Spectrum24
CB 1000

User Guide

INF-CB1000-01
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Patents

This product is covered by one or more of the following U.S. and foreign Patents:

U.S. Patent No.

4,460,120; 4,496,831; 4,593,186; 4,603,262; 4,607,156; 4,652,750; 4,673,805; 4,736,095; 4,758,717; 4,816,660; 4,845,350;
4,896,026; 4,897,532; 4,923,281; 4,933,538; 4,992,717; 5,015,833; 5,017,765; 5,021,641; 5,029,183; 5,047,617; 5,103,461;
5,113,445; 5,130,520; 5,140,144; 5,142,550; 5,149,950; 5,157,687; 5,168,148; 5,168,149; 5,180,904; 5,216,232; 5,229,591;
5,230,088; 5,235,167; 5,243,655; 5,247,162; 5,250,791; 5,250,792; 5,260,553; 5,262,627; 5,262,628; 5,266,787; 5,278,398;
5,280,162; 5,280,163; 5,280,164; 5,280,498; 5,304,786; 5,304,788; 5,306,900; 5,321,246; 5,324,924; 5,337,361; 5,367,151;
5,373,148; 5,378,882; 5,396,053; 5,396,055; 5,399,846; 5,408,081; 5,410,139; 5,410,140; 5,412,198; 5,418,812; 5,420,411;
5,436,440; 5,444,231; 5,449,891; 5,449,893; 5,468,949; 5,471,042; 5,478,998; 5,479,000; 5,479,002; 5,479,441; 5,504,322;
5,519,577; 5,528,621; 5,532,469; 5,543,610; 5,545,889; 5,552,592; 5,557,093; 5,578,810; 5,581,070; 5,589,679; 5,589,680;
5,608,202; 5,612,531; 5,619,028; 5,627,359; 5,637,852; 5,664,229; 5,668,803; 5,675,139; 5,693,929; 5,698,835; 5,705,800;
5,714,746; 5,723,851; 5,734,152; 5,734,153; 5,742,043; 5,745,794; 5,754,587; 5,762,516; 5,763,863; 5,767,500; 5,789,728;
5,789,731; 5,808,287; 5,811,785; 5,811,787; 5,815,811; 5,821,519; 5,821,520; 5,823,812; 5,828,050; 5,850,078; 5,861,615;
5,874,720; 5,875,415; 5,900,617; 5,902,989; 5,907,146; 5,912,450; 5,914,478; 5,917,173; 5,920,059; 5,923,025; 5,929,420;
5,945,658; 5,945,659; 5,946,194; 5,959,285; 6,002,918; 6,021,947; 6,047,892; 6,050,491; 6,053,413; 6,056,200; 6,065,678;
6,067,297; 6,068,190; 6,082,621; 6,084,528; 6,088,482; 6,092,725; 6,101,483; 6,102,293; 6,104,620; 6,114,712; 6,115,678;
6,119,944; 6,123,265; 6,131,814; 6,138,180; 6,142,379; D305,885; D341,584; D344,501; D359,483; D362,453; D363,700;
D363,918; D370,478; D383,124; D391,250; D405,077; D406,581; D414,171; D414,172; D418,500; D419,548; D423,468;
D424,035; D430,158; D430,159; D431,562

Invention No. 55,358; 62,539; 69,060; 69,187 (Taiwan); No. 1,601,796; 1,907,875; 1,955,269 (Japan); European Patent 367,299; 414,281; 367,300; 367,298; UK 2,072,832; France 81/03938; Italy 1,138,713

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About This Document

This User Guide refers to the following documents:

Part Number	Document Title
INF-WLAN-01 Revision A	Spectrum24 Wireless LAN Adapter Models LA-3021 PC Card & LA-3026 ISA Adapter Product Reference Guide
70E-20706-03 Revision A	Spectrum24 Wireless LAN Adapter Models LA-4121 PC Card & LA-4123 PCI Adapter Product Reference Guide

Conventions

Keystrokes are indicated as follows:

ENTER	identifies a key.
FUNC, CTRL, C	identifies a key sequence. Press and release each key in turn.
Press A+B	press the indicated keys simultaneously.
Hold A+B	press and hold the indicated keys while performing or waiting for another function. Used in combination with another keystroke.

Typeface conventions used include.

<angles>	indicates mandatory parameters in a given syntax.
[brackets]	for command line, indicates available parameters; in configuration files brackets act as separators for options.
GUI Screen text	indicates the name of a control in a GUI-based application.
Italics	indicates the first time a term is used, a book title, variables, and menu titles.
`Screen`	indicates monitor screen dialog. Also indicates user input. A screen is the hardware device on which data appears. A display is data arranged on a screen.
`Terminal`	indicates text shown on a radio terminal screen.
URL	indicates Uniform Resource Locator. Click the URL to launch browser.

This document uses the following for certain conditions or types of information:

Indicates tips or special requirements.

Indicates conditions that can cause equipment damage or data loss.

Indicates a potentially dangerous condition or procedure that only Symbol-trained personnel should attempt to correct or perform.

Contents

Chapter 1 Introduction

1.1 Spectrum24 Client Bridge 1000

The Spectrum24 Client Bridge (CB 1000) provides an interface between Ethernet devices, Serial (RS-232) devices and Spectrum24 radio LANs depending on the operational mode. The CB 1000 supports the Spectrum24 LA-41X1 direct-sequence (DS) and the LA-302X frequency-hopping, spread spectrum (FH) radio cards.

The CB 1000 does not include the Spectrum24 LA-41X1 Direct-Sequence (DS) or the LA-302X Frequency-Hopping, Spread Spectrum (FH) radio cards. Contact a Symbol Sales representative for the most current list of radio cards supported by the CB 1000.

1.2 Included with the CB 1000

- CD with configuration utility manager software and user guide.

1.3 Spectrum24 Features:

- bridging architecture to providing communication between radio and wired multiple network segments
- switchable data rates enabling 1 Mbps, 2 Mbps and 11 Mbps devices to communicate in the same network environment
- a design based on the IEEE 802.11 and 802.11b standards
- seamless roaming for mobile users
- data encryption supporting Open System, 40-bit and 128-bit (DS Only) Encryption algorithms
- automatic recognition of Spectrum24 2 Mbps (FH) and 11 Mbps (DS) radio cards
- RS-232 DB9 serial port with speeds up to 115,200 bps
- 10Base-T Ethernet with RJ45 network interface
- Ethernet bridging capability with single or multiple Ethernet clients
- Pass through serial mode for protocol-less devices
- support for standard TCP, IP, UDP, LPD, and Telnet protocols
- Telnet and serial user interface for parameter settings
- Windows supported configuration utility manager

1.4 Radio Basics

Spectrum24 devices use both *electromagnetic waves* to transmit and receive electric signals without wires. Users communicate with the network by establishing radio links between Mobile Units (MUs) and Access Points (APs).

Spectrum24 uses *FM (frequency modulation)* to transmit digital data from one device to another. Using FM, a radio signal begins with a carrier signal that provides the base or center frequency. The digital data signal is superimposed on the *carrier signal (modulation)*. The radio signal

propagates into the air as electromagnetic waves. A receiving antenna in the path of the waves absorbs the waves as electrical signals. The receiving device demodulates the signal by removing the carrier signal. This demodulation results in the original digital data.

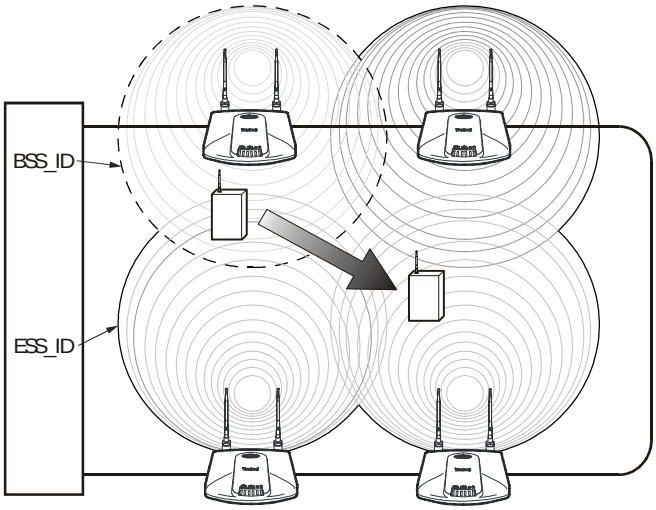
Spectrum24 uses the *environment* (the air and certain objects) as the transmission medium. Spectrum24 radio devices transmit in the 2.4 to 2.5-GHz frequency range, a license-free range throughout most of the world. The actual range is country-dependent.

Spectrum24 devices, like other Ethernet devices, have unique, hardware-encoded *Media Access Control (MAC)* or *IEEE addresses*. MAC addresses determine the device sending or receiving data. A MAC address is a 48-bit number written as six hexadecimal bytes separated by colons. For example:

```
ØØ:AØ:F8:24:9A:C8
```

1.4.1 Cellular Coverage

An AP establishes an average communication range with MUs called *a Basic Service Set (BSS*) or *cell*. When in a particular cell the MU associates and communicates with the AP of that cell. Each cell has a *Basic Service Set Identifier (BSS_ID)*. In IEEE 802.11, the AP MAC address represents the BSS_ID. The MU recognizes the AP it associates with using the BSS_ID. Adding APs to a LAN establishes more cells in an environment, making it an RF Network using the same *Extended Service Set Identifier (ESSID).*



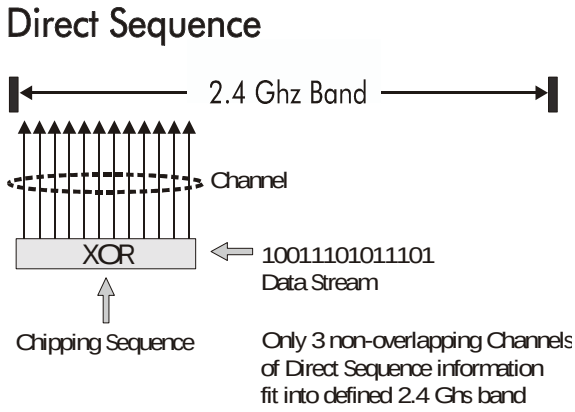
APs with the same ESSID define a coverage area. The MU searches for APs with a matching ESSID and synchronizes with an AP to establish communications. This allows MUs within the coverage area to move about or *roam*. As the MU roams from cell to cell, it switches APs. The switch occurs when the MU analyzes the reception quality and determines that a different AP canprovide better service based on the best signal strength and lowest load distribution.

If the CB does not find an AP with a usable signal, it performs a scan to find any AP. As MUs switch APs, the AP updates the *association table*.

1.5 Direct-Sequence Spread Spectrum

Spread spectrum (*broadband*) uses a narrowband signal to spread the transmission over a segment of the radio frequency band or spectrum. Direct-sequence is a spread spectrum technique where the transmitted signal is spread over a particular frequency range. The Spectrum24 AP-41X1 DS Access Point and the LA-41X1 WLAN PC Card adapter use direct-sequence spread spectrum (DSSS) for radio communication.

Direct-sequence systems communicate by transmitting a redundant pattern of bits called a *chipping sequence*. Each bit of transmitted data is mapped into *chips* by the DSSS device and rearranged into a pseudorandom *spreading code* to form the chipping sequence. The chipping sequence is combined with a transmitted data stream to produce the DSSS device output signal.



Note

In the United States, the three non-overlapping direct-sequence channels are channels 1, 6 and 11.

Mobile Units receiving a direct-sequence transmission use the spreading code to map the chips within the chipping sequence back into bits to recreate the original data transmitted by the DSSS device. Intercepting and decoding a direct-sequence transmission requires a predefined algorithm to associate the spreading code used by the transmitting DSSS device to the receiving DSSS device. This algorithm is established when the access point and MU are configured. The bit redundancy within the chipping sequence enables the receiving MU to recreate the original data pattern, even if bits in the chipping sequence are corrupted by interference.

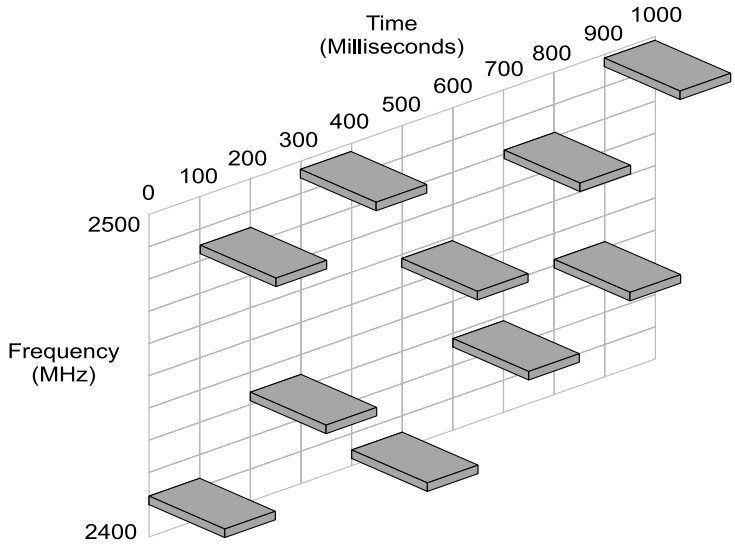
The ratio of chips per bit is called the *spreading ratio.* A high spreading ratio increases the resistance of the signal to interference. A low spreading ratio increases the bandwidth available to the user. The access point uses two chips per bit among three channels within the 2.4 GHz band in a pattern avoiding any 1 or 2 Mbps systems operating in the same area. The access point is capable of an 11 Mbps data transmission rate, but the coverage area is less than a 1 or 2 Mbps access point since coverage area decreases as bandwidth increases.

1.6 Frequency-Hopping, Spread Spectrum

The *spread spectrum* technique (also known as *broadband*) takes a narrowband signal and spreads the data signal over a broad segment of the radio frequency band or spectrum. Spectrum24 uses Frequency-Hopping Spread Spectrum (FHSS) technology for radio communication. FHSS spreads the signal by transmitting a short burst on one frequency, then jumps to another frequency for another short burst and so on. Spectrum24 uses the 2.4 - 2.5 GHz range depending on the country. This range does not require licensing from the FCC. FHSS offers a higher transmission rate than a conventional radio narrowband method.

In FHSS systems, the carrier frequency of the transmitter changes (or hops) in accordance with the pseudo-random code sequence. The code sequence dictates the frequency order selected by the transmitter. The transmitter takes the input data and spreads it in a predefined method. Each receiver has to understand this predefined method and reconstruct the signal before interpreting data. Stations in a FHSS cell hop or change the carrier frequency at synchronized intervals. Government regulatory agencies and standards, such as ETSI, MKK, the FCC and IEEE 802.11, determine the number of frequency *hops* (79 for the U.S.), the *hopping pattern* (sequence each frequency is used) and *dwell time* (time at each frequency). The FCC requires 75 or more hopping frequencies used and a maximum 400ms for dwell time per frequency. The transmitter and receiver synchronize to the hop sequence

to ensure communication. The time synchronization field included in message packets coordinates the hop timing of all units. Each hop is a frequency at least 6 MHz away from the previous frequency and has a 1 MHz bandwidth.



FHSS devices can operate in an adverse environment and coexist with other devices/services in the same band. The average signal strength being relatively low on any given frequency results from FHSS. When the signal intelligence is spread out over several MHz in the frequency spectrum, the resulting power spectrum also spreads out (less than 1 watt). This results in the transmitted power spread out over a wide frequency bandwidth and makes detection very difficult without the code sequence or pattern.

Hopping provides enhanced data reception in the presence of interfering signals, like fixed frequency radio networks or microwave ovens.
The system also resists interference because it spends a short time on each given frequency. If an interfering source is present or interference at a

specific frequency, only a small number of frequency hops are blocked rather than the entire range. With interference occurring on one frequency, the data is retransmitted on a subsequent hop at another frequency. Even if constant interference exists on a given frequency, it affects the radio network for only a short time on that specific frequency. Although APs can share the same hopping sequence, they usually do not synchronize in time. Rarely do they simultaneously arrive at the same frequency, referred to as contention. Interfering signals can be avoided by listening before transmitting. This reduces the probability and impact of overlapping frequencies or collisions. Although devices can hop to the same frequency, they eventually hop to different frequencies after the hop time.

In a Spectrum24 network, each AP negotiates a different hopping sequence at start-up. This allows APs to provide frequency separation and evenly divide the frequency spectrum among the units.

