 Carrier Detect	
2				2	Raw Port 4 Receive	Raw Port 4 Rx+ (FD)
3				3	Raw Port 4 Transmit	Raw Port 4 Tx- (FD/HD)
4				4	Raw Port 4 DTR	
5				5	GND	GND
6			9		Raw Port 3 Ring Indicator	
7			8		Raw Port 3 CTS	Raw Port 3 Rx- (FD)
8			7		Raw Port 3 RTS	Raw Port 3 Tx+ (FD/HD)
9			6		Raw Port 3 DSR	
10		1			Raw Port 2 Carrier Detect	
11		2			Raw Port 2 Receive	Raw Port 2 Rx+ (FD)
12		3			Raw Port 2 Transmit	Raw Port 2 Tx- (FD/HD)
13		4			Raw Port 2 DTR	
14		5			GND	GND
15	9				Raw Port 1 Ring Indicator	
16	8				Raw Port 1 CTS	Raw Port 1 Rx- (FD)
17	7				Raw Port 1 RTS	Raw Port 1 Tx+ (FD/HD)
18	6				Raw Port 1 DSR	
19	N O C O N N E C T I O N					
20				6	Raw Port 4 DSR	
21				7	Raw Port 4 RTS	Raw Port 4 Tx+ (FD/HD)
22				8	Raw Port 4 CTS	Raw Port 4 Rx- (FD)
23				9	Raw Port 4 Ring Indicator	
24			5		GND	GND
25			4		Raw Port 3 DTR	
26			3		Raw Port 3 Transmit	Raw Port 3 Tx- (FD/HD)
27			2		Raw Port 3 Receive	Raw Port 3 Rx+ (FD)
28			1		Raw Port 3 Carrier Detect	
29		6			Raw Port 2 DSR	
30		7			Raw Port 2 RTS	Raw Port 2 Tx+ (FD/HD)
31		8			Raw Port 2 CTS	Raw Port 2 Rx- (FD)
32		9			Raw Port 2 Ring Indicator	
33	5				GND	GND
34	4				Raw Port 1 DTR	
35	3				Raw Port 1 Transmit	Raw Port 1 Tx- (FD/HD)
36	2				Raw Port 1 Receive	Raw Port 1 Rx+ (FD)
37	1				Raw Port 1 Carrier Detect	

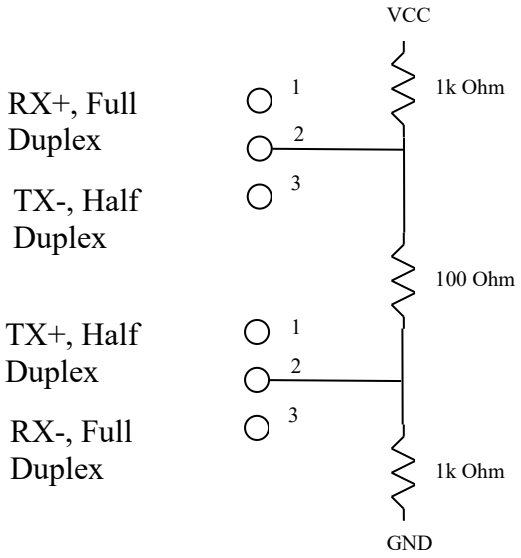
2.1.6.2 DB37-to-Quad-DB9 Serial Cable Pin-out for NBPKBU-485CR Blade Board

The following table lists the functions of the pins on each side of the DB37-to-quad-DB9 serial cable when the cable is connected to the NBPKBU-485CR blade board.

DB-37	DB9-1	DB9-2	DB9-3	DB9-4	Quad UART RS-485 Function
1				1	
2				2	Port 4 Tx- (FD/HD)
3				3	Port 4 Tx+ (FD/HD)
4				4	
5				5	GND
6			9		
7			8		
8			7		Port 3 Rx+ (FD)
9			6		Port 3 Rx- (FD)
10		1			
11		2			Port 2 Tx- (FD/HD)
12		3			Port 2 Tx+ (FD/HD)
13		4			
14		5			GND
15	9				
16	8				
17	7				Port 1 Rx+ (FD)
18	6				Port 1 Rx- (FD)
19	No Connection				
20				6	Port 4 Rx- (FD)
21				7	Port 4 Rx+ (FD)
22				8	
23				9	
24			5		GND
25			4		
26			3		Port 3 Tx+ (FD/HD)
27			2		Port 3 Tx- (FD/HD)
28			1		
29		6			Port 2 Rx- (FD)
30		7			Port 2 Rx+ (FD)
31		8			
32		9			
33	5				GND
34	4				
35	3				Port 1 Tx+ (FD/HD)
36	2				Port 1 Tx- (FD/HD)
37	1				

2.1.6.3 Termination Jumpers on the NBPKBU-485CR and –MMSCR Blade Boards

Each of the four serial ports on the blade boards that support RS-485 mode have a pair of 3-pin headers for optional resistor termination that can be added by installing jumpers. The schematic representation of the terminating resistors is shown below:



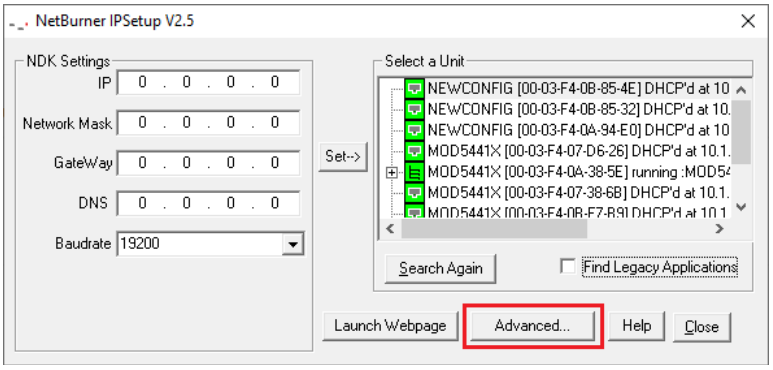
As shown above, there are two 3-pin headers for each serial port that can be jumped to short pins 1-2 or 2-3, depending on the duplex mode. To add termination in full duplex mode, add one 2-pin jumper to pins 1-2 of the RX+/TX- header, and a second 2-pin jumper to pins 2-3 of the TX+/RX- header. To add termination in half-duplex mode, add one 2-pin jumper to pins 2-3 of the RX+/TX- header, and a second 2-pin jumper to pins 1-2 of the TX+/RX- header.

NBPKBU-485CR Jumper Chart		
Port	**RX+/TX- Header**	**TX+/RX- Header**
1	JP1	JP2
2	JP3	JP4
3	JP5	JP6
4	JP7	JP8

NBPKBU-MMSCR Jumper Chart		
Port	**RX+/TX- Header**	**TX+/RX- Header**
1	JP6	JP5
2	JP3	JP4
3	JP1	JP2
4	JP8	JP7

2.2 Network Configuration

- Run the IPSetup utility. To view the advanced settings, click on the "Advanced" button. If you do not have the NNDK tools, you can download the standalone IPSetup utility from the NetBurner web site at www.netburner.com.

