N e t B u r n e r

Networking in 1 Day!

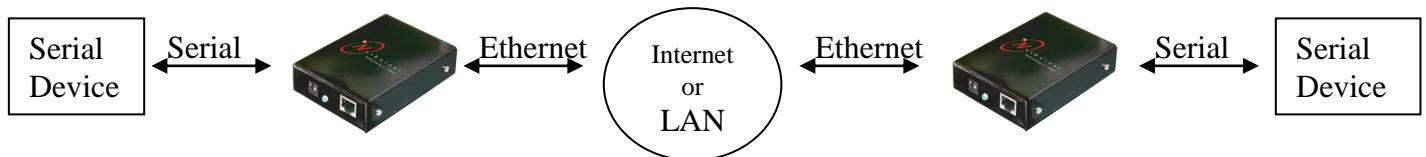# Serial-to-Ethernet Tunnel Application Note

Introduction

This application note applies to the platforms listed below. SBL2e based Serial To Ethernet devices can also do serial tunneling but the default factory application running on the devices is slightly different.

- CB34EX
- NANO54415
- PK70EX-232
- PK70EX-485
- PK70EX-MMS
- SB70LC
- SB700EX
- SB800EX

Throughout this document the term "S2E" will be used to represent any of these Serial-To-Ethernet devices.

A serial tunnel enables two serial devices to talk to each other over any distance by using a network connection between to transfer the serial data. The serial devices can be in the same building, or in different countries. They do not need to know anything about the tunnel or use a special protocol, the tunnel will be completely transparent to them. RS-232, RS-422 and RS-485 protocols are all supported (the NANO54415 and SB70LC also supports I2C).

Configuration:

Device Configuration Overview

Serial tunneling typically uses TCP, but UDP is also supported. SSL/TLS encryption is supported when using TCP.

When using TCP, the Serial-to-Ethernet application can be configured to act as a TCP Server or a TCP Client.

- **TCP Server mode (default)**: The S2E will wait for an incoming TCP connection. Once a connection has been made, serial and network data can flow in both directions.

- **TCP Client mode**: The S2E creates an outgoing TCP connection to a TCP server. The connection can be established at power-up, which keeps a TCP connection active at all times. Or, a TCP connection can be made only when serial data is available (i.e. serial data is received by the S2E serial port).

In order to enable serial tunneling:

- Configure one S2E as a Server, and the other as a Client. An analogy would be a telephone call in which one device (the Client) needs to "call" the other device who is listening for the call (the Server).
- Specify the device name or IP Address of the Server in the Client configuration

TCP Server Configuration for Incoming Connections

The TCP Server is the first of the two devices that must be configured. Use your web browser to access the web server of the S2E device that will be the Server. If the IP address is not known, run the NetBurner IPSetup utility to determine the IP address and type the IP address into the URL field of your web browser, or click on the IPSetup **Launch Webpage** button. In this example we will use serial Port 1 as the data port, and leave serial Port 0 as the debug/status port.

TCP Server Network Device IP Settings

The first section of the web page specifies the settings for the device's IP address, mask, gateway and DNS server. The S2E TCP Client must always know the IP address of the S2E TCP Server (this device), so the Address Mode must be set to "Static", and values for the IP address, mask, gateway and DNS server have been entered. These values can also be entered using the IPSetup utility.

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Network

Protocol	TCP/SSL ∨ (Changing will terminate all existing connections)		
Device Name (for DHCP)	SB70LCSX-0633		
NetBIOS Name	SB70LCSX-0633		
Version	02.07.0001		
	Static Settings	**DHCP Assigned Values**	**Address Mode**
Device IP Address	10.1.1.24		Static IP ∨
Device Subnet Mask	255.255.255.0		
Device Gateway	0.0.0.0		
DNS Server	0.0.0.0		
NTP Server	pool.ntp.org	208.75.88.4	No network gateway to get time
System Time:	NTP: AUG 15 2017 day: 226 (TUE) 16:38:07 UTC (When page was loaded)		

Reset To Factory Defaults   Submit New Settings

TCP Configuration Web Page

Configuration for both devices, the TCP server and client, is done through the TCP configuration web page shown below. Next we will go through the settings for each. Note this is a screen shot from the SB70LC which also has I2C.