1.6.1 S24 Network Topology

The variations possible in Spectrum24 network topologies depend on the following factors:

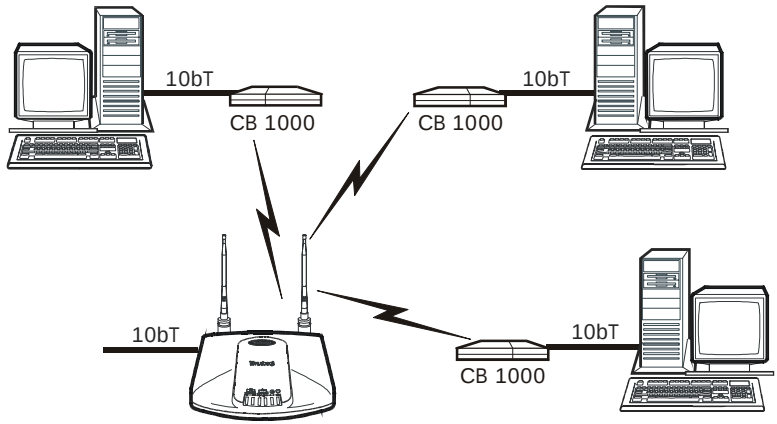
- Frequency-Hopping (FH) or Direct-Sequencing (DS) network environment
- the number of APs present in the network
- the types of Spectrum24 radios used, 1 and 2 Mbps (FH) or 11 Mbps (DS).

Chapter 2 Operating Modes

The Client Bridge has two different operational modes, Infrastructure and Peer-to-Peer mode, and three networking ports, Ethernet, Spectrum24 and RS-232.

2.1 Infrastructure mode

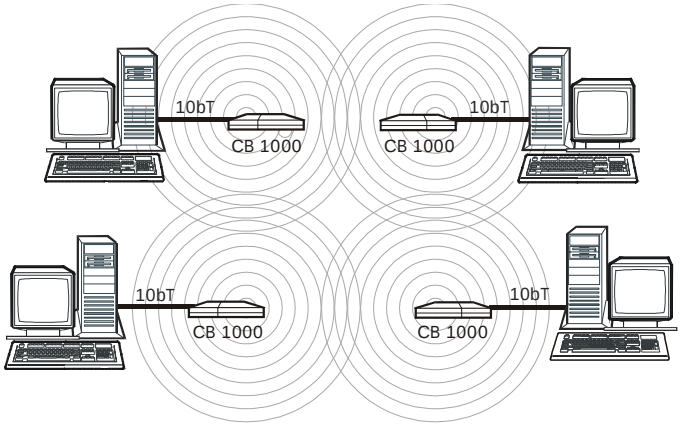
Infrastructure mode connects the CB 1000 Ethernet port with the Spectrum24 port and requires the use of an Access Point (AP). The Client Bridge connects through its Ethernet port to devices that have standard Ethernet capabilities. The Client Bridge associates with a Spectrum24 AP located nearby.
The AP sees this Client Bridge/network device combination as a standard Mobile Unit (MU). The AP forms a bridge between the wired LAN and the wireless clients. In infrastructure mode, the AP is a dedicated device that is wired into the LAN back bone while the Client Bridge units can be physically moved throughout the WLAN. The Client Bridge communicates with any device on the network by routing data through the associated AP. Multiple APs with the same ESSID can be placed within the same area. The 802.11 standard enables the Client Bridge to roam among the MUs and APs. Reassociation occurs as long as the Client Bridge has the same ESSID as the AP it is trying to associate with.



2.2 Peer-to-Peer Mode

Peer-to-Peer mode allows two or more Client Bridge units to communicate exclusively with one another without the use of an AP. Use this mode to connect serial devices (serial line replacement or wireless serial cable) or as an Ethernet bridge between Ethernet devices.

- In this configuration the Client Bridge communicates using the TCP network protocol.



2.3 Serial Line Replacement

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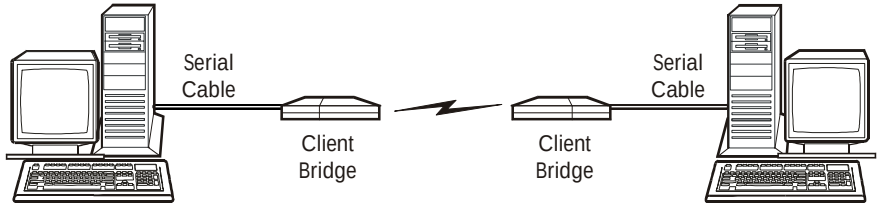


Two CB 1000s are required to perform wireless serial line replacement. Serial line replacement can operate with the radio in either Infrastructure or Peer-to-Peer mode. When performing Serial Line Replacement, data is exchanged using one of two protocols:

- RMP Pipe
- TCP Pipe.

2.4 LED Status and Error Indicators

LED indicators on the Client Bridge include:

	Power (green)	Indicates power when active.
	Status (amber)	Indicates the software has detected an abnormal condition. See event log for status information.
	Associated (green)/ Radio Activity (amber)	A green LED indicates association between the CB 1000 and an AP or a MicroAP operating in the Spectrum24 Network. Amber indicates Spectrum24 Radio traffic detected.
	Wired LAN Attached (green)/ In Use (amber)	A green LED indicates a connection between the CB 1000 and the wired Ethernet. Lights amber to indicate activity is detected on the wired Ethernet.
	Serial Activity Transmit (green)/ Receive (amber)	A green LED indicates the CB 1000 is receiving data through the serial port and displays amber when the CB 1000 is transmitting data through the serial port.

2.5 International Roaming Operation

Enable the international roaming mode to automatically adjust the CB 1000 to the country in which it operates. The CB 1000 requires association with an AP to provide country information. To enable International Roaming mode, select *International Roaming* in the Radio parameter window. After power up, the CB 1000 listens on several channels for 802.11 traffic. When it recognizes a valid frame, it sends an international probe and waits for an international probe response (IPR). If an IPR is received, the CB 1000 copies the appropriate country parameters to the RAM table and adjusts its hopping sequence table. At this point, the CB 1000 can associate with the AP.

The CB 1000 keeps the country parameter information as long as it is associated to the AP sending the IPR.

An associated CB 1000 probes the AP for a new country code after 20 minutes.

2.6 Data Encryption

Mobile nodes and other hosts can be a target of information theft. This occurs when unauthorized users eavesdrop on a network to glean proprietary information. The absence of a physical connection makes wireless links particularly vulnerable to eavesdropping.

Encryption becomes the most efficient method in preventing information theft and improving data security. *Encryption* requires scrambling and coding of information, typically with mathematical formulas called algorithms, before the information is transmitted over a communications link or network. An *algorithm* is a set of instructions or formula describing how to scramble and encode the data. A *key* is the unique code used by the algorithm to encrypt or decrypt the data. *Decryption* is decoding and unscrambling the received encrypted data.

The same device, host computer or front-end processor, usually performs both encryption and decryption. The data direction determines which function, encryption or decryption, the device performs. The device takes plain text, encrypts and scrambles the text typically by mathematically combining the key with the plain text as instructed by the algorithm, then transmits the data over the network. At the receiving end, another device unscrambles and decodes the encrypted text revealing the original message. A user can know the algorithm, but cannot interpret the data without the key. Only the sender and receiver of the transmitted data know the *secret key*.

Symbol uses the *Wired Equivalent Privacy (WEP)* algorithm, specified in IEEE 802.11 section 8, for encryption and decryption. WEP uses the same secret key for both encrypting and decrypting plain text. Typically, an external key management service distributes the secret key. Symbol recommends that users regularly change keys for added security.

IEEE 802.11 defines two types of *authentication*, *Open System* and *Shared Key. Open System authentication* is a null authentication algorithm. *Shared Key authentication* is an algorithm where both the AP and the MU share an *authentication key* to perform a *checksum*, an error-checking operation, on the original message.

By default, IEEE 802.11 devices operate in *an open system network* where any wireless device can associate with an AP without authorization. A wireless device with a valid shared key is allowed to associate with the AP. *Authentication management messages*, also called packets, are unicast, meaning authentication messages transmit between only one AP and one MU, not broadcast or multicast.

2.7 Distributed System Mobile Unit

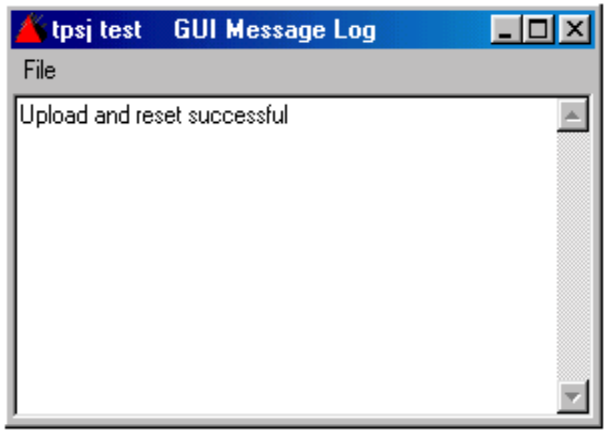
DS MU mode is available only with the Spectrum24 2 Mbps FH radio card. Configure APs for WLAP.

The Client Bridge in *Distributed System Mobile Unit* (DS MU) mode bridges multiple Ethernet stations. The DS MU performs like a wireless AP while retaining the roaming properties of an MU, but does not support associations with other MUs. An MU in DS MU mode functions as part of the distribution system, as defined by 802.11.

To configure the Client Bridge for DS MU support:

1. Start the CB Manager utility. The Unit List window displays.
2. Highlight the client to be configured for `dsmu` In the Unit List window.
3. Select Configure or double click on the client in the Unit List window.
4. Select the Radio tab at the configuration window for the client.
5. Select Advanced.
6. Select yes under the dsmu field.
7. Select Update and Reset the unit.

8. A message log window displays indicating the procedure was successful. Select Close to return to the Unit List window.



Once configured, DS MU mode can only be turned off by repeating the above procedure and selecting no in the dsmu field. The associated AP supports four CBs and each CB supports four Ethernet clients, providing the total throughput demanded does not exceed the radio's capability.

Chapter 3 Installing the Hardware

3.1 Preparation:

Determine the wireless protocol and obtain the *Extended Service Set Identifier (ESSID),* IP address and netmask (subnet mask) parameters from the network administrator if attaching the CB 1000 to an existing Spectrum24 network. Obtain the following components:

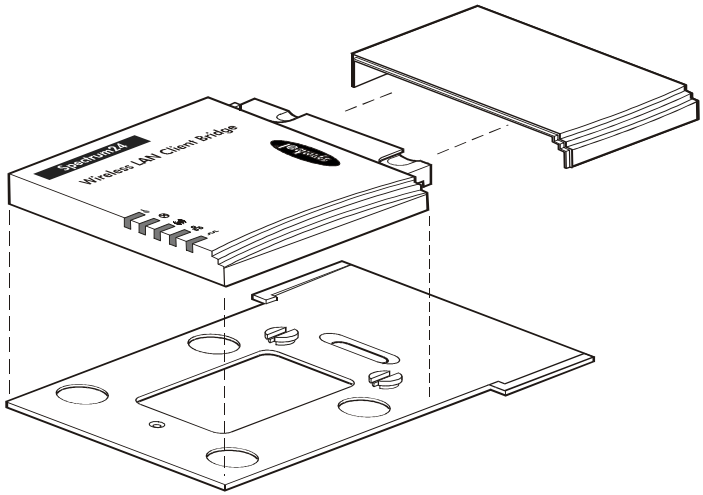
- CB 1000
- a CB 1000 power supply; 5.2 V, 1 A
- a Spectrum24 radio card
- a computer with an available CD ROM drive and an Ethernet port.
- a straight-through 10Base-T RJ-45 Ethernet cable
- The CB 1000 *Configuration Utility Manager* software.

3.2 CB 1000 Radio Card Installation

1. Remove the CB 1000 from the packaging.

The CB 1000 ships fully assembled. To install the radio and use the CB 1000, some disassembly and re-assembly is required.

2. Remove the bottom mounting plate.



Remove the cap from the CB 1000 by pulling on the side of the cap to release it from the main CB 1000 assembly. Removal of the cap allows access to the radio card slot.

Note

CB 1000 units do not include radio cards. Contact a Symbol Sales representative for the most current list of radio cards supported by the CB 1000.

Caution

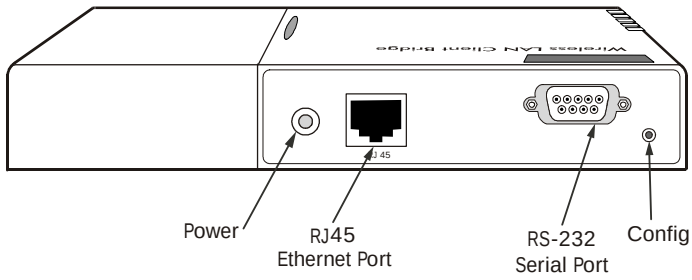
Confirm that the CB 1000 is not powered on

1. Insert the Symbol Spectrum24 radio card into the PCMCIA slot in the CB 1000. Arrows on the front of the card indicate the insertion point to the slot.

Caution

Align the card when inserting. Insert the card firmly without forcing. Forcing the card into the slot can damage the device or the card.

2. Replace the cap on the CB 1000.
3. Replace the bottom mounting plate.
4. Connect the power adapter to the port labeled 5V DC.
5. Plug one end of a standard, straight through 10Base-T RJ-45 Ethernet cable into the network port on the computer.



6. Plug the other end into the RJ-45 port on the CB 1000.

Note

If the CB 1000 is connected to a hub, the device requires an Ethernet *cross-over* cable to make the connection. Use a *straight through* cable to connect the CB 1000 directly to a PC.

7. Verify the Ethernet Link LED is illuminated (refer to *2.4 LED Status and Error Indicators* on page 14) on the CB 1000, indicating Ethernet connection from the CB 1000 to the attached device.

   The CB 1000 hardware is now ready for detection and configuration.

Chapter 4 Installing the CB 1000 Configurator Utility

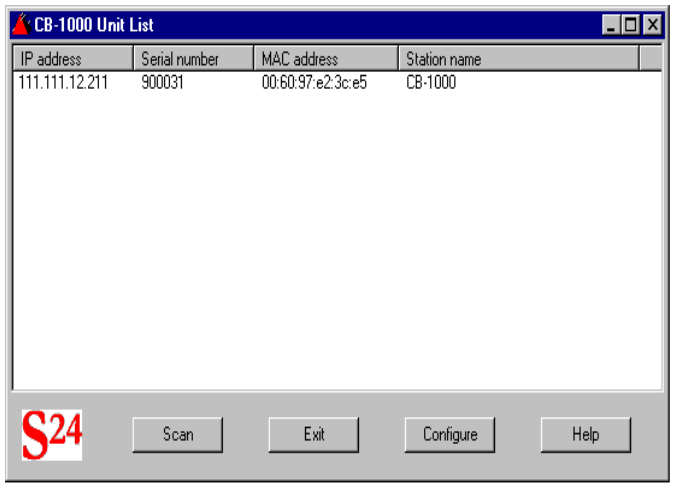
The *CB 1000 Configurator* operates on a host PC or workstation running Windows 95/98 or 2000. Refer to the README.TXT file on the CD included with the *CB 1000 for installation instructions.* This utility enables the user to graphically and remotely:

- display all CB 1000 units running on the local network
- display and edit the current configuration of any CB 1000
- save and load configurations to and from the local host
- update the CB 1000 firmware.

Chapter 5 Windows Configurator Utility

Windows 95,98, NT and 2000 supports the windows Configurator Utility. Start the Configurator Utility by double clicking on the SymbolWinManager.EXE file installed in *Chapter 4: Installing the CB 1000 Configurator Utility*. The *CB 1000 Unit List* window displays:

5.1 Configuring the CB 1000



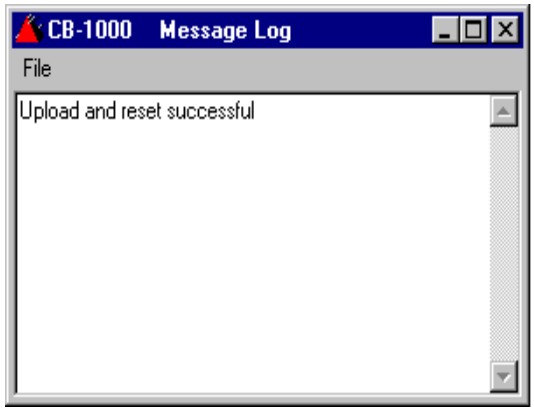
The *Unit List* window of the CB 1000 displays a list of CB 1000 units detected. All CB 1000 units can be controlled from this main window. The buttons on this window allow the user to SCAN, EXIT, CONFIGURE a unit, and display the HELP page. The SCAN function performs a search for active CB 1000 units. After a scan the display is updated with the available CB 1000 units.

In the CB 1000 Unit List window double click on the CB 1000 unit to be configured or click on the CB 1000 unit and select *Configure* from the *Unit List* window. Match the serial number of the CB 1000 displayed in the *Unit List* window with the serial number found on the bottom side of the CB 1000 to identify the correct Client Bridge.

The configuration window displays:

The configuration window displays information about the CB 1000 *Configurator* and the selected unit. Three vertical tabs appear; *Network, Serial,* and *Radio* that define the categories of configuration options. Select a vertical tab to display additional sub-categories for each configuration option. At the bottom of the window select *Close* to exit the current configuration window. Select *Reload from Unit* button, to reload the current configuration from the CB 1000 to the CB 1000 Conigurator. Selecting the Update and Reset Unit button uploads the parameters from the CB 1000 *Configurator* to the CB 1000, and resets the CB 1000 so the changes take effect. During this operation the CB 1000 *Configurator* performs a syntax check of all parameters.