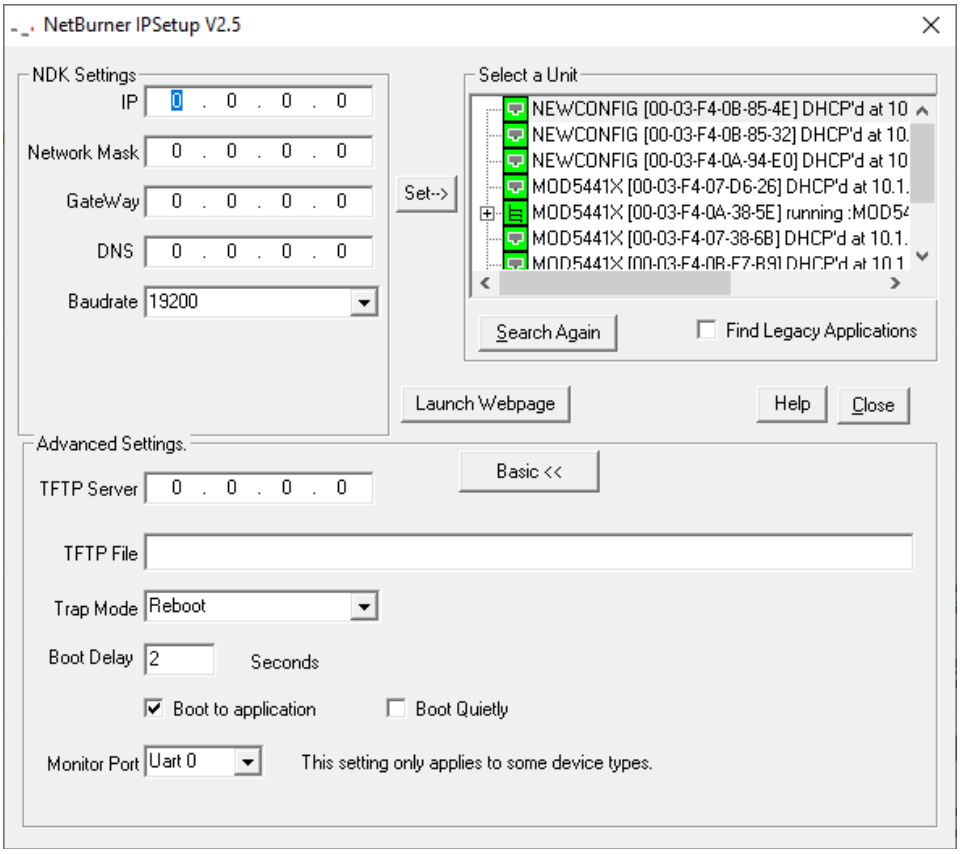


IPSetup Window

- Locate your device in the "Select a Unit" list box by matching its MAC address. The MAC address label is located on your device. If your device does not appear in the list box, then verify that the onboard power LED, network speed and activity LEDs on the Ethernet jack are illuminated, and click the "Search Again" button. If you are still unable to see your device, remove power, verify that all your cables are properly connected, reapply power, and click the "Search Again" button. Note that the IPSetup utility uses a UDP broadcast protocol, and therefore will not operate through a router. Also, UDP broadcasts may be blocked by firewalls.
- If your network supports a DHCP server, the dynamically assigned device IP address will also appear in the "Select a Unit" pane. If your network does not support a DHCP server, then you will need to configure the static device IP and mask address fields appropriate for your network. Static addresses usually reside in an address space set aside for private networks. Some common values are:

  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

1. After you have entered all of your values, click the "Set→" button in the center of the IPSetup utility dialog box to apply the new parameters to the selected target device in the "Select a Unit" list box.



IPSetup Window with Advanced Settings Expanded

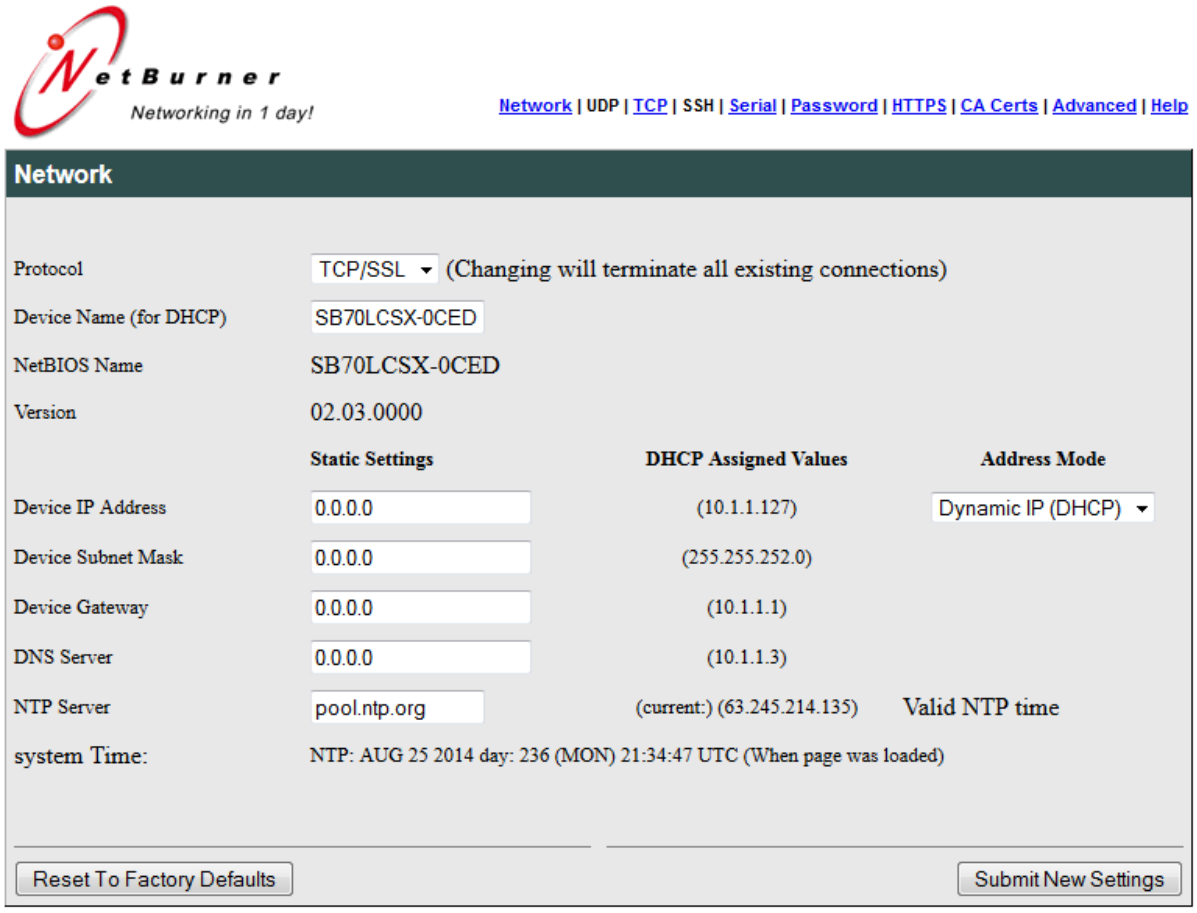
2.3 Operational Configuration

Once the network parameters are set, you can use the web server interface to modify the settings of your device. To access the web page, click on the "Launch Webpage" button in the IPSetup utility, or you can open your web browser and enter the device IP address in the address bar of the browser window (for example: "http://10.1.1.72").

3. Web Page Configuration

Once you have configured the IP address of your device, you can connect to the device's web server to configure your serial and network settings.

3.1 Network Settings

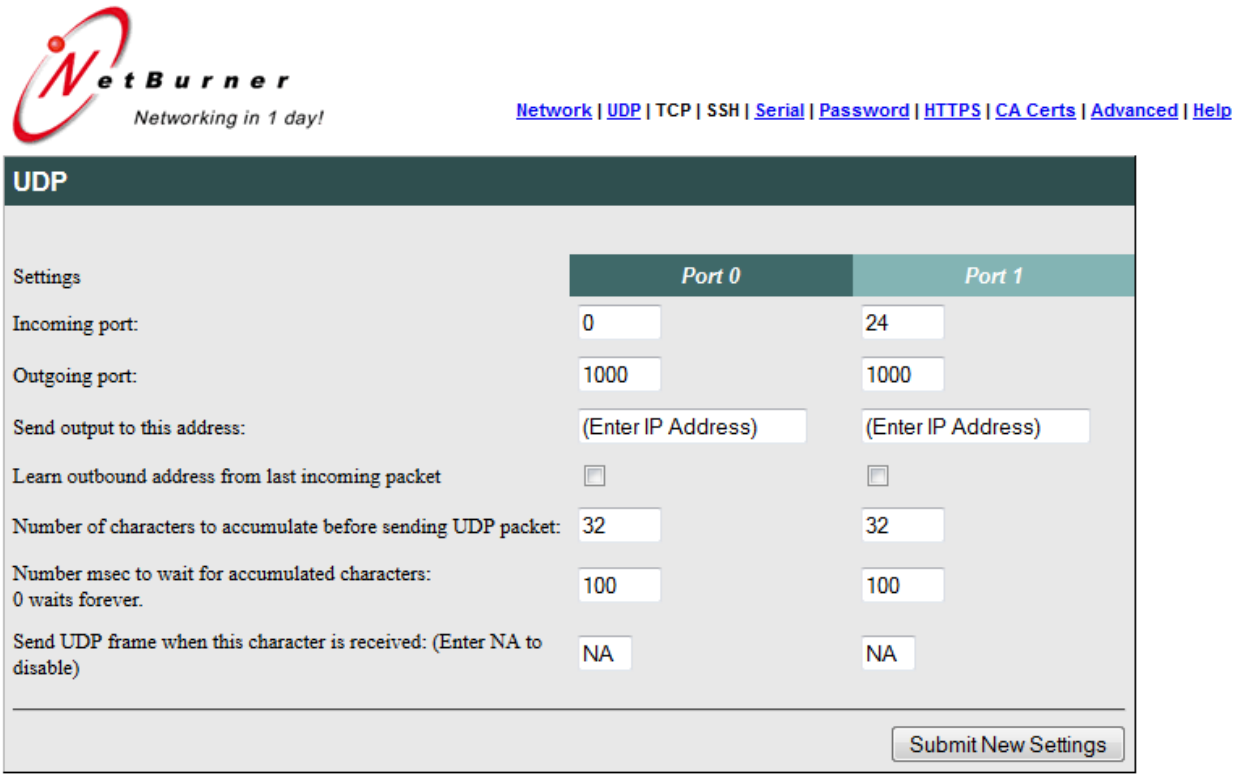


Network configuration page (SB70LC platform shown)

Protocol	Selects the network protocol: SSH, TCP or UDP. Selecting a mode will enable the navigation links that apply to that protocol, and disable navigation links that do not apply. For example, if you select SSH, then the TCP and UDP configuration screens are disabled.
Device Name	This specifies the device name reported to your DHCP server, and used as the NETBIOS name. Note that NETBIOS names are limited to 14 characters and no spaces.
Version	Software version number
Address Mode	Select between dynamic and static IP address settings
Device IP Address Device Subnet Mask Device Gateway DNS Server	If "Address Mode" is set to DHCP, then your DHCP server will provide these values and they will be displayed in the "DHCP Assigned Values" column. If you wish to specify these values yourself, set the address mode to "Static IP" and type the values in the appropriate fields. Note

	that if you do not specify a gateway and/or DNS server you will not be able to communicate outside your local network.
NTP Server	This specifies the network time protocol (NTP) server name or address that is used to set the system time.
System Time	This displays the date and time (UTC) when the web page was last loaded. This information updates with every web page refresh.