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TCP

	Port 0	Port 1	I2C Port
Listen for incoming network connections	☑	☑	☑
Listening network port:	23	24	26
Timeout and disconnect after this many seconds of inactivity.	60	60	60
Allow new connection if the existing connection has been idle for this many seconds.	30	30	30
When to begin making outgoing tcp connections:	Never ⌄	Never ⌄	
Connect on network port:	1000	1000	
Connect to this address:	(Enter IP Address)	(Enter IP Address)	
Alternate address:	(Enter IP Address)	(Enter IP Address)	
Timeout and disconnect after this many seconds of inactivity.	60	60	
Retry failed outgoing connections after this many seconds.	360	360	
Check and maintain valid connection at intervals in seconds.	0	0	
Use custom packetization logic (below)	☐	☐	
Number of characters to accumulate before sending TCP packet:	32	32	
Number of msec to wait for accumulated characters: 0 waits forever.	100	100	
Flush TCP frame when this character is received (Enter NA to disable):	NA	NA	
USE SSL rather than TCP for connections:	☐	☐	☐
Always Save Serial Chars reguardless of connection status:	☐	☐	

Network Settings on Serial Port - Advanced Serial Settings

Submit New Settings

TCP Server Settings: Listen for Incoming Connections

The first step is to configure the S2E server device to listen for an incoming network connection. The following settings are in the Listen for Incoming Connections section of the web page. In this example we will be using Port 1 for the serial tunnel. In the screen shot below we will be listening on TCP port number 4545. If no data is being transferred we disconnect after 60 seconds. If a new connecting comes in after 30 seconds and there is an existing connection, the server will close the existing connection and allow the new one.

The timers are important because a TCP connection is open, no data is being transmitted, and a client does not close the TCP connection, the result is a half open socket (for example, the client power cord get disconnected by mistake). This means the TCP server still thinks the connection is valid and keeps the socket open, preventing a new connection from being accepted on the same port number (in this case 4545). If data was being transmitted, then a socket error would occur and the socket would be closed.

The override timeout is nice because as soon as the client is back on line a connecting will be made immediately.

TCP

	Port 0	Port 1	I2C Port
Listen for incoming network connections	☑	☑	☑
Listening network port:	23	4545	26
Timeout and disconnect after this many seconds of inactivity.	60	60	60
Allow new connection if the existing connection has been idle for this many seconds.	30	30	30

TCP Client Network Device IP Settings

The first section of the web page specifies the settings for the device's IP address, mask, gateway and DNS server. The S2E TCP Client must always know the IP address of the S2E TCP Server, but the IP address of the Client does not need to be fixed. In this example the client uses DHCP as shown below.

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Network

Protocol	TCP/SSL ∨ (Changing will terminate all existing connections)		
Device Name (for DHCP)	SB70LCSX-0633		
NetBIOS Name	SB70LCSX-0633		
Version	02.07.0001		
	Static Settings	**DHCP Assigned Values**	**Address Mode**
Device IP Address	0.0.0.0	10.1.1.164	Dynamic IP (DHCP) ∨
Device Subnet Mask	0.0.0.0	255.255.252.0	
Device Gateway	0.0.0.0	10.1.1.1	
DNS Server	0.0.0.0	8.8.8.8	
NTP Server	pool.ntp.org	0.0.0.0	No status yet
System Time:	No valid time UTC (When page was loaded)		

Reset To Factory Defaults   Submit New Settings

TCP Client Settings: Make Outgoing Connections

Once the server is configured to listen for an incoming connection, the next step is to configure the client device to make an outgoing connection to the server. This is done on the TCP configuration page of the client device. In this case the Listen for incoming network connections checkbox is unchecked, and the other settings in that section no longer matter. Outgoing connections can be made at power up for a permanent connection, or connections can only be made when serial data is available. The next two fields specify the IP address of the server and the port number it is listening on.

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TCP

	Port 0	Port 1	I2C Port
Listen for incoming network connections	☑	☐	☑
Listening network port:	23	24	26
Timeout and disconnect after this many seconds of inactivity.	60	60	60
Allow new connection if the existing connection has been idle for this many seconds.	30	30	30
When to begin making outgoing tcp connections:	Never	If serial data received	
Connect on network port:	1000	4545	
Connect to this address:	(Enter IP Address)	10.1.1.24	
Alternate address:	(Enter IP Address)	(Enter IP Address)	
Timeout and disconnect after this many seconds of inactivity.	60	60	
Retry failed outgoing connections after this many seconds.	360	360	
Check and maintain valid connection at intervals in seconds.	0	0	

Custom Packetization

NetBurner S2E devices also have custom serial packetization options such as accumulating data bytes before sending and sending on receipt of a termination character. These options can be used for the server, client, or both.

Use custom packetization logic (below)	☐	☐
Number of characters to accumulate before sending TCP packet:	32	32
Number of msec to wait for accumulated characters: 0 waits forever.	100	100
Flush TCP frame when this character is received (Enter NA to disable):	NA	NA

Security: Use SSL (TLS) Instead of TCP

Selecting this checkbox on both the client and server will enable SSL/TLS encryption. Both server and client need to have the checkbox enabled.

USE SSL rather than TCP for connections:	☐	☐	☐

Additional Features

The NetBurner S2E devices have many other features including:
- UDP for serial transfers instead of TCP
- Custom serial baud rates
- Password management
- HTTPS
- SSH Server
- Certificate management