A message is displayed in the *GUI Message Log window* describing the errors and location or a successful operation.

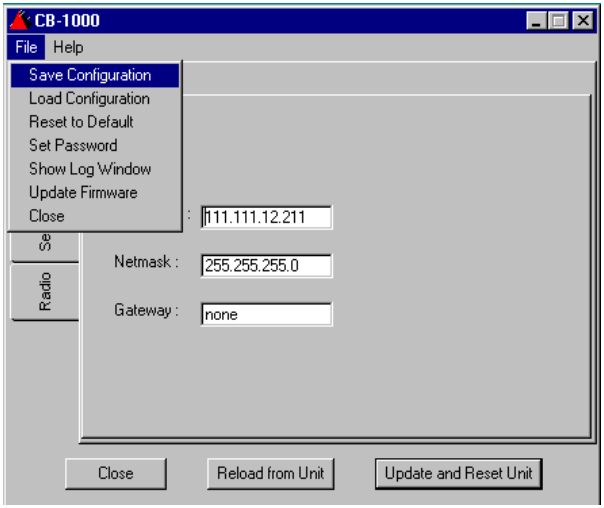


5.2 Using the File Menu Options

In the Configuration window select the *File* menu to:

- Save or load a configuration
- Reset the CB 1000 to factory defaults
- Set a new password or clear it
- Access a view of the log files
- Update the CB 1000 firmware.

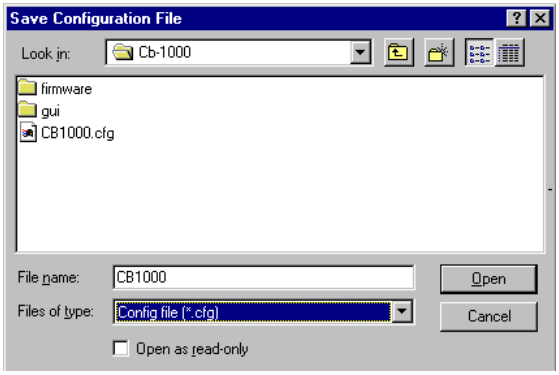
Perform the Reset To Default procedure (see *5.2.5: Resetting to factory defaults*) any time a radio card is installed. This loads the correct firmware to the specific Symbol radio card installed. The CB 1000 will not function unless this procedure is followed.



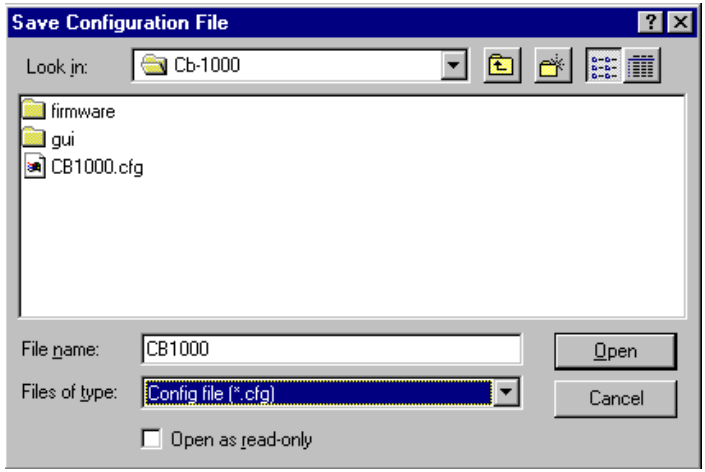
5.2.1 Saving the configuration file

To save the configuration settings of the CB 1000 to a local file.

1. Click the Update And Reset Unit button. This applies current parameters from the Configurator utility to the CB 1000.
2. From the FILE menu select Save Configuration.
3. Use the dialog box to navigate to a directory and save the current configuration. The default path is the CB 1000 program directory.



4. Click open to save the file.



5.2.2 Loading a Configuration

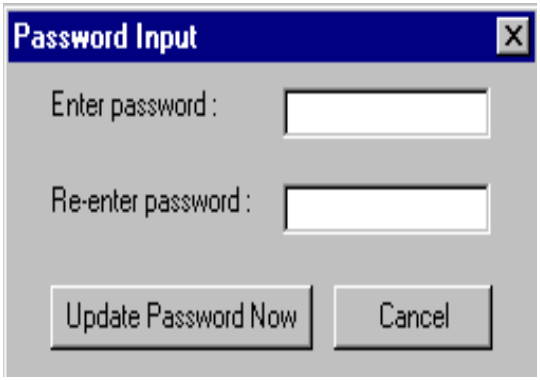
To reload a saved file to the currently selected CB 1000.

1. Click on the File menu.
2. Select Load Configuration. Use the dialog box to navigate to the directory which contains the saved configuration file.
3. Choose the desired configuration file and click the Open button. The loaded parameters display in the CB 1000 Configurator, but they are not uploaded to the CB 1000.
4. Click the Update And Reset Unit button to activate the parameters.

Note

If the CB 1000 radio is different than the radio in the CB 1000 when the configuration parameters were saved, all parameters but the radio options are loaded. Setup the new radio parameters manually. This procedure allows changing the radio while keeping the network and serial settings. Save a new version of the configuration file and use in future loads that use the same radio parameter settings.

5.2.3 Changing the password



Setting a password prevents unauthorized users from accessing or changing the settings on the CB 1000. Enter the password each time to access the Configurator utility and reconfigure a CB 1000. The default is no password required.

Set Password in the File menu allows setting or changing a password on a CB 1000. A dialog box requires the new password to be entered twice. Clicking Update Password Now causes the new password to activate immediately. Leave the field blank to remove the password or to access the Configurator utility and reconfigure a CB 1000 without entering a password.

5.2.4 Upgrading the CB 1000 Firmware

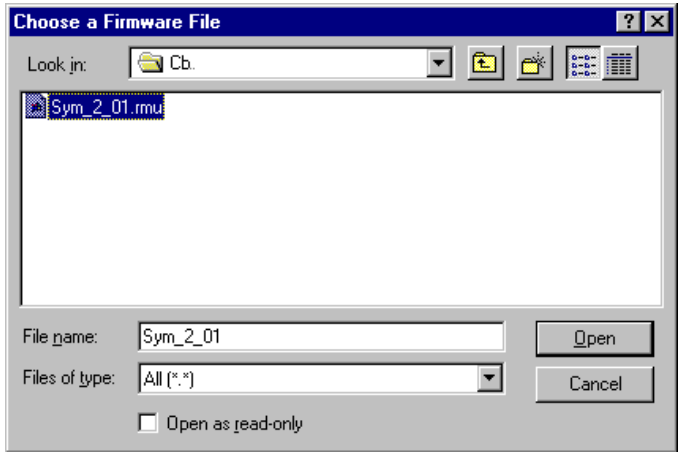
The CB 1000 *Configurator* is designed to update the firmware on the CB 1000.

Note

Refer to the radio documentation to upgrade the radio firmware.

Download the latest version of firmware from the Symbol Technologies web site at www.symbol.com to the computer that is currently running the CB 1000 Configurator and note the directory it is saved to. The firmware file will extension is *.rmu*.

1. Click on the File menu in the main window of CB 1000 configurator.
2. Select Upload Firmware.
3. Use the file selector to navigate to the location of the firmware file.

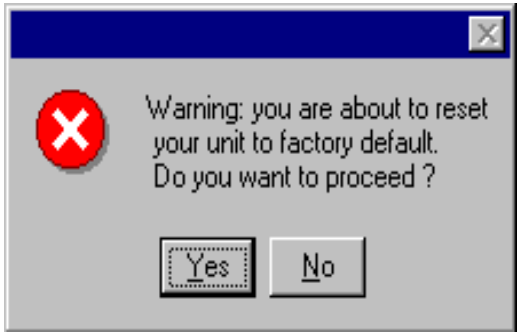


4. Double click on the file. The *Log Viewer* displays a progress status. At the end of the process, the CB 1000 resets. The *Log Viewer* indicates a successful update. The status light on the CB 1000 flashes, and after 15 to 20 seconds the new image is fully installed and the CB 1000 is ready for use.

5.2.5 Resetting to factory defaults

This feature restores the CB 1000 back to its original settings and adapts the firmware to the radio installed.

1. Click on the File menu in the main window of the CB 1000 *Configurator*.
2. Select Reset To Default. A warning banner appears indicating all parameters are being reset to factory defaults. Click Yes to continue or No to cancel.



Depending on the current radio network setting, resetting to factory default could leave the CB 1000 unable to associate. Resetting to default resets all parameters, including the radio *ESSID*.

5.2.6 Changing Radios

The CB 1000 Configurator utility is designed to detect the type of radio currently in use and to reset the specific radio parameters accordingly. This procedure retains the network and serial parameters of the previous radio type when the radio is changed.

1. Save the current radio configuration as described in *5.2.1 Saving the configuration file* on page 28.
2. Remove power from the CB 1000
3. Install the new radio, and return power to the CB 1000.

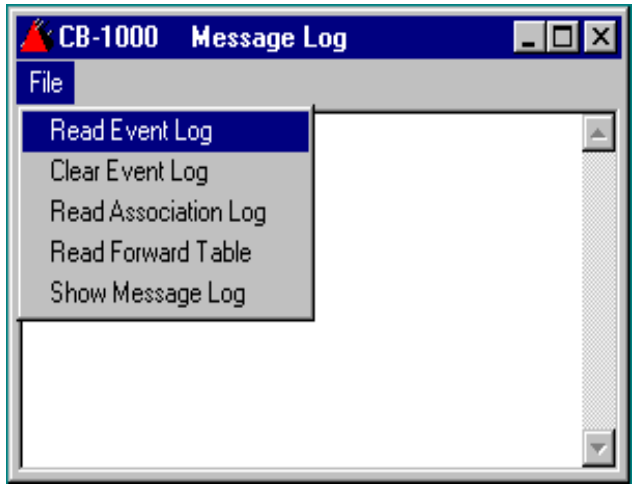
4. Reset to factory defaults as described in *5.2.5 Resetting to factory defaults* on page 32.
5. Load the configuration saved in step one follow the procedures described in *5.2.2 Loading a Configuration* on page 29.
   All non-radio parameters are retrieved.
6. Set the specific parameters for the new radio and follow the instructions described in *6.1 Configuration of the Radio Settings* on page 37.

Note

Perform the Reset To Default procedure (see *5.2.5 Resetting to factory defaults* on page 32) any time a radio card is installed. This loads the correct firmware to the specific Symbol radio card installed. The CB 1000 will not function unless this procedure is followed.

5.2.7 Log Viewer

7. Select Show Log Window from the FILE menu of the main window.
8. Select File.



The Log Viewer has two functions:

- displays the different logs and tables stored on the CB 1000
- displays status and error messages from the Configurator utility.

Select FILE menu from *Log Viewer window* to switch views between the different CB 1000 logs and the Configurator utility messages.

5.2.8 Message Log Window

The GUI Message Log displays status messages from the Configurator utility.

5.2.9 Event Log

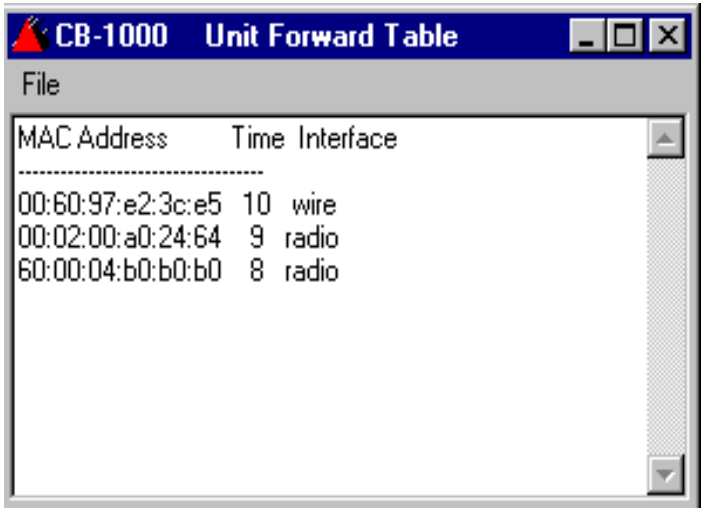
The event log displays status and information generated by the CB 1000 hardware. Display the event log by selecting the FILE in the Log window and choose the Read Event Log option. Clear the entries from the event log by selecting Clear Event Log option from the FILE menu. When the firmware identifies an unusual event. Information is written into the event log and the status LED is illuminated. After information is read, clear the entries from the event log and clear the status LED by selecting Clear Event Log. The CB 1000 if possible functions normally after the status LED is illuminated.

5.2.10 Association Log

The Association Log records association and dis-association from the AP or a MicroAP. Each event is timestamped and, if available, the AP MAC address is displayed. Each dis-association event contains only a timestamp. The timestamp indicates the number of 10 millisecond periods since the unit was turned on or reset. For example, a timestamp of 6000 corresponds to a time of 60 seconds, and a timestamp of 20 corresponds to a time of 0.2 seconds.

5.2.11 Forwarding Table

The forwarding table displays the MAC addresses that have been seen by the CB 1000. The table lists the interface, wire or radio, and the MAC address. The time for each entry indicates the number of seconds until that entry is removed from the forwarding table.

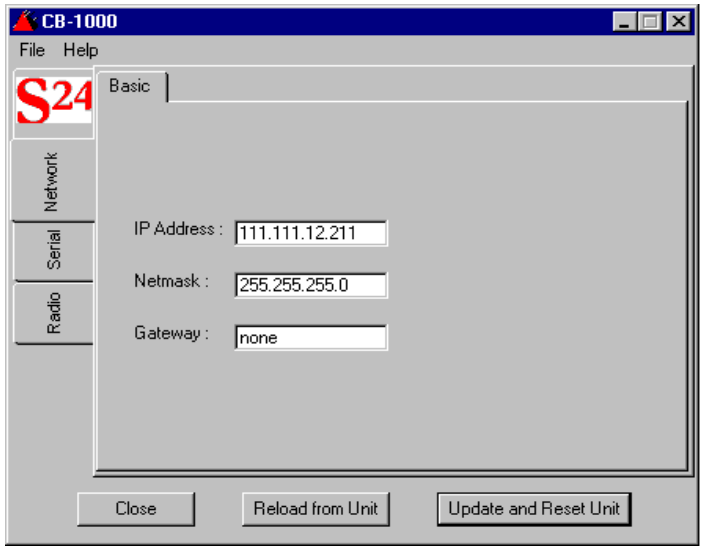


Chapter 6 Basic Radio Configuration

6.1 Configuration of the Radio Settings

These procedures are required to add a CB 1000 to a Spectrum24 wireless network. When the CB 1000 has associated, the radio association LED lights green. At the CB 1000 Unit List window, select the CB 1000 to configure, as described in *5.1 Configuring the CB 1000* on page 25.

1. Click on the Radio tab.
   When the Radio tab is selected, new horizontal tabs appear: Basic, Advanced, and Encryption. The Encryption tab does not appear if this option is not supported by the radio.

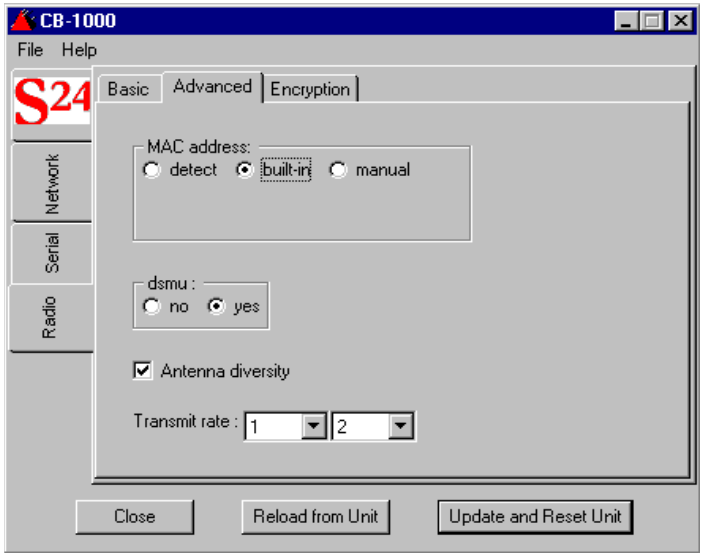


2. Enter the ESSID for the Spectrum24 wireless network or a Peer-to-Peer group. The ESSID, is used to specify a unique IEEE 802.11 wireless network. Wireless CB 1000 units use the ESSID to associate to a specific AP or other CB 1000s. Only devices with the same ESSID associate with each other. Alphanumeric values can be used in this field.

3. Enter the Station Name. The Station Name is a unique identifier that can be associted with a physical location. The value entered in this field is used to easily identify CB 1000 units with the *Configurator utility*. This field uses any alphanumeric combination. Assign a unique name to a CB 1000 device in this field. Any alphanumeric name can be used. The reserved name for accepting any ESSID is `Any`. The AP must be enabled to accept broadcast ESSID.
4. Click the Advanced tab.
5. In the MAC address field, select detect. The three options available are, detect, builtin, and manual (see page 102 for a description of each of these options). Symbol recommends leaving detect selected unless an advanced configuration is being performed. Selecting Detect allows the MAC address of the Ethernet client to be used throughout the network.
6. Click on the Update And Reset Unit button. The Configurator Message Log window appears with a message stating that the update was successful.