3.2 UDP Configuration



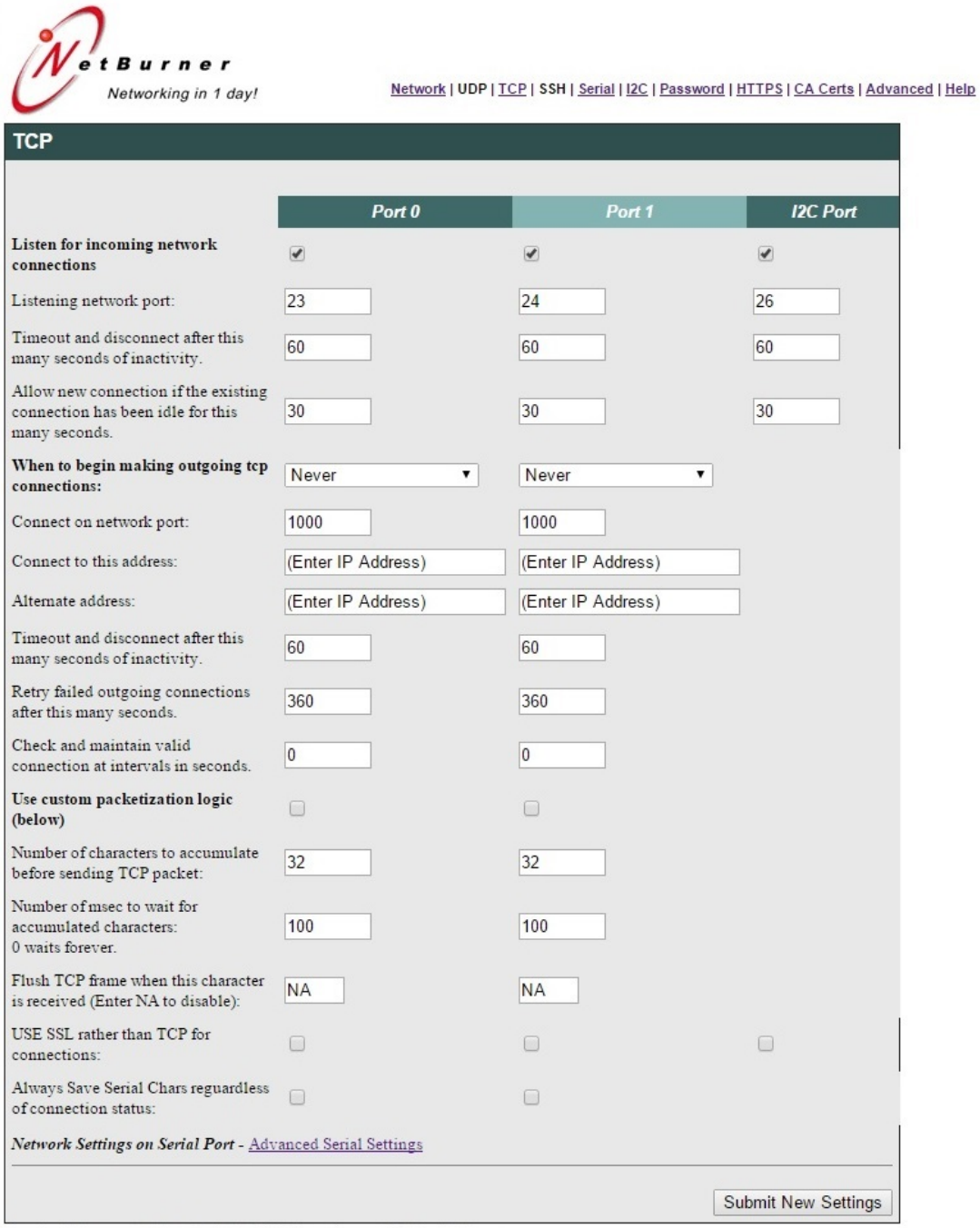
UDP configuration page (CB34EX platform shown)

This is only available if the UDP protocol is selected from the "Network" configuration web page. The column headings Port 0 and Port 1 refer to serial UARTs 0 and 1, respectively. The NANO54415 maps serial ports 3 and 4 to UARTs 8 and 9. The SB800EX maps serial ports 0 and 1 to UARTs 1 and 2.

Incoming Port	The UDP port to listen on for incoming network data that will be sent out the associated serial port
Outgoing Port	The UDP port used for outbound data received from the serial side
Send output to this address	The destination IP address for outgoing serial data
Learn outbound address from last incoming packet	Send outbound serial to the IP address from the last received UDP packet. Useful for clients that may have changing IP addresses.

Number of characters to accumulate before sending UDP packet	Maximum number of characters to accumulate from received serial port connection before sending them out in a UDP packet. This setting will be overridden if the accumulation delay time setting is used and the delay time expires.
Number milliseconds to wait for accumulated characters (0 waits forever)	Specified maximum wait time for received serial port character accumulation setting.
Send UDP frame when this character is received: (Enter NA to disable)	If a character is specified, a UDP frame will be sent upon receipt of that character from the serial port.

3.3 TCP Configuration



TCP configuration page (SB70LC platform shown)

This is only available if the TCP protocol is selected in the "Network" configuration page. The column headings "Port 0" and "Port 1" refer to the serial ports and associated UARTs 0 and 1 (the NANO54415 is the exception to this rule, where ports 3 and 4 are associated with UARTs 8 and 9). In the case that the SB70LC is used, there will be an additional column for I2C options.

In TCP protocol mode you can configure the device to be a TCP server, which listens for incoming connections, or a TCP Client, which makes outgoing connections. In TCP Client mode, you can

choose to make an outgoing connection on device power-up, or you can choose to only connect when serial data is available to send. You cannot be a TCP Client and TCP Server at the same time.

3.3.1 TCP Server Mode

Listen for incoming network connections	Select checkbox to enable the port to listen for incoming TCP connection requests. Checking this box will override the TCP Client mode.
Listening network port	Port number to listen on. The default port is 23 (telnet). The listen port numbers for Port0 and Port1 must be different.
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.
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.

3.3.2 TCP Client Mode

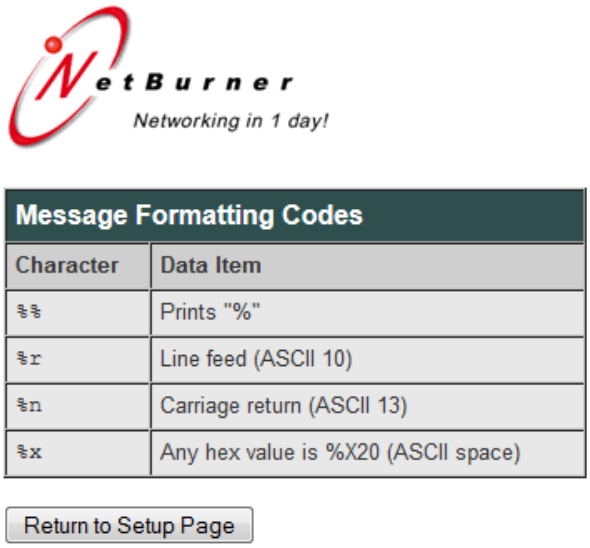
When to begin making outgoing serial connections	Selects between connect on power-up and connect on serial data available.
Connect on network port	Specifies destination TCP port number
Connect to this address	Specifies destination IP address
Timeout and disconnect after this many seconds of inactivity.	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.
Retry failed outgoing connections after this many seconds.	Number of seconds to wait before retrying an outgoing connection.
Check and maintain valid connection at intervals in seconds	Wait a given number of seconds since last received packet before sending a keep-alive packet to the remote device to verify connection. It will then wait at least two seconds for a return acknowledgement. If the remote device does not respond, then the existing connection is closed and retries until the remote device is available. A value of zero disables this feature.

3.3.3 TCP Packetization Options, valid for TCP Sever or Client Modes

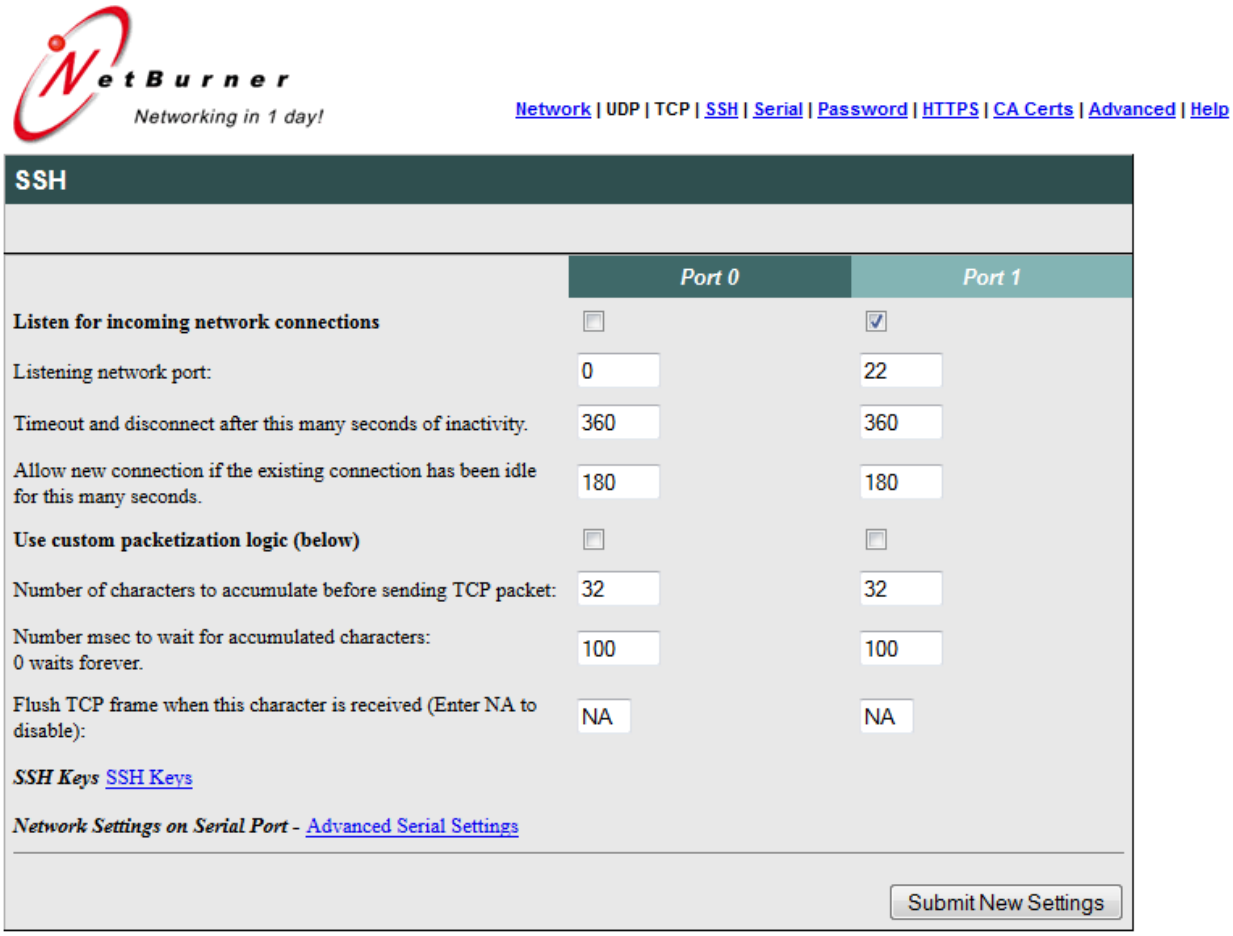
Use custom packetization logic	Enables/disables custom packetization settings
Number of characters to accumulate before sending TCP packet	Maximum number of characters to accumulate from received serial port before sending them out the network connection. This setting will be overridden if the accumulation delay time setting is used and the delay time expires.
Number milliseconds to wait for accumulated characters (0 waits forever)	Specified maximum wait time for received serial character accumulation setting.
Flush TCP frame when this character is received (Enter NA to disable)	Send all accumulated serial data upon receipt of this character from the serial port.
Use SSL rather than TCP for connections	Checking this box enables the SSL protocol for the port connection used; unchecking the box reverts back to regular TCP connections.
Always save serial chars regardless of connection status	Checking this box allows received serial chars to be stored, whether the connection is established or not; unchecking the box discards any incoming serial characters.
DTR will reflect current connection status (this option is available only for the SB700EX platform)	When checked, the DTR output signal will toggle high or low depending on whether a serial-Ethernet connection is established for the associated port. If there is an active connection, the DTR signal will go high; a closed connection will cause DTR to go low.
Network Settings on Serial Port - Advanced Serial Settings	Link to advanced network settings that enable serial messages to be sent upon specific network events.

3.3.4 TCP Advanced Serial Network Settings

Advanced Serial configuration page (CB34EX platform shown)



4. SSH Configuration



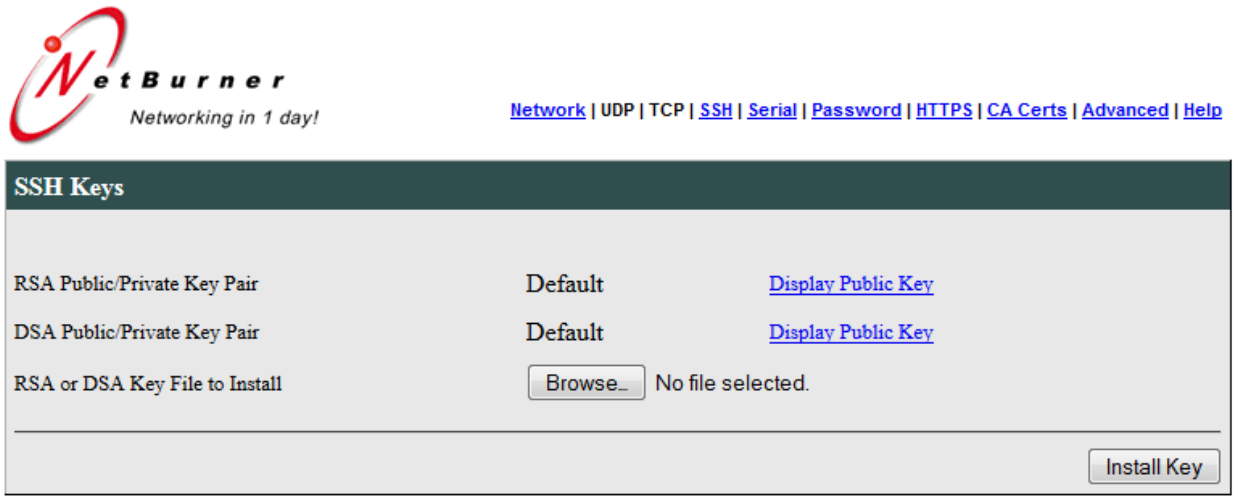
SSH configuration page (CB34EX platform shown)

Only available if the SSH Protocol is selected in Network Configuration. The column headings Port 0 and Port 1 refer to the serial ports and associated UARTs 0 and 1. For the NANO54415, ports 3 and 4 are associated with UARTs 8 and 9. For the SB800EX, serial ports 0 and 1 are associated with UARTs 1 and 2.

Listen for incoming network connections	Select checkbox to enable the port to listen for incoming SSH connection requests.
Listening network port	Port number to listen on. The default SSH port is 22. The listen port numbers for Port0 and Port1 must be different.
Timeout and disconnect after this many seconds of inactivity.	Terminate SSH 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.

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.
Use custom packetization logic	Enables/disables custom packetization settings
Number of serial characters to accumulate before sending TCP packet	Maximum number of serial accumulated characters to accumulate before sending them out the SSH port. This setting will be overridden if the accumulation delay time setting is used and the delay time expires.
Number milliseconds to wait for accumulated characters (0 waits forever)	Specified maximum wait time for received SSH serial character accumulation setting.
Flush TCP frame when this character is received (Enter NA to disable)	Send all accumulated serial data upon receipt of this character from the serial port.
SSH Keys	Link to the SSH key management page.
Network Settings on Serial Port - Advanced Serial Settings	Link to advanced network settings that enable serial messages to be sent upon specific network events.

4.1 SSH Key Configuration



Device Name: CB34EXSX-5AF0 | Version: 02.03.0000

SSH Keys - Key size must be at least 512 and no more than 4096 and in openSSH(openSSL) format.