6.1.1 Advanced Radio Configuration

The Advanced Configuration screen is specific to the feature set of the wireless LAN card. Consult the radio user manual for appropriate settings. After configuration is complete, click on the Update And Reset button.



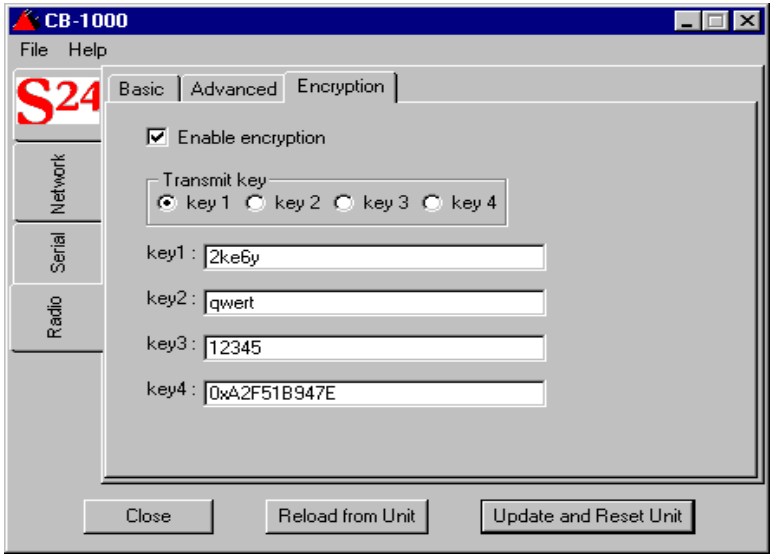
6.1.2 Encryption

Encryption is necessary to associate to an AP configured for encryption. Consult the radio manual for detailed description of how to set up encryption on the radio.

Note

For advanced radio configurations such as encryption, go to (http://www.symbol.com/services/downloads/download_spec24.html) and reference the Spectrum24 Wireless LAN Model LA-41X1 (for DS radios supporting 40 and 128 bit encryption) or Spectrum24 Wireless LAN Model LA-3021(for FH radios supporting 40 bit encryption) documentation.

1. Click the Encryption tab, and select Encryption.



2. Enter up to four encryption key values.
   Enter values for the encryption keys as text (ASCII) strings or hexadecimal numbers. Enter 0x before Hexadecimal values and use numbers 0 to 9 and the letters A-F. Text strings cannot begin with 0x. The level of encryption corresponds to the length of the encryption key. Spectrum24 FH radios support 40 and 128 bit keys. Spectrum24 DS radios only support 40 bit encryption keys.

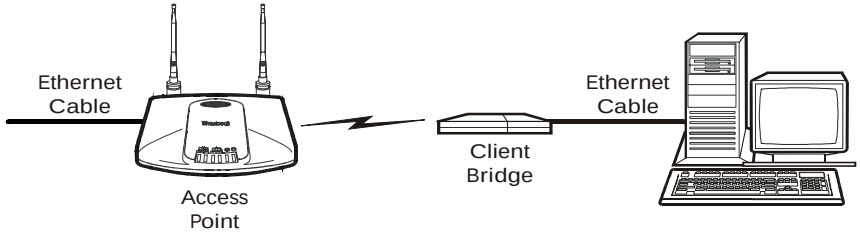
Encryption Level	Key Length	Example	
	Hex	ASCII	
40 bit DS & FH radios	0x + 10 digits	5 characters	0xFEDCBA9876
128 bit DS only radios	0x + 26 digits	13 characters	ALazyBrownDog

3. Select a transmit key. The transmit key is the encryption key used by the CB 1000 to encrypt messages sent over the radio. Messages received by the radio are decrypted if they were created using any of the four keys.

4. Click the Update And Reset Unit button at the bottom of the window. In Infrastructure Mode, the CB 1000 associates to the access point with the specified ESSID.

6.1.3 Wireless Ethernet Bridge

Configure the CB 1000 as a wireless Ethernet bridge to connect a wired unit such as a computer or Ethernet printer to a wireless network. The CB 1000 can be configured as a wireless Ethernet bridge in addition to performing any of the serial port applications.



Wireless Ethernet bridge configuration:

When connecting an Ethernet client into the AP network, reset the CB 1000 to default parameters and setup the ESSID to match the AP. No other parameters are required.

Chapter 7 Network Configuration

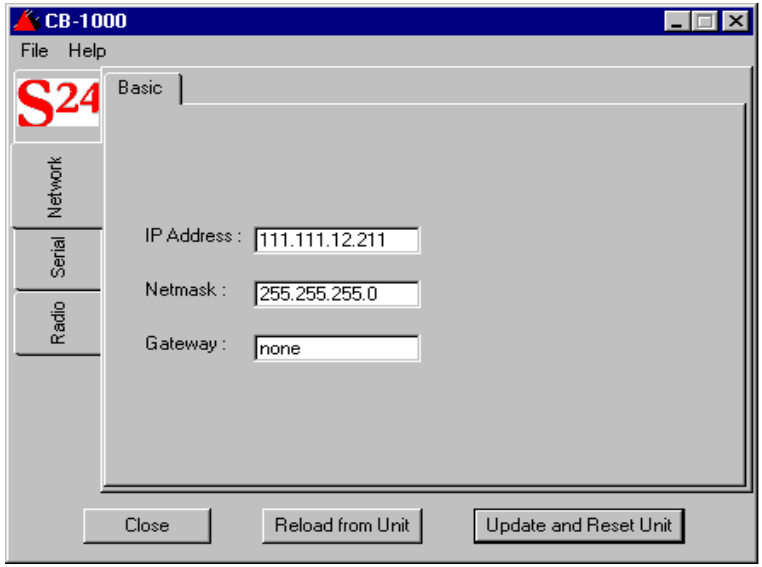
Communication directly with the CB 1000 allows the following:

- use of the serial port applications
- performing a network ping of the CB 1000
- remotely configure the CB 1000 via the telnet protocol.

Bridging does not communicate with the CB 1000 and does not require setting up the basic network parameters.

After completing the Configuration of Radio Settings in *6.1 Configuration of the Radio Settings* on page 37, proceed with the following steps to configure the network settings.

1. Click on the Network Tab. The IP Address, Netmask and Gateway fields are displayed.



2. Enter an IP address assigned to the CB 1000. The IP address is the network address that other computers use to communicate with the CB 1000.
3. Enter the Netmask. This is a value that defines the range of IP addresses available within the local network.
4. If the network uses a gateway (router or firewall), enter the IP address of the gateway. For serial applications the CB 1000 requires a gateway IP address to access computers or other CB 1000s beyond the Local Area Network (LAN) router or firewall. Enter `none` if no gateway is present or a gateway is not needed.

A gateway is not necessary for Ethernet bridging.

7.1 General Serial Configuration

Match the settings of the device connected to the CB 1000 via the RS-232 port. Configure the UART Settings and Flow Control Settings.

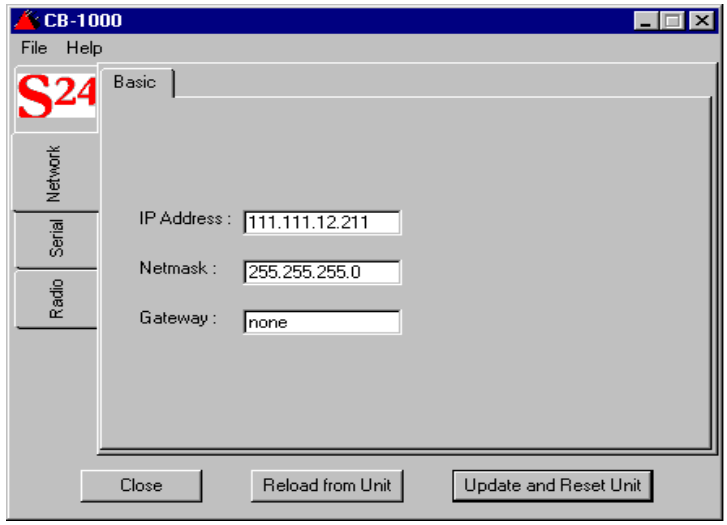
7.1.1 UART Settings

Universal Asynchronous Receiver/Transmitter (UART) is the fundamental hardware for serial communication. The speed and method of data transfer of the serial port are controlled here.

Configure the UART:

1. Click on the Serial tab at the Configuration window.

2. Click on the UART tab.



3. Select the baud rate (or type) that matches the device the CB 1000 is connected to. The baud rate indicates the data transfer rate of the serial port. The baud rate ranges from 300 to 115200 bps. Standard rates are 300, 1200, 2400, 9600, 19200, 38400, 57600, 115200.
4. Select the Data Bits setting that matches the device the CB 1000 is connected to. Data Bits determines the number of bits used to transmit data. The possible values are 7 and 8.
5. Select the Stop Bits setting that matches the device the CB 1000 is connected to. Stop Bits determine the number of bits used to represent an end of a character. The value can be 1 or 2.
6. Select the Parity that matches the device the CB 1000 is connected to. The parity bit is used to check for correct data transmission. Options are: none, even, and odd.

7.1.2 Flow Control

Flow control adjusts the flow of data from one device to another. This ensures the receiving device can handle all of the incoming data. Flow control becomes an important factor when one of the devices is capable of transmitting data at a rate faster than the other can receive it. There are two basic types of flow control, Hardware and Software.

7.1.3 Hardware Flow Control

Hardware flow control uses dedicated signal lines to dictate transmission of data and has two options that allow selecting which pair of lines to use for this type of flow control:

- RTS/CTS - Request To Send/Clear To Send
- DTR/DSR - Data Terminal Ready/Data Set Ready

The Windows flow control setting, Hardware, uses the RTS/CTS pair of flow control lines.

7.1.4 Software Flow Control

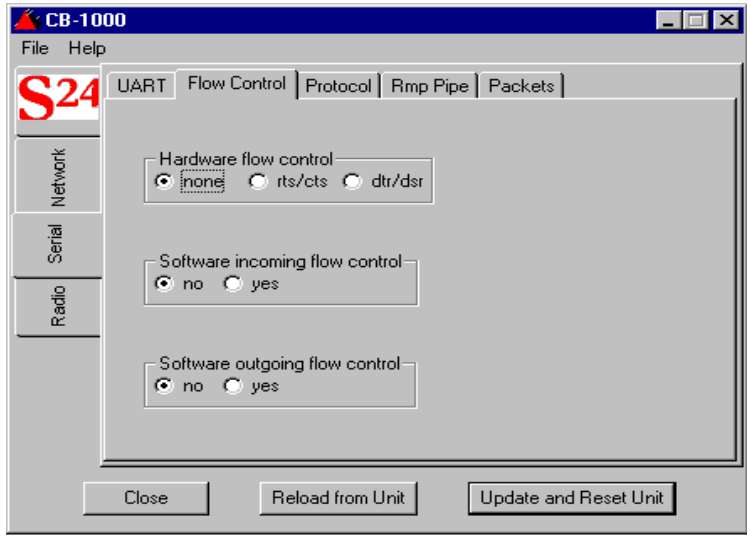
Software flow control uses two special characters, Xon and Xoff. Xon and Xoff are embedded in the data. These special characters instruct the computer to start and stop sending data. In the incoming direction, flow control prevents the CB 1000 from sending data when the computer is not ready. Enabling incoming flow control, enables the CB 1000 to interpret Xon/Xoff characters in the data stream as flow control signals. The Xon/Xoff characters are not considered part of the data.

The outgoing software flow control option specifies the generation of Xon/Xoff flow control characters by the CB 1000. The control characters are sent out the serial port and instruct the computer to start or stop sending data. This option prevents the computer from sending data when the CB 1000 is not ready to accept it.

Software flow control can have both incoming and outgoing mechanisms running simultaneously, individually, or not at all (this is the default).

7.1.5 Flow Control Configuration

1. Click on the Flow Control tab.



2. Check the flow control settings that match the device the CB 1000 is connected to.

7.1.6 Serial Packets

The serial packets parameters control the serial to network packet conversion process. Adjusting the default settings is not necessary for the Serial Packet Parameters. These parameters control the way that data received on the serial port is divided into Ethernet packets. The Ethernet packets are sent to serial application network connection. For specific information about the effects of the serial packet parameters see *Chapter 11 Serial Stream To Network Packet Conversion* on page 71.

Chapter 8 Serial Port Protocol Configuration

This chapter describes how to configure the CB 1000 serial port protocols. When a Client Bridge receives a message from the serial port, the Client Bridge turns the message into a series of network packets. The transmitting Client Bridge adds the originating port address, the destination port address and other critical information to each packet. When the transmitting Client Bridge finds radio silence, the Client Bridge sends the packets. RMP Pipe is used in situations that require real time or high-reliability data transfer. TCP Pipe is useful in situations when poor radio reception is a problem. RMP Pipe is the preferred protocol for Serial Line Replacement applications.

8.1 RMP Pipe

For applications where an RS-232 serial cable is being replaced by a pair of CB 1000s, or when CB 1000s are being used to form a broadcast topology (data is sent to all CB 1000s), the RMP Pipe protocol is used. In the RMP pipe protocol, the CB 1000 accepts a stream of data at its serial port and transmits it over the network to one or more receiving CB 1000s. When the data arrives at the receiving CB 1000, it is sent is out the serial port.

The RMP Pipe protocol sends data to the receiving unit as though CB 1000s were connected via serial cables. The data is not filtered or interpreted by the CB 1000s. Use this protocol when the CB 1000 is used as a drop-in replacement for a serial cable.

The RMP Pipe protocol has several configuration options that are designed to optimize data throughput and minimize packet loss according to the needs of any particular system.

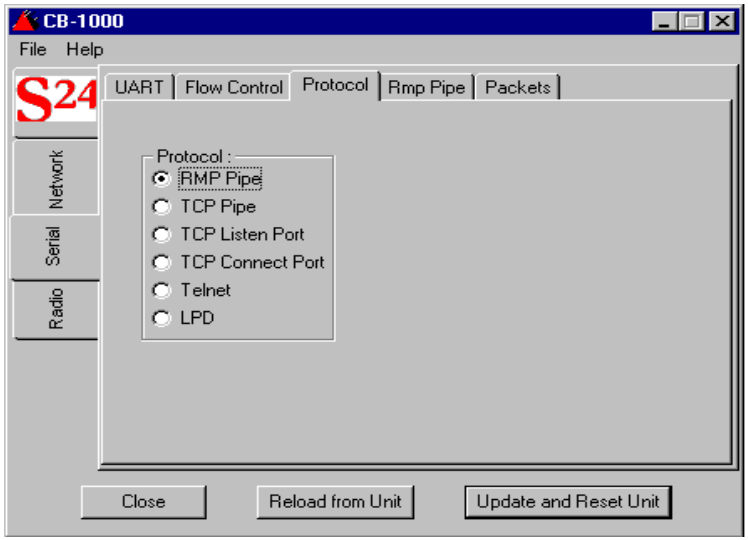
8.1.1 Configuring RMP Pipe

1. Complete the Basic Radio Configuration instructions in *Chapter 6 Basic Radio Configuration* on page 37.

Note

Use Peer-to-Peer mode if replacing a serial line or serial network with two or more CB 1000s without using an access point.

2. Complete the General Serial Configuration instructions in *12.1 CB 1000 Basic Serial Configuration* on page 75.
3. Click on the Serial tab.
4. Select the Protocol tab.
5. Select RMP Pipe in the Protocol field.



6. Click on the RMP Pipe tab.
7. If only two CB 1000s are used, do not change the settings from their default values. The default values allow two units to automatically detect each other and establish a connection. If more units are used configure each RMP Pipe Parameter as appropriate.

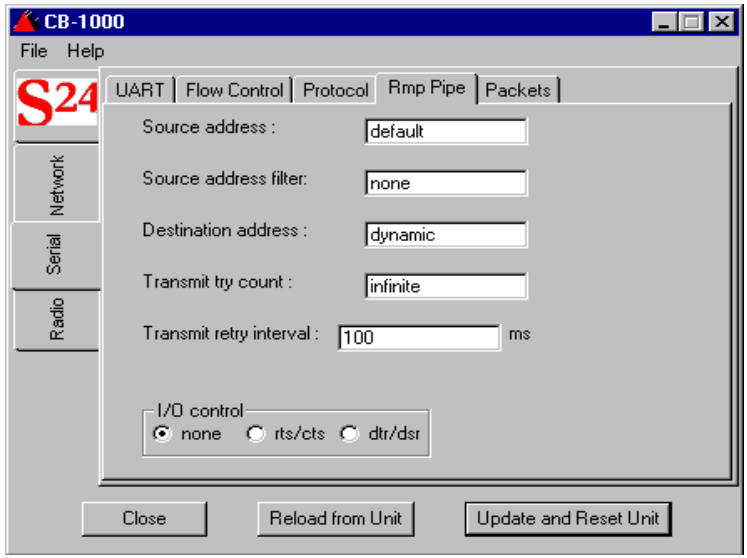
8.1.2 RMP Pipe Parameters

- Source Address

The RMP address is used to identify the CB 1000s when sending serial data to each other. The RMP Pipe value of `default` enables the CB 1000 to use its unique serial number as the RMP address. It is not necessary to change this setting.