SSH key configuration page (CB34EX platform shown)

Only available if the SSH Protocol is selected in Network Configuration. RSA and DSA are algorithms for public-key cryptography and involve a public key and a private key. The public key can be known to everyone and is used for encrypting messages. Messages encrypted with the public key can only be decrypted using the private key. For detailed information on the NetBurner SSH implementation, please refer to the NetBurner SSH suite page.

This configuration screen is used to display the current key configuration and provide the ability to upload your own key. Each private key also contains the public key, so uploading your own private key will also upload the public key. You can use the Display Public Key link to copy the public key and provide it for encryption purposes.

There are 3 possible key configurations. The first two are present so the system is functional if you have not uploaded your own user created keys.

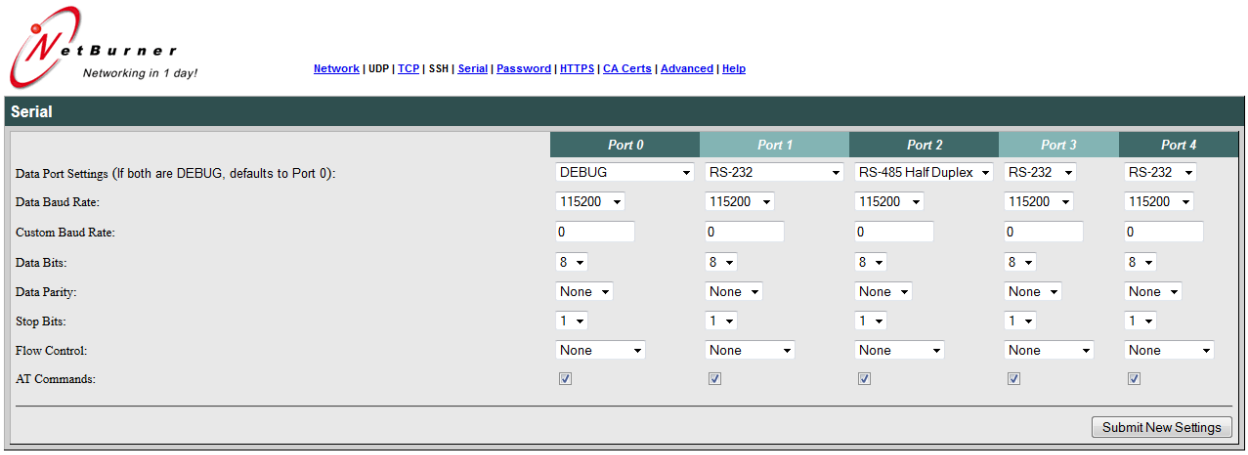
1. The NetBurner factory key, designated by the name "NetBurner". This key is built into the SSH library and will be active if no other keys are present.
2. The SSH application key, designated by the description "Default". This key is compiled into the SSH application and will be used if no user created keys have been uploaded.
3. A key you have created and uploaded.

RSA Public/Private Key Pair	Displays current RSA key in use.
DSA Public/Private Key Pair	Displays current DSA key in use.
RSA or DSA Key File to Install	Use this field to select a user created key file to upload. Once selected, click on "Install Key" to upload.

4.2 SSH Advanced Serial Settings

These are the same as with TCP. Please refer to the TCP Advanced Serial Settings section.

5. Serial Settings



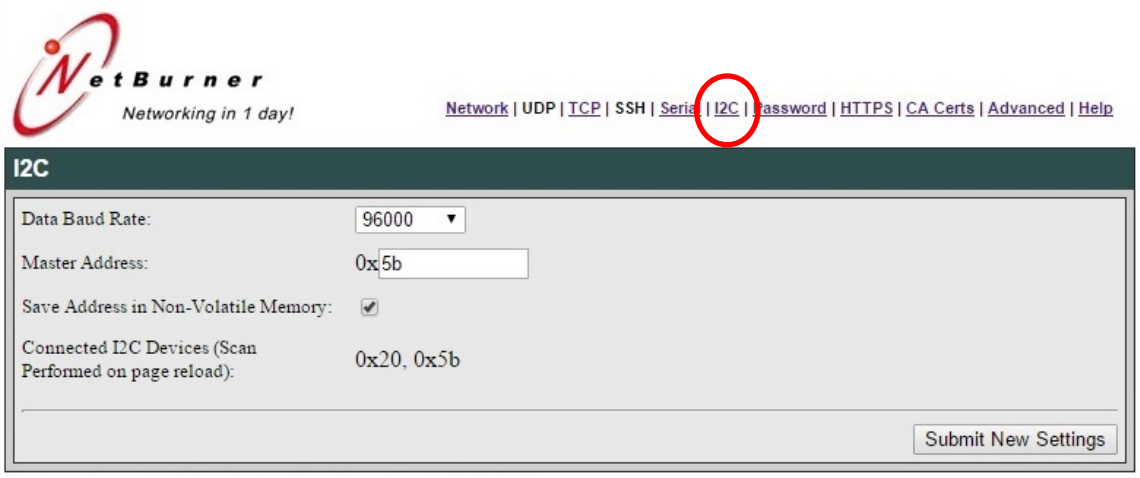
Serial configuration page (NANO54415 platform shown)

Depending on the device, anywhere from two to five serial ports are provided. Each port may vary in what serial modes are supported. If applicable, the hardware jumpers must also be set to the correct mode.

Data Port Settings	Each port may support one or more of the following modes: RS-232, DEBUG, RS-485 Half Duplex, and RS-485 Full Duplex
Data Baud Rate	Set a baud rate from a predefined list
Custom Baud Rate	Set any custom value to be the baud rate. "Custom" must be selected in "Data Baud Rate" for this field to be a valid. Entering '0' will default to 115.2 kbps.
Data bits	Number of data bits – valid values are 5, 6, 7, and 8.
Data parity	Parity mode – valid values are odd, even, and no parity.
Stop bits	Number of stop bits – valid values are 1 and 2.
Flow control	Set to "None" for no flow control. If using RS-232, valid selections are none, XON/XOFF software flow control, or RTS/CTS hardware flow control.

6. I2C Settings (SB70LC ONLY)

The SB70LC has the additional feature of Ethernet-to-I2C support. An additional I2C page link will appear in the navigation bar. The functionality is different from the UART based serial to Ethernet data pump behavior; when I2C is enabled the interface is a command/response protocol as described in the command protocol section below.



I2C configuration page (SB70LC platform shown)

Data Baud Rate	Set the I2C baud rate.
Master Address	Set the 7-bit address of this master device. The input must be a two-digit hex value between 0x08 and 0x77.
Save Address in Non-Volatile Memory	Save the address in Non-Volatile memory so that the address persists after powering down the module.
Connected I2C Devices	Displays the addresses of the devices detected on the I2C bus. The scan is performed when the webpage is loaded.

6.1 Command Protocol

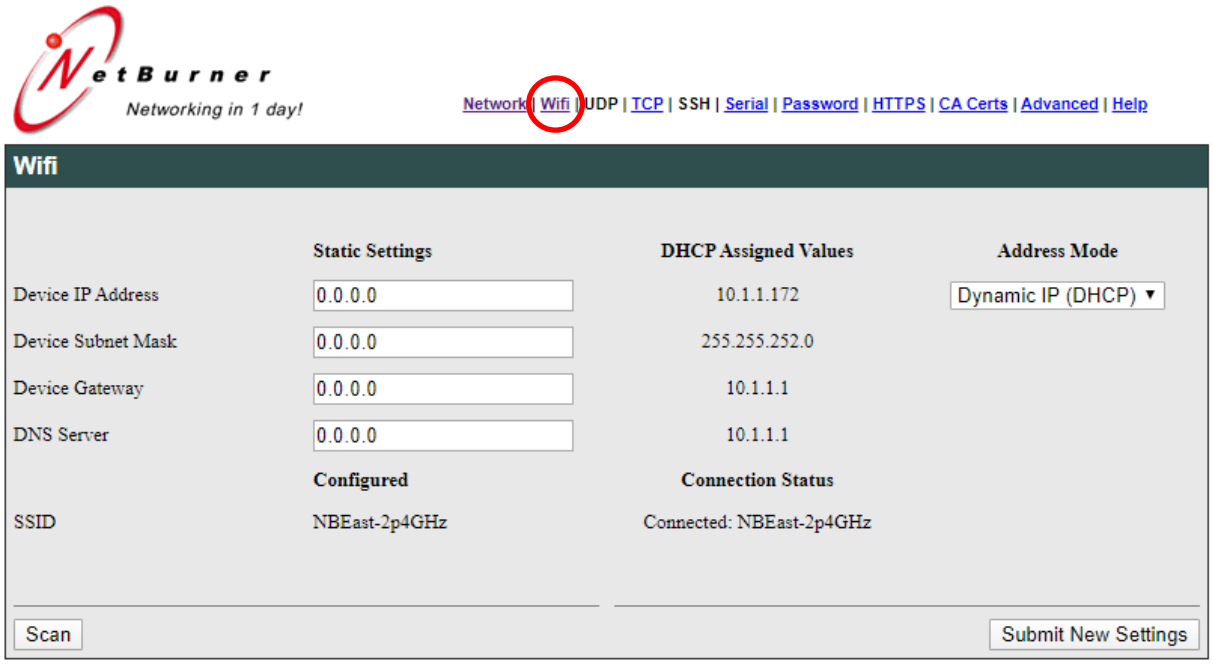
All Ethernet-to-I2C commands begin with a '#' symbol, and terminate with a carriage return and line feed: 0x0D 0x0A. All data fields are two-digit hex values.

Command	Description	Returns
#MENU or #HELP or ?	Print the main menu	<Main menu>
#WB<address><data byte>	Write a byte. Example: #WB39AC writes 0xAC to the address 0x39	<byte written> OK
#WW<address> <write length><data>	Write a buffer. Example: #WW390203AC writes 0x03AC to the address 0x39	<bytes written> OK
#RB<address>	Read a byte. Example: #RB39 reads a byte from the address 0x39	<byte read> OK
#RR<address><read length>	Read a buffer. Example: #RR390A reads 10 bytes from the address 0x39	<bytes read> OK
#WR<address><data byte>	Write a byte then read a byte. Example: #WR39AC writes 0xAC to the address 0x39 and reads a byte	<byte written>, <byte read> OK
#WA<address><data byte> <read length>	Write a byte then read a buffer. Example: #WA39AC0A writes 0xAC to the address 0x39 then reads 10 bytes	<byte written>, <bytes read> OK
#SE<new address>	Set a new I2C address. Example: #SE08 sets the address of the module to 0x08	<new address> OK
#SV<new address>	Save a new I2C address. Example: #SV0A sets the address of the module to 0x0A and saves the new address in Non-Volatile memory	<new address> OK
#ST	Print the I2C bus status.	"<I2C bus status>" OK
#RE	Reset the I2C bus.	OK
#SC	Scan the I2C bus for active devices.	<address of device>, <address of device>, ... OK

7. WIFI Settings (SB800EX only)

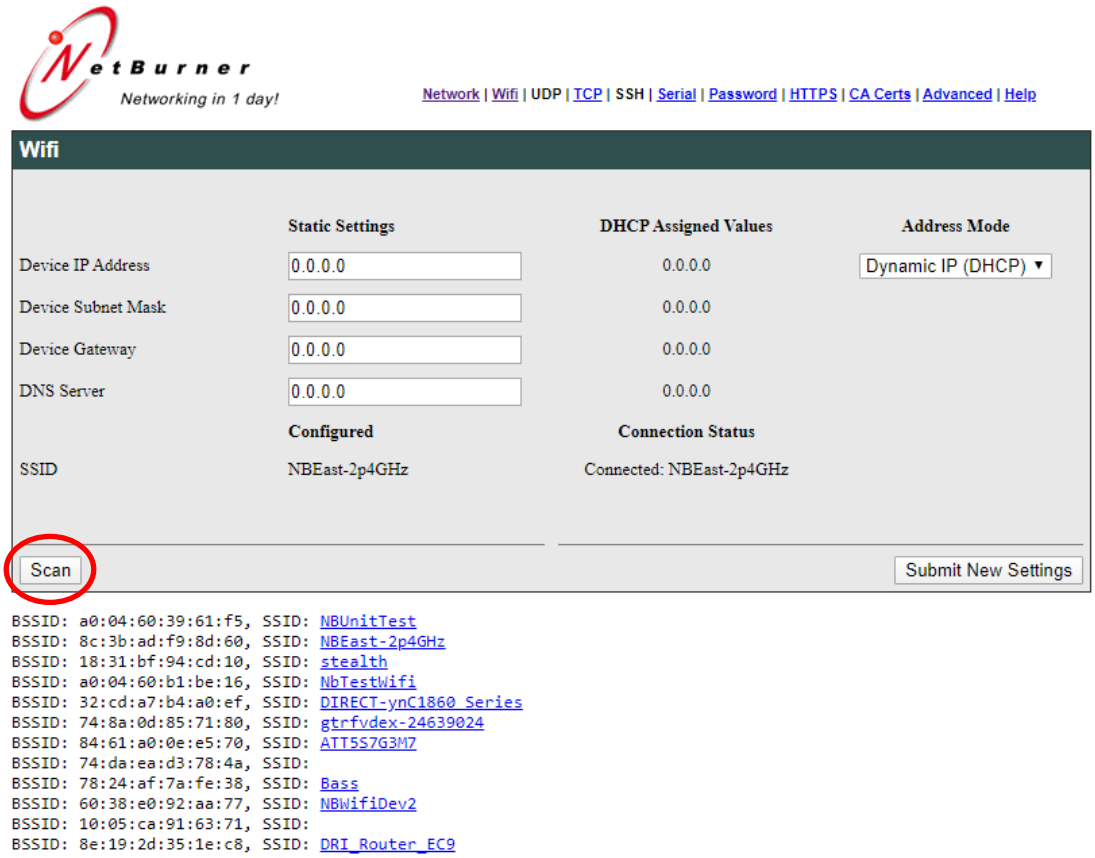
The SB800EX-JDDW-IR and SB800EX-JDTW-IR both support WIFI network connections. To access the WIFI configurations, select the “Wifi” hyperlink at the top of the web interface. This configuration screen will allow you to select whether the WIFI interface will allow the network settings (IP address, subnet mask, gateway, and DNS server) to be set by a DHCP server, or

whether they should be set statically by the user. To do this, select either DCHP or Static from the "Address Mode" dropdown on the configuration screen.



WIFI configuration page (SB800EX platform shown)

At the bottom of the configuration page, the SSID will be displayed for the WIFI network that is currently configured, as well as the connection status for that SSID. To choose a different WIFI network to connect to, hit the "Scan" button on the bottom left of the screen. This will show a list of available WIFI networks that can be connected to.



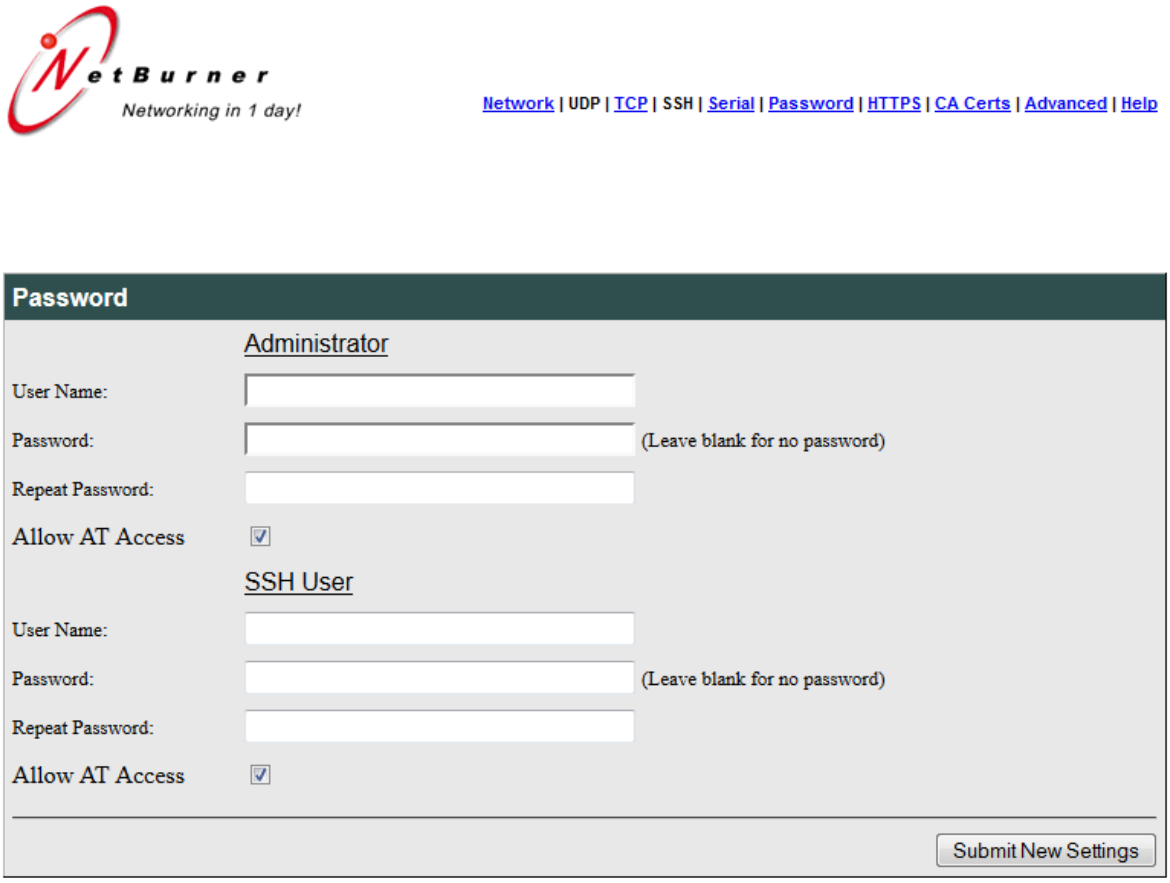
WIFI scan results (SB800EX platform shown)

To attempt a connection to one of the listed WIFI networks, click on the corresponding SSID name in the list. An input field will be presented for you to input the SSID password. When it's entered, click the submit button.