- Source Address Filter

The CB1000 only accepts data coming from the specified address. For example, if the entry is set to 1234, only data originating from a CB 1000 with the RMP address of 1234 is accepted. All other data is ignored. The default value `none` allows data from any RMP address to be accepted. Change the Source Address Filter value only when there are multiple *RMP Passthrough Serial Line Replacement* installations in close proximity.



- Destination Address

The CB 1000 sends data received on the serial port to this address. Enter the RMP address of another CB 1000 for direct serial line replacement. Other possible values are `dynamic` (default) or `broadcast`. The `dynamic` value returns data to the CB 1000 data was received from. Using the value of `dynamic` allows two CB 1000s to communicate to each other. Entering `broadcast` sends data to all CB 1000s set to use RMP Pipe.

- Transmit Try Count

For `dynamic` data, this count specifies the number of attempts the CB 1000 makes to transmit each RMP packet of data. Ensure the CB 1000 is in range and powered up to reduce the possibility of transmission failures. When failures occur, data is lost if additional attempts are not made. This count allows the user to specify how many attempts to take at re-transmitting data. The maximum is 65,000 retries. The default is infinite, which causes each packet to be retried until successfully sent. Select the Transmit Try Count based on the sensitivity of the application to data delay and/or data loss.

- Transmit Retry Interval

This setting determines the time period to wait between re-transmission attempts. The value is specified in 1/100ths of a second, 100 (default) equals 1 second. The maximum value is 65000.

- I/O Control

I/O control is only relevant to serial line replacement applications that use the RMP protocol. I/O control defines control over digital inputs and outputs of the CB 1000 separately from the data lines. Digital input and output are shared with the flow control lines (RTS, DTR, CTS, and DSR), but in this mode the CB 1000 does not interpret them as flow control signals. They give the ability to send digital data from one device to another without interpretation by the CB 1000. Use of Hardware Flow control on lines that have been enabled for I/O Control is not allowed.

8.2 TCP Pipe

TCP Pipe, similar to RMP Pipe, makes no changes to the serial data stream. TCP Pipe differs from RMP Pipe by creating two independent network connections for transmitted and received data. Using two connections allows each CB 1000 to detect conditions when it has lost radio contact with the CB 1000.

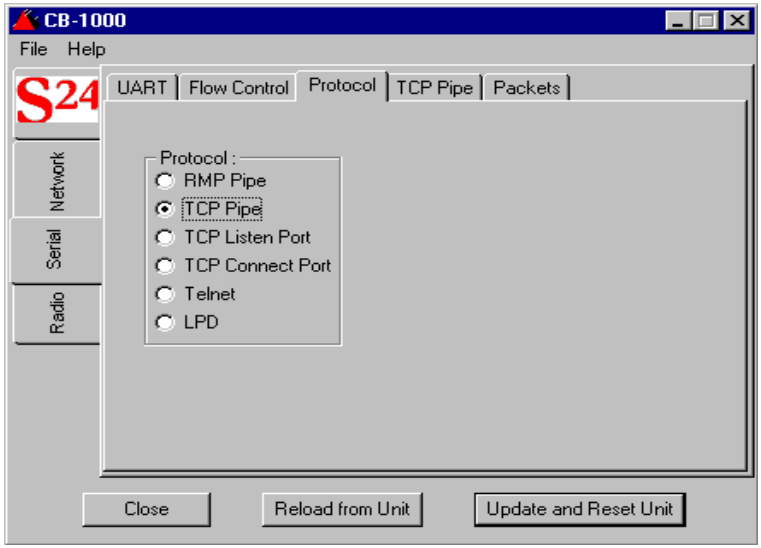
In this configuration, each CB 1000 simultaneously acts as a client and a server.

1. Complete the Basic Radio Configuration instructions in *6.1 Configuration of the Radio Settings* on page 37.

Use Peer-to-Peer mode if replacing a serial line or serial network with two or more CB 1000s without using an access point.

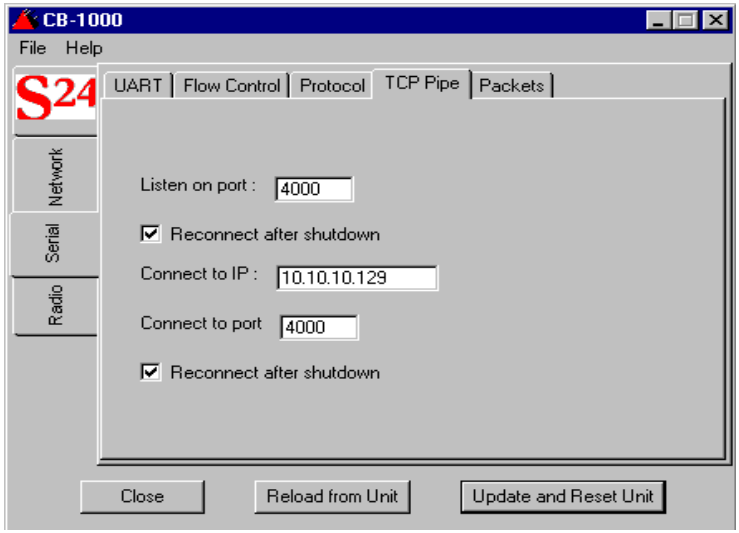
2. Complete the Network Configuration instructions in *Chapter 7 Network Configuration* on page 43.
3. Complete the General Serial Configuration instructions *7.1 General Serial Configuration* on page 44.

4. Click the Serial tab.



5. Select the Protocol tab.

6. Click on the TCP Pipe tab.



7. Set the Listen on port number for each unit to match the Connect to port number of the opposite unit. The defaults for both of these ports are 4000. Ensure a matching configuration by leaving the default values on both CB 1000s.
8. Enter the IP address of the opposite unit in the Connect to IP field.
9. The Re-connect after shutdown Listening Port and Connecting Port are checked by default. This feature allows the CB 1000s to re-establish communication after one of the CB 1000s loses communication with the other. For example, if one of the CB 1000s loses power or loses radio communication, the unit re-connects if this feature is enabled.
10. Click the Update And Reset Unit button.

8.3 Network Serial Port Configuration

This section describes how to configure the CB 1000 as a network serial port. This is a standard configuration for connecting a client serial device with a network server. Connection to a network serial port is accomplished over a TCP/IP socket connection. Any program that uses standard TCP/IP network sockets can communicate with the serial port of the CB 1000. Once a socket is established to the CB 1000, any data written to the socket is sent out the serial port and any data received by the serial port is returned via the socket connection.

The CB 1000 network serial port may be used in two modes:

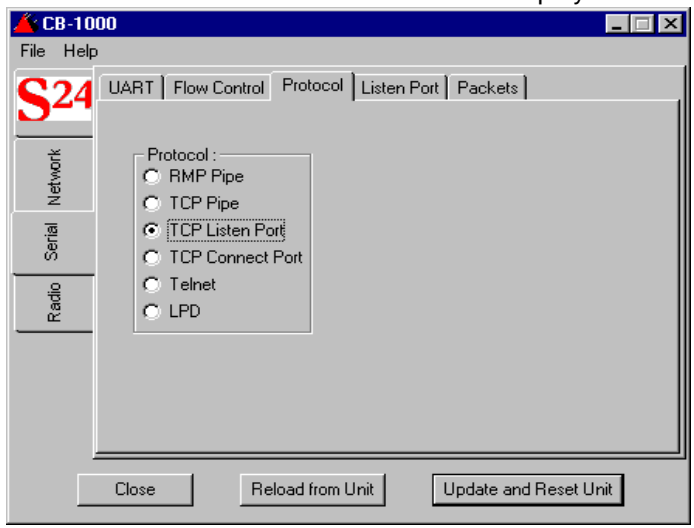
- TCP Listen Port
- TCP Connect Port.

In the *TCP Listen Port* mode before any serial communication is possible the socket connection is made by the network program for the CB 1000 to communicate. For example, use the TCP Listen Port if a central server expects to open a TCP/IP socket connection to the CB 1000. In the TCP Connect Port mode the CB 1000 establishes a socket connection to the IP address and port number specified in the configuration. For example, use the TCP Connect Port if the system expects the CB 1000 to open a TCP/IP socket connection to a central server.

The following procedures configure CB 1000 as a network serial port.

1. Complete the configuration of the basic radio settings instructions in *6.1 Configuration of the Radio Settings* on page 37.
2. Complete the Network Configuration instructions in *Chapter 7 Network Configuration* on page 43.
3. Complete the General Configuration instructions *7.1 General Serial Configuration* on page 44.

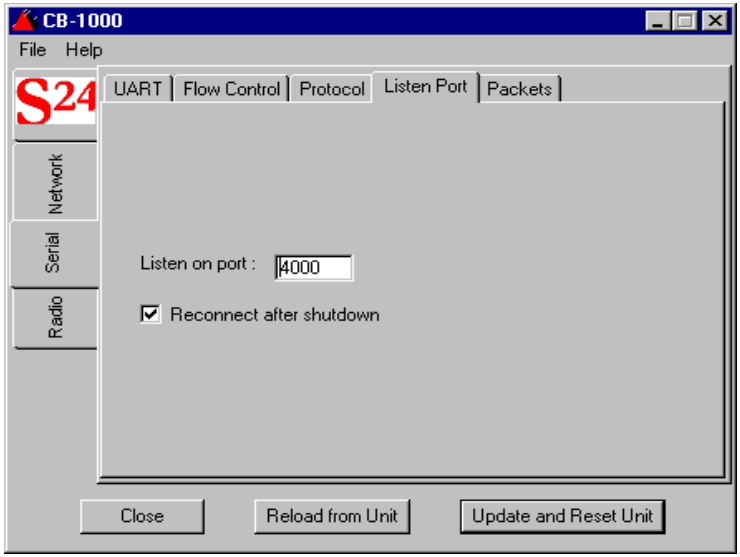
4. Click the Serial tab.
5. Select the Protocol tab. TCP Listen Port displays.



8.3.1 TCP Listen Port

Complete the configuration described in steps 1-4 on page 56 then follow the steps below:

1. Click on TCP Listen Port from the Protocol list.
2. Click on the Listen Port tab.

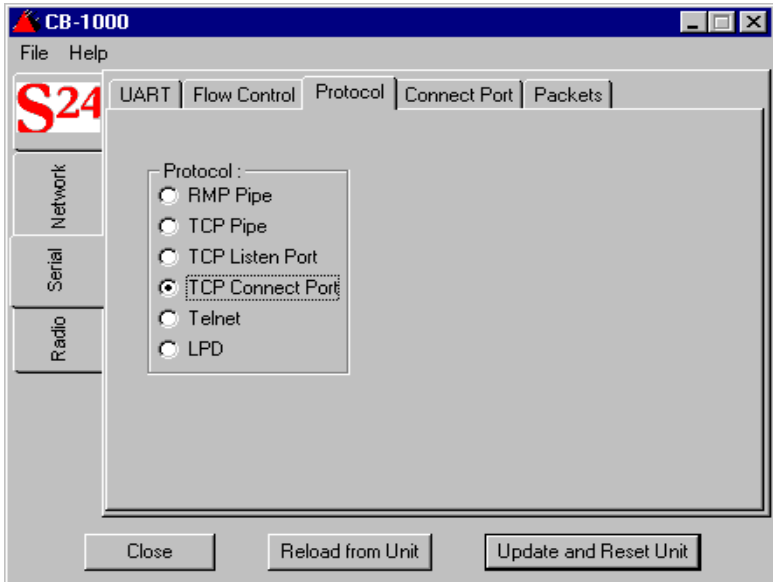


3. Type the port number the CB1000 listens for a connection. This is the port number the application uses to connect to the CB 1000. The default is 4000.
4. For most applications, leave the Reconnect after shutdown box checked. Check this box to accept a new connection if the active one closes.
5. Click the Update And Reset Unit button.

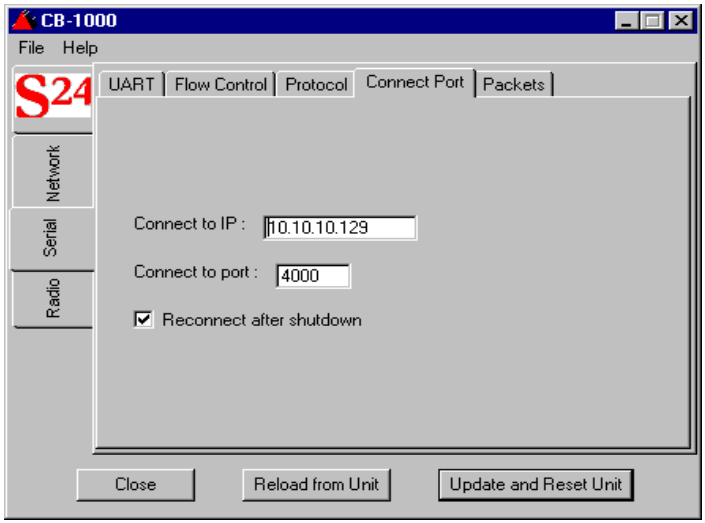
8.3.2 TCP Connect Port

Complete the configuration described in steps 1-4 on page 56 then follow the steps below:

1. Select the Protocol tab.



2. Click on TCP Connect Port from the Protocol list.
3. Click on the Connect Port tab.



4. Enter the IP address of the device the CB 1000 is connecting to in the Connect to IP field.
5. Type the port number of the device the CB 1000 is connecting to in the Connect to Port field. The default is 4000.
6. For most applications, leave the Reconnect after shutdown box checked. Check this box to accept a new connection if the active one closes.
7. Click the Update And Reset Unit button

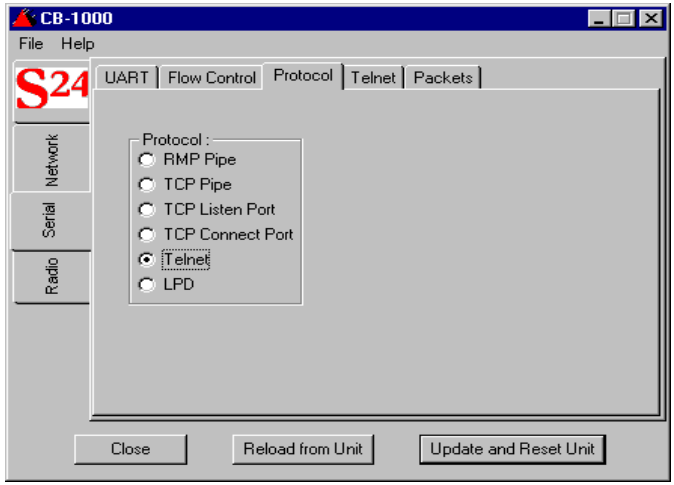
Chapter 9 Serial Telnet Client Configuration

This chapter describes how to configure the CB 1000 as a serial telnet client. Telnet is a method to connect and remotely log-in to a host computer or network device. The host computer or device requires a telnet server running for this service to be available. Once the telnet session is established from the CB 1000, any data received by the serial port of the CB 1000 is sent to the host. Any data returned from the host is sent out the serial port of the CB 1000. The serial port of the CB 1000 is connected to a serial terminal or a computer that is running terminal emulation software.

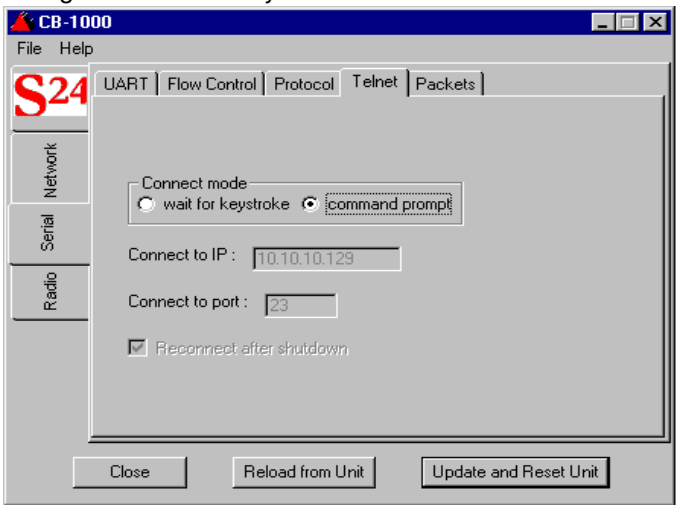
To configure the CB 1000 as a serial telnet client:

1. Complete the configuration of the basic radio settings instructions in *6.1 Configuration of the Radio Settings* on page 37.
2. Complete the Network Configuration instructions in *Chapter 7 Network Configuration* on page 43.
3. Complete the General Configuration instructions *7.1 General Serial Configuration* on page 44.
4. Click the Serial tab.
5. Select the Protocol tab.

6. Select the Telnet option in the Protocol list.



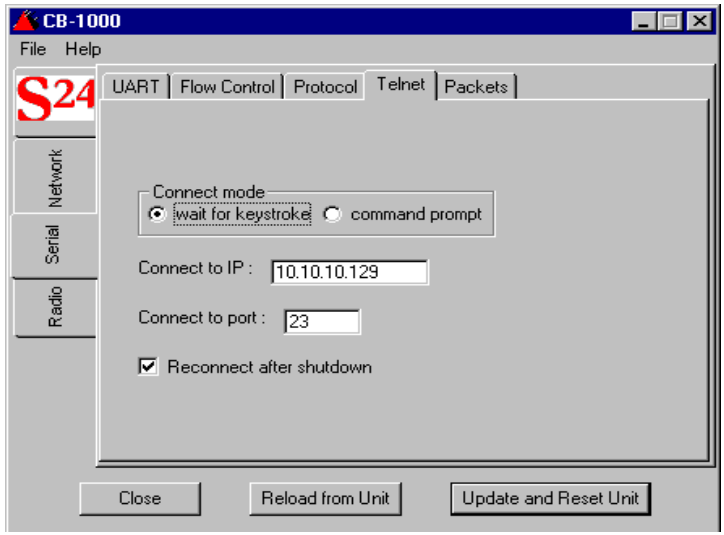
7. Click on the Telnet tab at the top of the panel. There are two methods that can be used to establish a telnet connection, Wait for Keystroke and Command Prompt. The following sections describe the methods and the configuration necessary for each.



9.1 Wait for Keystroke Connection

The wait for keystroke connection method establishes a connection to a specific telnet host when the user presses a key on the telnet terminal window. When the telnet connection is closed, the CB 1000 waits for a keystroke for re-connection to the host.

To configure the CB 1000 as a serial telnet client using the wait for keystroke connection method, follow steps 1-7 in *Chapter 9 Serial Telnet Client Configuration* on page 61 and then complete the steps below:



1. Click on the wait for keystroke button.
2. Enter the IP address of the device the CB 1000 establishes a telnet connection to in the Connect to IP field.
3. The default Connect to port value, 23, is the industry standard port number for telnet connections.
4. Leave the Reconnect After Shutdown box checked to allow a new session after closing an active one.
5. Click the Update And Reset Unit button.

9.2 Command Prompt Connection

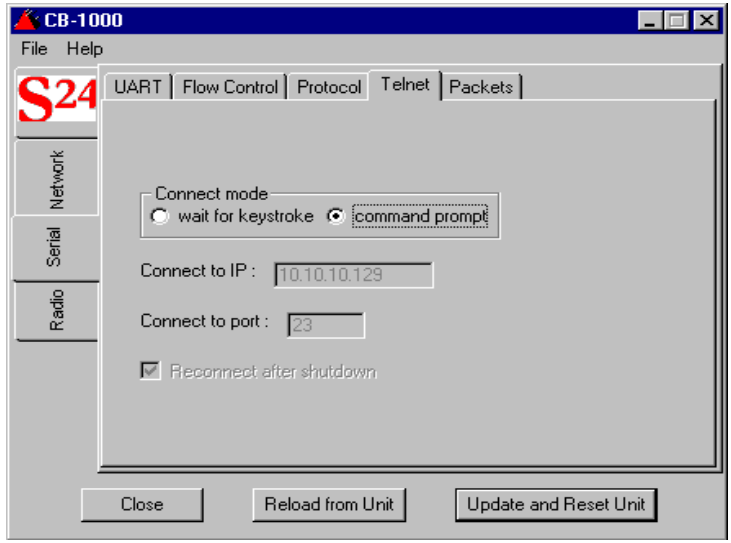
This section describes the command prompt connection method for a serial telnet client. The command prompt connection method provides a telnet prompt to the serial terminal. From the telnet prompt, the user can open a telnet session to any computer or device that is accessible on the network and is capable of accepting telnet connections.

To establish a telnet connection, at the command prompt type the command `open` followed by the IP address of the host computer or device (for example `telnet> open 10.10.10.129`). The IP address can optionally be followed by the TCP port number on which to open the connection. If the port number is omitted, the industry standard, default telnet port number of 23 is used.

Use the IP address, not the name of the host since only IP addresses are recognized by the CB 1000. When the telnet connection is closed, the CB 1000 displays a new telnet prompt.

To configure the CB 1000 as a serial telnet client using the command prompt connection method, follow steps 1-7 on *Chapter 9 Serial Telnet Client Configuration* on page 61 and then complete the steps below:

1. Click on command prompt button.
2. Click the Update And Reset Unit button



Chapter 10 LPD Print Server for Serial Printing

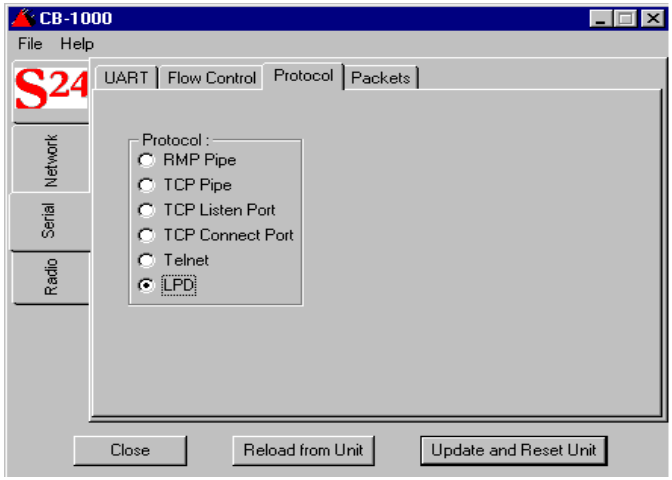
This section configures the CB 1000 for wireless printing to a serial printer. If configuring an Ethernet printer, follow the instructions for configuring a *6.1.3 Wireless Ethernet Bridge* on page 41.

The Line Printer Daemon (LPD) protocol requires an operating system that supports LPD to a remote host such as Windows. The LPD server on the CB 1000 uses a uni-directional protocol. Data is received via a wireless network connection and sent out the serial port to the printer. Data received from the serial port is ignored. This means the CB 1000 ignores data received from the printer except for software flow control characters (see *7.1.4 Software Flow Control* on page 46).

Use the network hostname or IP address of the CB 1000 as the remote printer host when configuring the operating system.

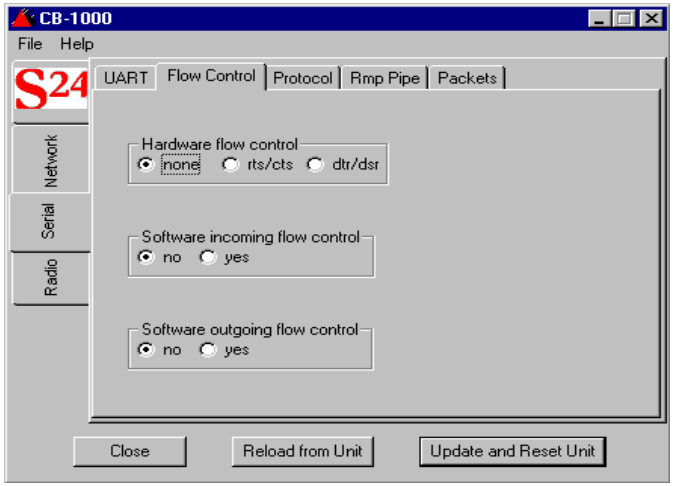
1. Complete the Basic Radio Configuration instructions described in *Chapter 6 Basic Radio Configuration* on page 37.
2. Complete the Network Configuration described in *Chapter 7 Network Configuration* on page 43.
3. Complete the General Serial Configuration described in *7.1 General Serial Configuration* on page 44.

4. Click on the Serial tab and then select the Protocol tab..



5. Click on the LPD option.

6. Click on the Flow Control tab. Verify that the Flow control settings of the CB 1000 match those of the printer.



To avoid print errors match the Flow Control settings between the CB 1000 and the printer. The LPD port setting shuold be 515. Refer to the printer manual to configure Flow Control settings in the printer.

Finish configuration by clicking the Update And Reset Unit button. The CB 1000 is now configured to act as a LPD print server for a serial printer

Chapter 11 Serial Stream To Network Packet Conversion

The serial port on the CB 1000 can be used for a range of different applications, though almost all applications involve bridging data between the CB 1000 serial port and one of the network interfaces. Data that is received on the serial port is packetized, then transmitted on either the radio or wired network interface to the network device configured to receive serial data. This section explains the process of packetizing data received on the serial port.

Network devices transmit and receive data in a fundamentally different way than the serial port. Network devices operate on packets whereas serial devices operate on single characters. A network packet is a well-defined structure that includes enough information for the packet to be interpreted by different network devices, routed to the appropriate destination, and interpreted by the destination application. Each network packet carries some amount of application data. In the case of network packets for serial port applications, this data is the information that was received or should be transmitted on the serial port.

Data transmission between serial devices is simpler. The most basic difference is that there is no requirement for data to be sent in well-defined packet structures. Each device sends serial data one character at a time. The other device must receive and process each character as it is received. Additionally, since serial communication is between two devices, there is no need to include information about the source and destination of the data. The CB 1000 interprets the serial data stream, collects it into data groups and then forms network packets with this data
and transmit the packet to the network device which is set to receive the serial information.

The CB 1000 uses three user-configurable parameters to segment the serial character stream into groups of data for network packets. These parameters, line length, timeout, and delimiters, are described below. Keep in mind that the CB 1000 always uses all three of these parameters and when the conditions of any one of them are met a network packet is generated.

11.1 Line Length

As data arrives on the serial port it is accumulated in a buffer in the CB 1000. The Line length parameter sets the maximum size for this buffer. When the number of characters in the buffer reaches the Line length value the entire buffer is sent as the data in a single network packet. The value of Line length can range from 1 to 1408 bytes. The default value is 1408.

11.2 Timeout

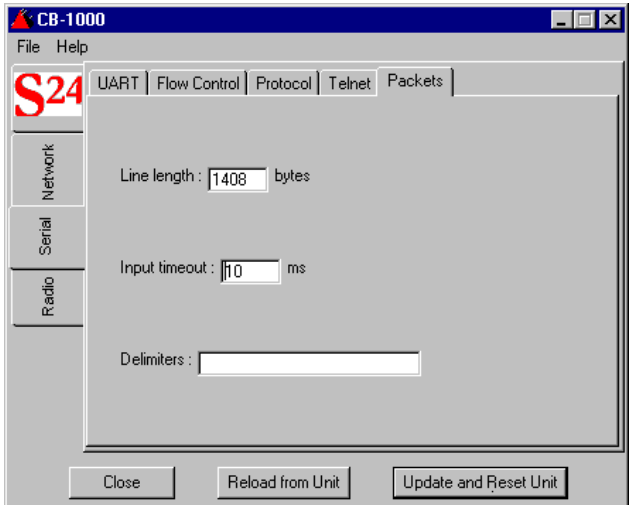
Serial data arrives in small bursts of characters. When the CB 1000 receives a burst of data and waits for a period of time for additional data to be received. When additional data is received, it is added to the receive buffer, and the CB 1000 begins to wait again. If additional data is not received for longer than the period specified by the Timeout value, then the buffer of characters received is sent in a single network packet, and the process begins again. Specify the timeout value in 10 millisecond increments. The valid range for timeout is from 10 milliseconds (0.01 second) to 65000 milliseconds (650 seconds). The default value is 10 milliseconds.

11.2.1 Delimiters

Some serial devices transmit and receive data in a known structure. In these cases there are often special characters that the transmitting device uses to indicate a complete message has been sent. These characters are referred to as delimiters. Specify up to five different delimiting characters to the CB 1000. When the CB 1000 adds one of these characters to the buffer of serial received characters the CB 1000 immediately sends that buffer as a network packet.

11.2.2 Configuration

To configure the Serial Packet parameters click on the Serial tab and then select the Packets tab. Using the descriptions in this section as a guide, enter the values for Line Length, Input Timeout, and Delimiters specific to the environment being configured.



Chapter 12 Serial Configuration of the CB 1000

12.1 CB 1000 Basic Serial Configuration

Serial configuration requires a direct connection between the CB 1000 and a computer using an RS-232 serial cable (included with the CB 1000) and terminal emulation software like HyperTerminal for Windows. Obtain the following items before proceeding:

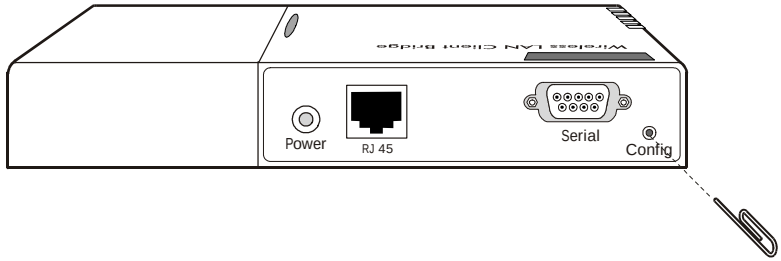
- a terminal or PC with an RS-232 connection and ANSI emulation software
- an RS-232 serial cable supplied with the CB 1000
- the CB 1000 and power supply
- paper clip (or a tool small enough to be inserted into the reset button opening next to the Ethernet port).

To begin the CB 1000 basic serial configuration:

1. Before powering up the CB 1000, connect the CB 1000 to a computer with the serial cable supplied with the CB 1000.
2. Power up the CB 1000.
3. Start the terminal emulation program, such as *HyperTerminal* for Windows, on the computer connected to the CB 1000.
4. Select the correct COM port along with the following parameters.

emulation	ANSI
baud rate	9600
data bits	8
parity	none
stop bit	1
flow control	none

5. Connect the power adapter to the port labeled 5V DC on the CB 1000.
6. Insert one end of the paper clip in the hole labeled *Config,* located in the rear of the CB 1000, next to the serial port connector.



7. An audible click is heard, the serial LED momentarily illuminates and the main menu displays.

```
CB 1000 serial number 900034                    Symbol Technologies, Inc.
Version 1.00-F2                        Ethernet HW address 00:d0:d8:0d:bb:c2

                    MAIN MENU
                    ---------

                    Resume operation
                    Edit configuration
                    View configuration for capture
                    Reset configuration to default
                    View forwarding database
                    View roaming log
                    View system event log
                    Clear system event log
                    Reset the CB 1000
```

Any time a new radio card is installed select the `Reset configuration to default` option. This loads the correct firmware to the specific Symbol radio card installed. The CB 1000 will not function unless this option is run with each new radio card.

8. Select `Edit configuration` to display :

```
CB 1ØØØ serial number 9ØØØ34                    Symbol Technologies, Inc.
Version 1.ØØ-F2                        Ethernet HW address ØØ:dØ:d8:Ød:bb:c2

                      SELECT A FILE
                      -------------

                      Return to Main Menu
                      system
                      RS-232 port (uartØ)
                      1ØBaseT Ethernet (lanØ)




Use arrow keys, or Ctrl-N and Ctrl-P to move selector bar.
Press Enter to make selection.
```

9. Configure `1ØBaseT Ethernet, RS-232 port` with network parameters such as protocol, gateway ESS, encryption and IP Address in addition to serial port parameters.
10. Once the correct parameters are entered and saved, exit to the *Main Menu* and select `Resume operation.`

12.1.1 Using the Terminal Configurator

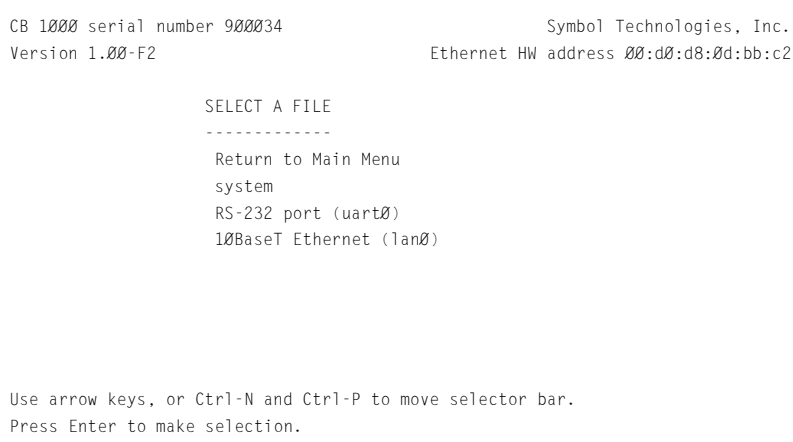
Once a connection to the Terminal Configurator is established the Main Menu screen appears.

```
CB 1000 serial number 900034                          Symbol Technologies, Inc.
Version 1.00-F2                              Ethernet HW address 00:d0:d8:0d:bb:c2

                    MAIN MENU
                    ---------
                    Resume operation
                    Edit configuration
                    View configuration for capture
                    Reset configuration to default
                    View forwarding database
                    View system event log
                    Clear system event log
                    Reset the CB 1000


Use arrow keys, or Ctrl-N and Ctrl-P to move selector bar.
Press Enter to make selection.
```

1. Use the arrow keys to move the highlighted bar.

The UI uses the ARROW keys to navigate the menus and screens. See *13.2 Terminal Emulator Control Characters* on page 83 for control characters used in terminal emulation programs that are supporting ARROW keys or the ENTER key.