WIFI SSID password input

If successful, the "Configured" and "Connection Status" fields on the WIFI configuration page will be updated to reflect the new WIFI network.

8. Password Settings

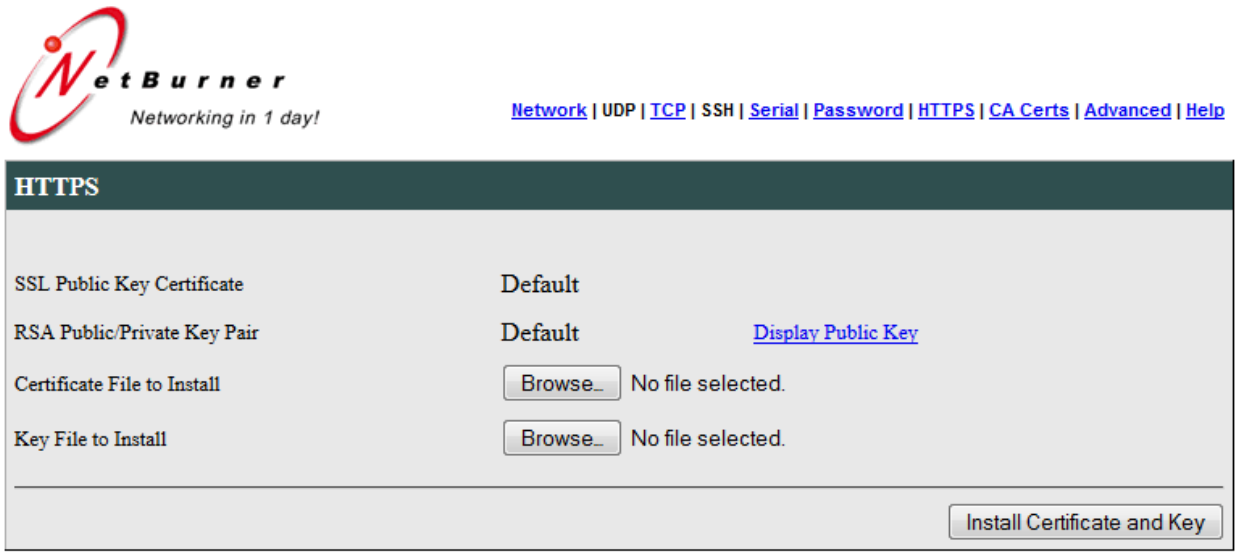


Device Name: CB34EXSX-5AF0 | Version: 02.03.0000

Password configuration page (CB34EX platform shown)

Administrator Password	This password applies to: • Web page access • AutoUpdate capability for software updates • Configuration changes with IPSetup • SSH client log-in
SSH Password	Password for SSH clients with no administrative privileges to log in to the web server. Because a SSH log-in is possible with either an Admin or SSH password, an Admin password is required to enable this feature.

9. Hypertext Transfer Protocol over SSL (HTTPS) Configuration



Device Name: CB34EXSX-5AF0 | Version: 02.03.0000

HTTPS - Hypertext Transfer Protocol over Secure Shell Layer (HTTPS) secure web site settings.

Key size must be at least 128 and no more than 1024 and in openSSL(openSSH) format.

HTTPS configuration page (CB34EX platform shown)

HTTPS refers to HTTP over a secure SSL connection. To use HTTPS you can simply enter a URL of "https://xxxxx" instead of "http://xxxxxx". Your NetBurner device can simultaneously run both HTTP and HTTPS access to the web server.

HTTPS requires both a Certificate and a public/private Key (we recommend ECDSA for SSL, though RSA will work). The key must match the certificate and if you are creating your own self signed certificate or purchasing a certificate from a certificate authority, both the certificate and key must be uploaded at the same time. If you are creating your own certificate, called a self-signed certificate, anyone accessing the secure web page will first receive a warning message from the web browser asking to confirm if the certificate should be accepted. For detailed information on the NetBurner SSL/TLS implementation, please refer to the NetBurner security suite page at www.netburner.com.

There are 3 possible key/certificate configurations. The first two are present so the system is functional if you have not uploaded your own user created certificate and key.

1. The NetBurner certificate/key built into the SSL library, designated by the name "NetBurner", which will be used if no other keys are present.
2. The application certificate/key, designated by the description "Default". This SSL certificate and key are compiled into the application and will be used if no other user created certificate and key have been uploaded.
3. A certificate and key you have uploaded.

SSL Public Key Certificate	Displays current certificate in use.
RSA Public/Private Key Pair	Displays the current keys in use.
Certificate file to install	Selects the certificate file to upload (must also upload the key).
Key file to install	Selects the ECDSA public/private key pair to upload (must also upload certificate). Note that RSA will work, but is deprecated for SSL.

10. AT Commands

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

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

10.1 Enter and Exit Command Mode

AT configuration commands can only be processed when in "AT Command Mode".

To enter AT command mode:

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

To exit 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.

Return Values:

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

To reset settings to factory default:

Send "AT&F" to reset all settings to factory default (does not save). If you wish to save the settings, use the AT&P command.

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

10.2 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 is ignored
- All commands and queries are terminated by a carriage return <cr> (decimal value 13), if a line feed <lf> follows a <cr>, it will be ignored.

10.3 System/Network Configuration

10.3.1 Setting System Parameters

Example: `AT#SYSIP=10.1.1.100<cr>`

Root Command	Sub Command	Description
#SYS		Set a system parameter
	`IP=<ip address>`	Set IPv4 IP address
	`MK=<ip address>`	Set IPv4 mask address
	`GW=<ip address>`	Set IPv4 gateway address
	`DN=<ip address>`	Set IPv4 DNS address
	`DH=<value>`	DHCP: 0 = disable, 1 = enable
	`NB=<device name>`	Set NETBIOS device name
	`UN=<string>`	Set User Name
	`PW=<string>`	Set Password
	`MD=<T|U|S>`	`Network protocol mode: TCP, UDP, SSH`

10.3.2 Reading System Parameters

Example: `AT#CURIP? <cr>`

Root Command	Sub Command	Description
#CUR		Read a system parameter
	`IP?`	Read IPv4 IP address
	`MK?`	Read IPv4 mask
	`GW?`	Read IPv4 gateway
	`DN?`	Read IPv4 DNS
	`ST?`	Read network port status for current serial port
	`S<n>?`	Read network port status for serial port "n". The serial port numbering starts at 0. The number of serial ports depends on your specific NetBurner device.

Return Values for #CURS<n>?

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

10.4 Serial Port Configuration

Example: `AT#SER0LN=1<cr>` // Listen for incoming network connections

Root Command	Sub Command	Description
#SERn		n = serial port number, which is platform dependent. Numbering begins at 0. For example , the SB800EX has 2 serial ports, numbers 0 and 1.
	Network Server Mode Commands	
	`SM=<R|D|H|F>`	R = RS232, D = debug, H = Half duplex RS485, F = Full duplex RS485.
	`LN=<0|1>`	Listen for incoming network connections. 0 = disable, 1 = enable.
	`BR=<baud rate>`	Serial port baud rate
	`DB=<data bits>`	Data bits: 7 or 8
	`PR=<N|O|E>`	Parity: None, Odd, Even
	`ST=<stop bits>`	Stop bits: 1 or 2
	`FL=<N|S|H>`	Flow control: None, Software, Hardware RTS/DTS
	`SP=<port number>`	Listen network port number
	`SD=<seconds>`	Inactivity disconnect timeout
	`SO=<seconds>`	Connection override
	Network Client Mode Commands	
	`CM=<N|P|R>`	Outgoing connection mode: Never (listen only, server mode)
	`CI=<destination>`	IP address or DNS name to connect to
	`CP=<port number>`	Destination port number
	`CD=<seconds>`	Inactivity disconnect timeout in seconds
	`CR=<seconds>`	Connection retry timeout
	`KA=<seconds>`	TCP Keep Alive timeout
	`UL=<0|1>`	UDP learn mode: 0 = disable, 1 = enable

10.5 Passwords

10.5.1 Administrator

Example: `AT#SYSAUN=BobAdmin<cr>`

```
#SYSA
     UN=<name>            // set user name
     PW=<password>        // set password
     UN?                  // query user name
     PW?                  // query password
```

10.5.2 SSH

Example: `AT#SYSSUN=BobSsh<cr>`

```
#SYSS
     UN=<name>            // set user name
     PW=<password>        // set password
     UN?                  // query user name
     PW?                  // query password
```

10.6 AT Command Examples

The following examples display the full transcript of serial communication including commands sent and replies from a SB700EX. Commands are marked in red, responses are marked in blue.