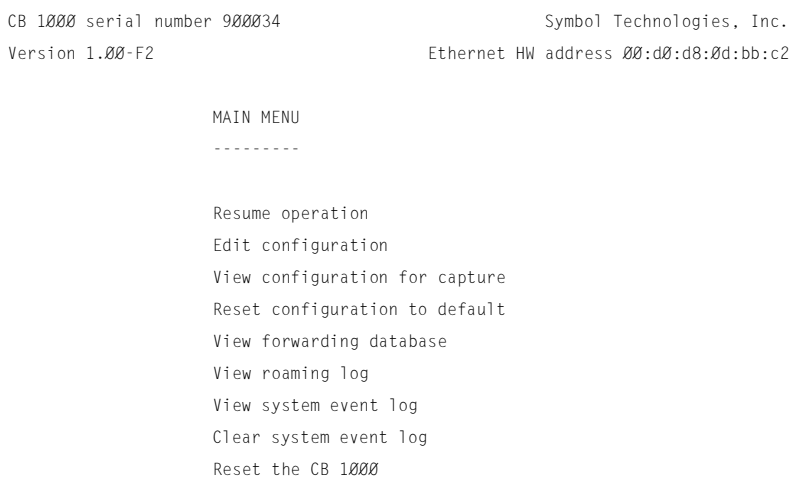
2. SELECT A FILE displays. Select one of the four configuration files on the menu. Selecting a file displays a text editor used to modify the file, see *13.1 Navigating the Configurator Editor* on page 81 for navigating instructions and detailed information on each of the configuration menu items.
3. SELECT A FILE menu displays. Select one of the four configuration files on the menu. Selecting a file displays a text editor used to modify the file, see *13.1 Navigating the Configurator Editor* on page 81 for navigating instructions and detailed information on each of the configuration menu items.



4. Select the Reset the Unit after the CB 1000 is configured.
5. Select Yes. Resetting the device, allows the new configuration to take effect and places the CB 1000 into operating mode. The CB 1000 is ready to use the new configuration.

Chapter 13 Main Menu Configuration Screens

The following sections list *Main Menu* options, their functions, and editing information for specific configuration files associated with the *Main Menu*.



13.1 Navigating the Configurator Editor

Selecting one of the *Main Menu* options displays bring a specific configuration file into the editor. Once inside the editor, use the arrow keys to move the cursor. If the arrow keys do not work with the terminal emulator, use CTRL-P for up (previous), CTRL-N for down (next), CTRL-B for left (back) and CTRL-F for right (forward). See *13.2 Terminal Emulator Control Characters* on page 83 for a complete list.

Main Menu Option	Result/Action
Resume operation	This option exits Configuration. It returns the CB 1000 to the settings the CB 1000 had before the `Configure` button was pressed.
Edit configuration	Displays a list of editable files. • *Return to Main Menu* – Returns to the previous menu selection. • *System* – Displays the editor screen with the configuration file for options that are not communication dependent. • *RS-232 port (uart0)* – Displays the editor screen with the configuration file for the serial port and per-connection network settings. • *10BaseT Ethernet (lan0)* – Displays the editor screen with the configuration file for the radio parameters and IP network interface settings
View configuration for capture	Enables capture mode in the terminal software. The display scrolls through all configuration settings and gives the option to disable capture mode at the end of the displayed data. Use this option to keep a record of the settings made for a particular CB 1000 unit or to generate a file for Symbol Technologies Technical Support when requested.
Reset configuration to default	Sets all configuration files to their factory default.
View forwarding database	Lists the MAC addresses of all network nodes detected and the network interface.
View roaming log	Lists the MAC addresses of the access points the CB 1000 has associated/disassociated.

Main Menu Option	Result/Action
View system error log	Displays a list of errors that occurred when the Symbol CB 1000 *Status* LED is lit. See *A.3 Event Log Error Table* on page 110 for a list of possible error messages.
Clear system error log	Removes all messages from the error log described above.
Reset the Unit	Performs a hardware reset. Use this after making configuration changes to allow the changes to take effect.

13.2 Terminal Emulator Control Characters

The UI uses the following keystrokes to navigate through the menus and screens depending on the terminal emulation. For terminal emulation programs that do not support using ARROW keys or the ENTER key, use the control-character equivalents:

UP ARROW or NEXT	CTRL + N
DOWN ARROW or PREVIOUS	CTRL + P
ENTER or SELECT	CTRL + M
LEFT ARROW or BACK	CTRL + B
RIGHT ARROW or FORWARD	CTRL + F
HOME (beginning of line)	CTRL + A
END (end of line)	CTRL + E
BACKSPACE (delete text in back of cursor)	CTRL + H
DELETE (delete text in front of cursor)	CTRL + D
DELETE (text from the cursor to the end of the line)	CTRL +K
SAVE FILE	CTRL + W
EXIT WITHOUT SAVING	CTRL + X
REFRESH SCREEN	CTRL + L

13.3 Configuration File Format

The configuration file format is broken down into sections that define a particular grouping of options. The section title contains a section header; which is a string of text surrounded by square brackets `[hardware]` . The text before the equal sign is a key and the text after the equal sign is the value `baud = 96ØØ` . Change the value of different keys to make configuration changes. For example, in the first two lines of the RS-232 uart0 file:

```
[hardware]
baud = 96ØØ
data bits = 8
parity = none
stop bits = 1

[telnet]
```

`[hardware]` is the name of the section. All entries are either key/value pairs (such as `baud = 96ØØ`) or comments until the next section title (for example `[telnet]`). The key/value pairs listed before a section name are invalid.

Comments are stored in the configuration file by inserting a pound sign (#) before the text to be added. Multi-line comments are enabled by inserting the # at the beginning of each line. For example:

```
[telnet]
# wait for keystroke or command prompt
connect = command prompt
# prompts to use in "wait for keystroke" mode (1 = before, 2 = after)
wait data 1 = "Press any key to connect to host... "
```

13.4 Edit Configuration Files

Select `Edit configuration` from the *Main Menu* to change the settings that pertain to the operation of the *Configuration* menus as follows:

Reset the CB 1000 From the *Main Menu* for the new settings to take effect.

```
CB 1ØØØ serial number 9ØØØ34                          Symbol Technologies, Inc.
Version 1.ØØ-F2                              Ethernet HW address ØØ:dØ:d8:Ød:bb:c2

                    SELECT A FILE
                    -------------

                    Return to Main Menu
                    system
                    RS-232 port (uartØ)
                    1ØBaseT Ethernet (lanØ)




Use arrow keys, or Ctrl-N and Ctrl-P to move selector bar.
Press Enter to make selection.
```

13.4.1 system

Contains the settings controlling the operation of the Configuration menus.

```
[configure]
# password is disabled; uncomment and change the next value to enable
#password = testpassword
```

– Set the password required for entry to the *Configuration* screen. Up to 12 alphanumeric characters are accepted. Valid characters are numbers and letters. The password is visible only during editing.

```
[bridge]
# Access Point refresh ping in units of seconds
ap refresh period = 60
ap refresh period
```

– Periodically, a CB 1000 pings an access point. The AP Refresh Period is the time (in seconds) between pings. The default is 60 (do not change this default setting). If this default is changed, the access point ignores the CB 1000 unit; and the unit is not found on the network. Having a refresh period active does not affect the performance of the CB 1000.

13.4.2 RS-232 port (uart0)

RS-232 serial UART configurations are found on all UARTs that allow communication over the serial port. Configure serial port and devices identically. There are 12 sections available for configuration. Setup only the section applicable to the configuration being used.

hardware

```
[hardware]
baud = 9600
data bits = 8
parity = none
stop bits = 1
```

- The hardware section configures the data transfer rate, number of bits per data transfer, error checking and the number of bits used to signal end of data transfer. Match the serial port and device setup to communicate.
- baud
  – Selects the data transfer rate of the RS-232 serial port. The baud rate can be between 112.5 and 115,200 bps.The default data transfer rate is 9600. The CB 1000 UART is capable of operating at non-standard speeds.

- data bits
  - In a UART character frame, this selects the number of bits that are used to transmit data. Available values are 7 and 8 (default).
- Parity
  - Sets the parity used in the UART character frame to check for correct data transmission. Options are none (default), odd, and even.
- stop bits
  - Select the number of bits used to represent an end of character bit in the UART frame. The value can be 1 (default) or 2.

software

```
[software]
line length = 14Ø8
# input timeout is specified in msec, and rounded to nearest 1Ømsec
input timeout = 1Ø
#delimiters = Øxa
# passthrough, passthrough2, telnet, or lpd
protocol = passthrough
```

The software controls the transmission and reception of bytes over the serial port. Correct set-up values enable data transmission between the radio and the serial port. The radio data is *packet based* and the UART data is *stream based.* Stream based data is transmitted and received one byte at a time, without any mechanism to separate chunks of data.
The devices generating and using the data produced by the stream based packet (serial data) determine how the data is delimited (beginning and end of data). The devices determine the meaning of the packet. Packet based data (radio data) is grouped into chunks of information, destination data is then added to the packet. Computer network traffic is packet based similar to the CB 1000 (radio) that transmits packet based data. The radio in the CB 1000 is a *wireless* network interface card (NIC) able to communicate with hard wired or wireless computer networks when properly setup.

When data is received over the radio (packet based data), the destination information is removed and only the data inside the packet is sent out the serial port (stream based packet).

Data received over the serial port is not transmitted as soon as it is received, it is converted into packet based data before the radio can send the data. The CB 1000 uses a set of rules that tell it when to start transmitting data. The destination information is removed and the data extracted from the data packet before radio data transmission. The values in the `[software]` section define the conversion rules and specify when data can be transmitted over the radio. The data does not get modified by the rules.

- line length
  - Data is transmitted over the radio once the specified number of characters have been received by the UART. The value can range from 1 to 1408 (default), using values too small results in data loss.
- input timeout
  - The Input timeout specifies how long the CB 1000 waits after data has been received on the UART and before giving up on waiting for more data. Once a character has been received the timer starts with the *input timeout* value. If the timer expires, the data is considered to be complete and is transmitted. Conversely, if another character is received before the *input timeout* is reached, the timer is restarted. The *input timeout range* for this value is from 10 (default) to 65536 milliseconds, it always rounds up to the nearest tenth millisecond. For instance, setting the timeout to 55 results in the CB 1000 waiting for 60 milliseconds before transmitting the data.
- delimiters
  - Delimiters are special characters that specify the end of the data transmission. Once any of the characters listed in this option are received, the data is transmitted. In serial communications, there is frequently a character reserved to mean "end of transmission". In human-interface applications, this character is the "newline" or Enter key. For computer to computer communication, this value may be different. If one exists, adding it to this list improves communication efficiency. Up to four delimiters can be listed here. They are specified as a space separated list of ASCII values. The values can be written as decimal or hexadecimal numbers.

- protocol

The data format of the communication between the UART and radio network. Protocol values are *passthrough, passthrough2, telnet*, and *LPD*.

  - *Passthrough (default)* forwards any data received over the UART or radio interface to the other interface with the data unchanged.
  - *Passthrough2* is similar to passthrough, but opens a socket in each direction. If a CB 1000 loses power, it can re-establish communications much faster when power returns.
  - Telnet displays a prompt similar to telnet applications found on UNIX systems. Telnet also interprets the data received over the radio, removing special character sequences known as *DO* and *DONT* requests.
  - LPD is a UNIX print serving protocol. LPD receives data in a particular format over the radio, and converts it into the data stream that is sent to the printer. Data sent from the printer is ignored.

When configuring LPD, set the printing parameters so the file is sent using the CB 1000 as the remote host. Any remote printer name can be used so long as it fits within the guidelines for naming a printer.

flow control

```
[flow control]
# yes or no (for all but cts)
incoming software = no
rts = no
dtr = no
outgoing software = no
# yes, no, or rts
cts = no
dsr = assert
# how often to retransmit passthrough I/O (in seconds; Ø = disable)
resend interval = Ø
# socket that governs passthrough I/O (must use RMP)
socket = rmpbind
```

The CB 1000 supports the following six flow control options: *Recognize RTS*, *Generate CTS*, *Recognize DTR*, *Generate DSR*, *Recognize XON/XOFF*, and *Generate XON/XOFF*. It also supports the original RS-232 specification for flow control where CTS is generated only when RTS is asserted.

The *incoming flow* control options in the CB 1000 specify the method of communication, when to start/stop sending data and how often to resent data. The CB 1000 is a Data Communications Equipment (DCE) device, the three methods of incoming flow control software are XON/XOFF, Request To Send (RTS) and Data Terminal Ready (DTR). These three methods are all signals that the host computer sends when it wants the CB 1000 to stop or start sending data.

Software flow control is implemented as two specific characters that are sent on the wire embedded with the data. *RTS* and *DTR* are signals that have their own wires, independent of the data wires.

The outgoing flow control options specify the data transmission method used between the CB 1000 and the host computer. This transmission instructs the computer to start and stop sending data. The host computer is a *Data Terminal Equipment* device (DTE) and uses *Clear To Send* (CTS) and *Data Set Ready* (DSR) as its flow control signals. Software flow control functions identically transmitting or receiving. *CTS* and *DSR* work the same way *RTS* and *DTR*.

When one device requests the other to stop sending data, it can use any of the flow control options to communicate to the other device. Selection for software flow control is made during the configuration.

For both incoming and outgoing flow control, use the words `yes` or `no` to enable or disable recognition.

CTS has one additional entry, *RTS*. The UART protocol was originally designed to restrict data flow in one direction from a modem to the host computer. With the CB 1000, flow control handles this protocol in the same fashion. The modem (CB 1000) is allowed to send data to the host computer at any time. The host computer, requests permission from the modem (CB 1000) to send data (RTS). The modem (CB 1000) recognizes this and checks to see if it is ready to accept data. The modem (CB1000) asserts the CTS line. The host computer has permission to send data when ready. Once the host computer finishes sending data, it drops the RTS line and the modem (CB1000) drops the CTS line.

Most devices are designed for RTS to enable flow control in the computer's direction. When older equipment is used with the CB 1000 RTS it is used in the manner described above. Set the RTS entry to `no` since that line does not have the meaning of incoming flow control.

Incoming flow control key	Allowed values
incoming software	yes or no.
rts	yes or no.
dtr	yes or no.

Outgoing flow control options	
outgoing software	yes or no.
dsr	yes or no
cts	yes, no, or rts.

I/O control

```
[i/o control]
# passthrough or none
rts = none
# passthrough or none
dtr = none
# negate, assert, sleep, or passthrough
cts = assert
# negate, assert, sleep, or passthrough
dsr = assert
# how often to retransmit passthrough I/O (in seconds; 0 = disable)
resend interval = 0
# socket that governs passthrough I/O (must use RMP)
```

I/O control defines control over digital inputs and outputs of the CB 1000, separately from the data lines. Digital input and output are shared with the flow control lines (*RTS, DTR, CTS, DSR*), but they are not flow control. I/O control gives the ability to send digital data from one CB 1000 to another without interpretation by either CB 1000. I/O control can also provide information to the device the CB 1000 is connected to such as the status of low-power mode.

I/O control key	Allowed values
rts	*none* and *passthrough*.
dtr	*none* and *passthrough*.

RTS and DTR are output lines. When set to *passthrough*, the status of these lines is forwarded to the CB 1000 unit specified by the *socket* option described below. When set to *none* they do not function as digital inputs.

I/O control key	Allowed values
cts	Allowed values are *negate, assert* and *passthrough*.
dsr	Allowed values are *negate, assert* and *passthrough.*

CTS and *DSR* are output lines. When set to *negate* or *assert*, *CTS* and *DSR* output a continuous digital value. The value *negate* outputs a logic 1 or mark which is electrically negative. This is also the state seen on an RS-232 connector when the cable is unplugged. The value *assert* outputs a logic 0,

or space which is electrically positive. When set to *passthrough*, *CTS* outputs the value that the remote CB 1000 is receiving on its *RTS* line, and *DSR* outputs the remote *DTR* value. The source of these remote signals depends on the remote CB 1000 *socket* setting in this section.

- resend interval
  - Digital input lines are transmitted whenever they change. In some cases (such as when the remote unit is turned off and on so that it forgets the previous output states), this is insufficient. Setting the resend interval value to a non-zero number causes the input lines to be re-transmitted at a regular interval. The resend interval value is in seconds.
- socket
  - The socket entry specifies the network connection used to send the RTS and DTR input states to a remote CB 1000. The socket value is the name of a section that describes the network connection to use. The connection must use the RMP protocol. This is typically set to the rmpbind section.

passthrough

```
[passthrough]
socket = rmpbind
```

Socket is the only entry used for the *passthrough* protocol.

- socket
  - The passthrough entry specifies the values necessary to bind a socket, (required information to create a network connection). The default is rmpbind. The connection used in *passthrough* mode creates a socket using the values in the `[rmpbind]` section found further down in the file to create the network connection.

passthrough2

```
[passthrough2]
listen = tcpbind1a
connect = tcpbind1b
```

There are two sockets in passthrough2, one for incoming data *listen*, and one for outgoing data *connect*. Both of these sockets use the TCP/IP protocol.