10.6.1 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
```

10.6.2 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 was required.

```
+++
OK>AT#SER0SP?23
OK>AT#SER0SP=30
OK>AT&P2,Returning to listening connection
```

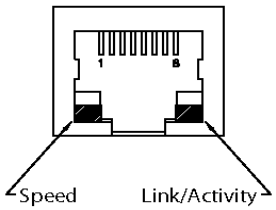
10.6.3 Configure Outgoing Network Client Connection

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

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

11. LEDs

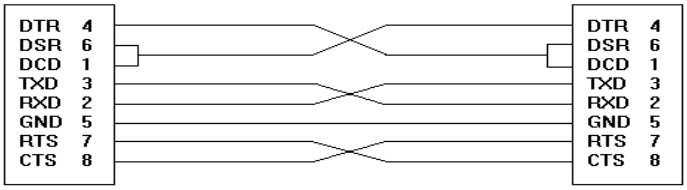
Power LED: Illuminated while power is applied.
LED1 on RJ-45: Ethernet speed – 10 (off) or 100 (on)
LED2 on RJ-45: Link and data activity



Pin	Signal	Pin	Signal
1	TX+	2	TX-
3	RX+	4	N/C
5	N/C	6	RX-
7	N/C	8	N/C

12. DB9 RS-232 NULL Modem Wiring

The following table and diagram describe how to create a null modem cable/adapter for RS-232 DB9 connections. A null modem cable is required if you are connecting a device such as the CB34EX, SB700EX, or SB800EX to a standard serial port on a PC.



13. Power Connector

Some of the devices may support multiple connection methods in receiving power. For those that support the standard 2.1-mm P5 input jack and/or 2-pin quick-disconnect terminal block, the specifications for these interfaces are shown below:

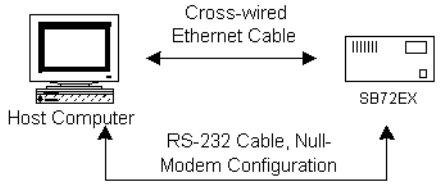
1. A standard 2.1-mm P5 input jack. The center pin has a positive ('+') polarity and the outer shell has a negative ('–') polarity.
2. A 2-pin quick-disconnect terminal block. Red is positive, black is negative.

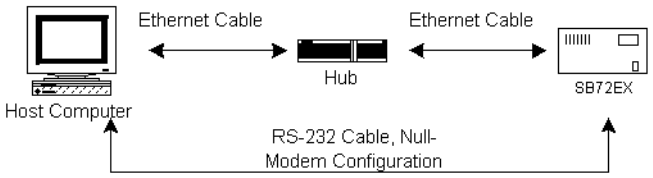
14. Web Browsers and Proxy Servers

If you are working on a corporate LAN that uses a proxy server for Internet web browsing, you will need to exclude the IP Address of your device 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 device to 255.255.255.0.

15. Testing with a Telnet Connection

One quick way to test the functionality of your Serial-to-Ethernet connection is with the Telnet program and an RS-232 Serial terminal program (e.g. MTTTY). To run this test, configure your system as one of the two examples shown below (null modem not required for all device platform types):





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. Therefore, if you type text in the telnet window, it should appear in the serial terminal window and vice versa. For a serial terminal, you can use MTTTY (available as a download at www.netburner.com) or HyperTerminal.

In the following example, an IP Address of 10.1.1.79 will be used for the SB700EX. **Note:** Replace this number with the specific IP Address you assigned (if using a Static IP Address) during configuration.

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. You will see a valid ping response. Remember to substitute your IP Address for our example IP Address (i.e.10.1.1.79).

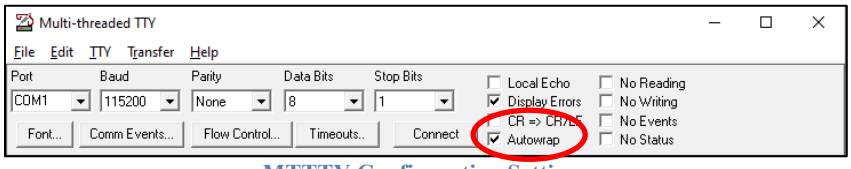
4. Run either HyperTerminal or MTTTY. Set the baud rate to the value you assigned to the SB700EX during configuration. To use MTTTY (with the factory default settings):

    - Connect your NULL modem cable from Port 0 on your SB700EX to your host computer's serial port. Remember, a standard serial cable will not work.

    - Run Mttty.exe by double clicking its icon. When the MTTTY window appears use the factory default setting shown below:

        - The Port setting is the communication port that you connected the NULL modem cable to on your host computer.
        - The host computer and the attached SB700EX must agree on a speed or baud rate to use for the serial connection.
        - Parity checks whether the data has been lost or written over when transmitted between your host computer and your SB700EX.
        - Data Bits are the number of bits in a transmitted data package.
        - The Stop bit follows the data and parity bits in serial communication. It indicates the end of transmission.

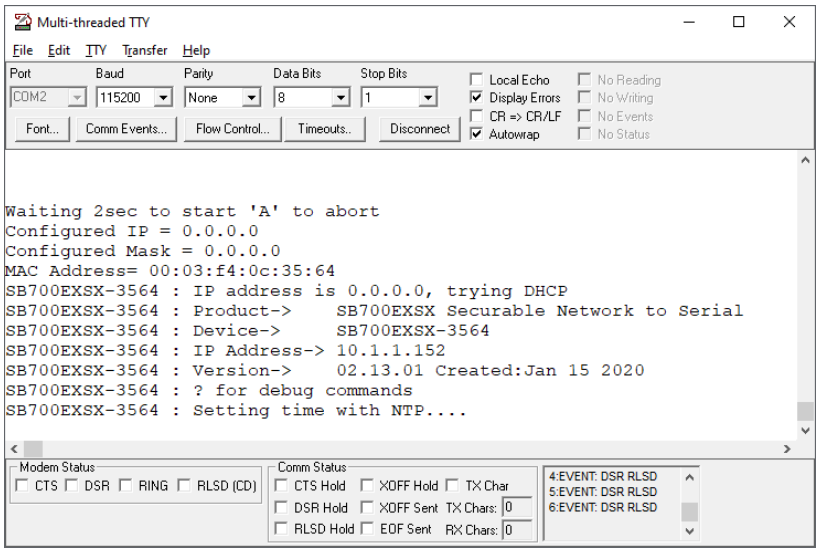
    - Click the MTTTY **Connect** button.



MTTTY Configuration Settings

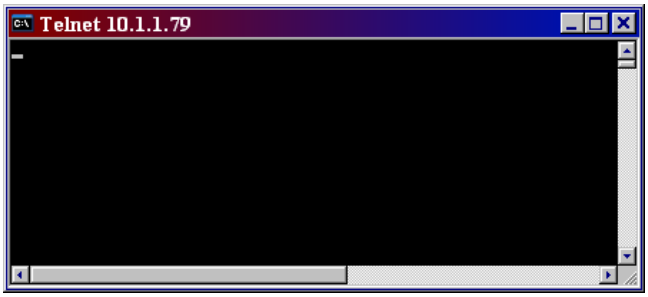
    - Remove and reapply power to your SB700EX.

- The SB700EX factory application will boot.



MTTTY Application Boot

5. Run Telnet by typing: telnet 10.1.1.79 24 after the prompt, and press the Enter key. Note: This assumes a port number of 24. You must replace this port number with the listening port number that you assigned in the "Device Connection Settings (TCP mode)" section. Remember to substitute your IP Address for our example IP Address (i.e.10.1.1.79).



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

16. Revision History

Revision	Date	Comments
1.0	2014-09-02	Initial release as a universal platform manual for devices running the secure factory application by default
1.1	2014-09-11	Updated documentation to include hardware sections for usage of the NBPKBU-XXXCR quad-UART blade boards with the NBPK70EX-100IR
1.2	2015-03-18	Updated to include TCP outgoing connection parameter on power-up of checking and attempting to maintain a valid connection with a remote device even after it has returned from being disconnected or offline
1.3	2015-11-23	Updated to include Ethernet-to-I2C features.
1.4	2016-10-14	Added SB800EX
1.5	2020-01-02	Removed references to A/D and GPIO configuration, since those are not available on these platforms. Updated various sections to clarify operation.