- listen
  - Similar to the `[passthrough]` section, the value of the `listen` entry is the name of another section defining a network connection. The default value *tcpbind1a* and is found farther down in the configuration file. The connection used by *passthrough2* mode creates a socket using the values in the `[tcpbind1a]` section to create the network connection.
- connect
  - The value of this entry points to a network connection definition that initiates the connection instead of listening for it. The default for this setting is *tcpbind1b*.

telnet

```
[telnet]
# wait for keystroke or command prompt
connect = command prompt
# prompts to use in "wait for keystroke" mode (1 = before, 2 = after)
wait data 1 = "Press any key to connect to host... "
wait data 2 = Øxd Øxa
# fixed IP address to connect to (if in auto or wait modes)
ip address = 1Ø.1Ø.1Ø.129
# fixed TCP port to connect to (if in auto or wait modes)
tcp port = 23
# after disconnect, try again?
reopen after shutdown = on
```

- connect
  - The `connect` entry dictates the prompt displayed on the serial port output. The two choices are: `wait for keystroke` and `command prompt` *(default)*. The default command prompt is `telnet>` much like Telnet software prompt on a UNIX system. Use the *open* command and the IP address to connect the device to a particular machine. For example:

    ```
    telnet> open 1Ø.1Ø.1Ø.129
    ```

    The `wait for keystroke` option enables a configuration that connects to only one machine. The `wait for keystroke` option requires only a keypress to initiate the connection.
- wait data 1
  - The value is specified as a combination of a string and ASCII values. The default value is `"Press any key to connect to host..."` (The double-quote marks are a part of this value). Add binary data by writing data as hex or decimal, outside of quote marks.
    For example, the ANSI clear-screen command string can be added to the front of this string like this:
    `Øx1b "[H" Øx1b "[J" "Press any key to connect to host..."`

- wait data 2
  - This entry defines the text displayed after the keystroke is received. The format of the data is the same as in *wait data 1*. The default is 0xd 0xa, which moves the cursor to the next line.
- ip address
  - In wait for keystroke mode, this specifies the IP address of the machine to automatically connect to. 10.10.10.129 is the default.
- tcp port
  - In wait for keystroke mode, the TCP port specifies the TCP port number to connect to automatically.
- reopen after shutdown
  - After one connection, this value appears and prompts for a connection. wThe default is on.

Network Bindings

This section defines the entries describing network binding. Five prewritten bindings are provided as examples.

rmpbind

```
[rmpbind]
protocol = rmp
# The default address is this unit's serial number
source address = default
source address filter = none
destination address = dynamic
transmit try count = infinite
transmit retry interval = 100
```

This binding can be used for both the passthrough protocol and for the I/O control socket setting.

- protocol
  - This example uses the RMP protocol so the value of this entry is rmp. This section describes the RMP binding options. If using the TCP/IP protocol, see the *TCPIP Bindings* on page 98.

- source address
  - Source addresss is the value the CB 1000 uses to identify its serial port address when sending and receiving serial data from other CB 1000 units. The default value is `default` which causes the CB 1000 to use its serial number as the address.
- source address filter
  - Set this value to only accept data coming from the address specified. For example, `source address filter = 1234` only data originating from a CB 1000 with the port address of `1234` is accepted. All other data is ignored if it does not have the source address filter set to a specific address. The default value is `none`.
- destination address
  - This address tells the CB 1000 which port address to send data received from the serial port. It can be the port address of another CB 1000's serial port, or it can be `broadcast` or `dynamic`. *Broadcast* sends the data to all CB 1000 devices. *Dynamic* sends the data to the CB 1000 it last received data from. *Dynamic (*default) enables two CB 1000 units to communicate.
- transmit try count
  - For non-broadcast data, this count specifies the number of remote CB 1000 transmission attempts the CB 1000 makes for each piece of data. Ensure the CB 1000 is in range and powered on to reduce the possibility of transmission failures. When failures occur, data is lost if additional attempts are not made. This count allows the user to specify how many attempts to take at re-transmitting data. The maximum is 65,000 retries. The default is infinite which causes each packet to be retried until successfully transmitted. Select the Transmit Try Count based on the sensitivity of the application to data delay and/or data loss transmit retry interval
  - This setting determines the time period to wait between re-transmission attempts. The value is specified in 1/100ths of a second, 100 (default) equals 1 second. The maximum value is 65000.

TCPIP Bindings

The bindings *(tcpbind1a, tcpbind1b, tcpbind2,* and *tcpbind3)* are provided for TCP/IP. When *protocol* is set to *passthrough*, only one binding is used because only one network socket is created (*tcpbind2* and *tcpbind3* are *passthrough* binds). When the protocol is set to passthrough2, two complimentary bindings (one connect, *tcpbind1b* and one listen, tcpbind1a) are used. They are complimentary because a socket is created in each direction. The key/value for each binding section is very similar.

[tcpbind1a]

```
protocol = tcp
local tcp port = 4ØØØ
reopen after shutdown = on
#socket connect data = "Please login: "
#serial connect data = "Received listener connection." Øxd Øxa
#serial disconnect data = "Disconnected from listener." Øxd Øxa
#serial fail data = "Accept failed." Øxd Øxa
```

[tcpbind1b]

```
protocol = tcp
ip address = 1Ø.1Ø.1Ø.129
remote tcp port = 4ØØØ
reopen after shutdown = on
#socket connect data = "Hello!" Øxd Øxa
#serial connect data = "Connected to socket." Øxd Øxa
#serial disconnect data = "Disconnected from socket." Øxd Øxa
#serial fail data = "Connection failed." Øxd Øxa
```

[tcpbind2]

```
protocol = tcp
type = listen
local tcp port = 4000
reopen after shutdown = on
#socket connect data = "Please login: "
#serial connect data = "Received listener connection." 0xd 0xa
#serial disconnect data = "Disconnected from listener." 0xd 0xa
#serial fail data = "Accept failed." 0xd 0xa
```

[tcpbind3]

```
protocol = tcp
type = connect
ip address = 10.10.10.129
remote tcp port = 4000
reopen after shutdown = on
#socket connect data = "Hello!" 0xd 0xa
#serial connect data = "Connected to socket." 0xd 0xa
#serial disconnect data = "Disconnected from socket." 0xd 0xa
#serial fail data = "Connection failed." 0xd 0xa
```

- protocol
  - *TCPBIND1a*, *TCPBIND1b*, *TCPBIND2*, and *TCPBIND3*, use the *TCP protocol*, so the value of this entry is tcp.
- local tcp port
  - This port defines the TCP port number the CB 1000 uses for connections from other networked devices. *Type* is set to *listen (tcpbind2)* for this port to be used.
- reopen after shutdown
  - If the type is *listen (tcpbind2)*, this value (default is on) determines whether a second connection is accepted after the first connection terminates. If the type is *connect (tcpbind3)*, this value determines whether another connection attempt is made if the first connection is closed by the remote computer.

- socket connect data
  - Socket connect data is data written to the connection once the connection is made. The value can be specified as a combination of a string and ASCII values. For example, the default value is "Hello!" 0xd 0xa. (The double-quote marks are a part of this value). This example would cause 8 bytes to be written to the socket; these are, in hexadecimal, 0x48 0x65 0x6c 0x6c 0x6f 0x21 0x0d 0x0a. The data could be specified on this line by using the eight hexadecimal values instead of a combination of string and hex.
- serial connect data
  - The serial connect data format is the same as the socket connect data. Data is written to the UART upon a successful connection.
- serial disconnect data
  - Serial disconnect data is written to the UART when the network connection is closed. The data is appended to any data already in progress. The closing of the socket does not cancel UART transmission of data received over the socket. The format of this data is the same as in *socket connect data*.
- serial fail data
  - When the socket connection fails, the data is written to the UART. This happens in the case of a *connect type* where the remote machine was unavailable or refused the connection. This value can be used to catch listen to problems. The format is the same as in *socket connect data*.
- type
  - The values in this entry can be either *listen* or *connect*. This specifies whether the CB 1000 waits for a connection from another computer or attempt to initiate the connection itself.
- ip address
  - The ip address is used in the *TCP protocol* to specify the address to connect. *Connect* must be selected for the IP address to be used.

- remote tcp port
  - The remote tcp port specifies the TCP port address used for remote computer connection. Use `connect` for this port.

10BaseT Ethernet (lan0)

```
[hardware]
network id = 101
station name = CB 1000
mac address = detect 00500e8381c
# station or microap
radio mode = station
dsmu = no
transmit rate = 1 2
drop zero length packets = yes
enable encryption = no
```

Settings for the actual CB 1000 hardware are determined under this category. The 10BaseT Ethernet category varies depending on the particular radio being used.

- station name
  - Assign a unique name to a CB 1000 device in this field. Any alphanumeric name can be used. The reserved name for accepting any ESSID is `Any`. The AP must be enabled to accept broadcast ESSID.

- MAC address
  - A *MAC* address is a 48-bit number written as six hexadecimal bytes separated by colons. Spectrum24 devices, like other Ethernet devices, have unique, hardware-encoded, alphanumeric, *Media Access Control (MAC)* or *IEEE addresses* that define each node on the network. Values for this setting are: `detect` (default setting) the CB 1000 assumes the MAC address of the device on the CB 1000's ethernet port; `builtin` The CB 1000's builtin MAC address is used or a specific MAC address can be used by entering a 12 character MAC address without the colons for the value. For example, to use MAC address 01:23:45:67:89:ab, enter `Ø123456789ab`. Use the value `detect save` for wired to wireless ethernet bridging.
- radio mode
  - Sets the radio to `station` or `microap`. In `station` (default) mode the CB 1000 can be used in configurations within the Infrastructure or Peer-to-Peer network topologies. In the microap mode the CB 1000 acts as an AP. It establishes a single-cell wireless network coverage area for other CB 1000 devices in station mode. A unique ESSID is required for the CB 1000 in microap mode.
- dsmu
  - *DSMU* mode is available only with the Spectrum24 2Mbps FH radio card. It bridges multiple Ethernet stations and performs like a wireless AP while retaining the roaming properties of an MU, but does not support associations with other MUs. An MU in DS MU mode functions as part of the distribution system, as defined by 802.11. Default value is set to `no` change this value to `yes` to enable *DS MU* mode.
- transmit rate
  - The data rate at which the radio transmits is set by this field. Valid values are radio dependent.

- enable encryption
  - This value is used to indicate whether WEP encryption by the radio is enabled or not. If the radio in the CB 1000 does not support setting WEP, this option does not appear (all Symbol Technologies radios supported by the CB 1000 support WEP encryption). Set the various encryption options in the `[encryption]` section.

encryption

Symbol uses the *Wired Equivalent Privacy (WEP)* algorithm, specified in IEEE 802.11 section 8, for encryption and decryption. WEP uses the same secret key for both encrypting and decrypting plain text. Typically, an external key management service distributes the secret key. Only the sender and receiver of the transmitted data know the *secret key*. Symbol recommends that users periodically change keys for added security. The CB 1000 and the AP are required to have matching keys. Modify both to maintain data transmissibility.

- transmit key
  - This value specifies the encyption key used to encrypt transmitted data. The CB 1000 and the AP are required to have matching keys. The default setting is 1.
- encryption key 1
  - Use this value for encrypting and decrypting data on the radio. The key should be specified as either a 10 digit or a 26 digit hexadecimal number. The number should always have a 0x before the hexadecimal digits. Use 10 digits for a 64 bit key, and 26 digits for a 128 bit key. 128 bit key is only supported on High Data Rate (HR) Direct Sequencing (DS) Spectrum24 radios.
- encryption key 2
  - Use this value for encrypting and decrypting data on the radio. The key should be specified as either a 10 digit or a 26 digit hexadecimal number. The number should always have a 0x before the hexadecimal digits. Use 10 digits for a 64 bit key, and 26 digits for a 128 bit key.

- encryption key 3
  - Use this value for encrypting and decrypting data on the radio. The key should be specified as either a 10 digit or a 26 digit hexadecimal number. The number should always have a 0x before the hexadecimal digits. Use 10 digits for a 64 bit key, and 26 digits for a 128 bit key.
- encryption key 4
  - Use this value for encrypting and decrypting data on the radio. The key should be specified as either a 10 digit or a 26 digit hexadecimal number. The number should always have a 0x before the hexadecimal digits. Use 10 digits for a 64 bit key, and 26 digits for a 128 bit key.

ip

Set the configuration of the IP protocol.

- ip address
  - Assign the IP address used by other computers to communicate with a particular CB 1000.
- netmask
  - When logically ANDed with the IP address, specifies the range of IP addresses within the local network.
- broadcast
  - In the local network, this is the IP address used to refer to all computers simultaneously. The default automaticly works for almost all configurations. There should be no need to change this value.

- route
  - This value references section names that specify the routing options for the network interface card (radio card). The default of `automatic` works for most configurations.
- gateway
  - The value specifies the IP address of the Internet router or firewall. By default, the value is set to `none`. Change this value to the IP address of the gateway if an Internet router or firewall is be used.

Appendix A Troubleshooting

A.1 Problems Encountered during setup

Most installation problems can be solved by carefully progressing through these steps:

- Ensure power is applied and light is illuminated
- Insert one end of the paper clip in the hole labeled *Config* the serial LED momentarily illuminates
- When using the Ethernet port ensure the Ethernet LED is illuminated green. If not illuminated green the wrong cable is in use or the client has not enabled the Ethernet NIC
- The RF association LED is illuminated green. If not illuminated:
  - Ensure that the Reset To Default procedure has been performed after installing the radio
  - The ESSID matches the AP
  - Antennas are installed on the AP and the client is within range.

A.2 Hardware Error Diagnosis

Indication	Problem	Corrective Action
Power LED is off or the power LED is blinking.	The CB 1000 is not receiving power properly.	Verify all physical connections are secure. Contact Technical Support if the problem persists.
Power LED is steady and the error LED is illuminated.	Configuration or software error	Check the System Event Log to determine the error, and refer to the following Event Log Error.CB 1000
CB 1000 is connected to an Ethernet cable, but the Ethernet Link LED is not lit.	Invalid connection to Ethernet	Verify both ends of the cable are plugged in securely. If the CB 1000 is attached to a hub, use a crossover Ethernet cable. If the CB 1000 is attached directly to an Ethernet device (a PC or Ethernet printer), use a straight-through cable. If the correct cable is being used, verify connection is to a 10BaseT Ethernet device. The CB 1000 does not support 100BaseT.

Indication	Problem	Corrective Action
Radio Association LED is not illuminated LED and the Status LED is off.	The radio is not linking to the access point.	Verify the radio is a Symbol Technologies CB 1000 supported radio. Verify the ESSID matches the access point. Perform the Reset To Default procedure (see *5.2.5 Resetting to factory defaults* on page 32) any time a radio card is installed.
FLASH failure. Unable to read or write configuration.	FLASH could be damaged. Configuration cannot be accessed or saved.	Contact Symbol Technologies Technical Support.
Initialization of interface *lan0* failed.	Radio could not be initialized.	Follow these steps. Continue to the next step until the problem is resolved. 1. Reset the CB 1000. 2. Unplug the power. Wait approximately 30 seconds and apply power. 3. Reset the CB 1000 to the factory default configuration and reset the CB 1000. 4. Contact Symbol Technologies Technical Support if the problem persists.

Indication	Problem	Corrective Action
xxxx: file does not exist.	Configuration file could not be found.	Reset the configuration to Factory Default, and reset the CB 1000. If the problem persists, contact Symbol Technologies Technical Support.

A.3 Event Log Error Table

All entries in the event log are preceded by a number. This number is a timestamp used by Technical Support, but is not relevant to looking up items in this table.

Configuration Error Code	Error Code Explanation	Corrective Action
`xxxx: [yyyy]: section does not exist`	Section named `[yyyy]:` in configuration file named `xxxx`: is missing.	Save the current configuration (if applicable). Reset the CB 1000 configuration to Factory Default. Reset the CB 1000. Restore configuration (if applicable).
`xxxx: [yyyy]: "zzzz": entry refers to non-existent section`	Entry `zzzz` refers to a section that is not located in file xxxx.	Save current configuration (if applicable). Reset the CB 1000 unit configuration to Factory Default. Reset the CB 1000. Restore configuration (if applicable).

Configuration Error Code	Error Code Explanation	Corrective Action
`xxxx: [yyyy]: "zzzz": entry does not exist`	Entry zzzz in section yyyy of file xxxx was missing.	Save current configuration (if applicable). Reset the CB 1000 unit configuration to Factory Default. Reset the CB 1000. Restore configuration (if applicable).
`xxxx: [yyyy]: "zzzz": entry is invalid`	Entry zzzz in section yyyy of file xxxx contains an invalid value.	Check the entry in the configuration for `zzzz`. If it cannot be found in the *Configuration Manager* program, use the serial port or telnet configuration menus.
`Unable to bring up interface "lanX".`	Configuration values for the radio could be incorrect.	Check the configuration for the PCMCIA radio Ethernet card used.
`Xxxx: <[yyyy]zzzz>: Unable to add route.`	Route values are out of range compared to the interface values.	Set the route value to `automatic`. If `automatic` does not work, check the route values. Ensure the values correspond to the other IP parameters.
`UART Error - No Rx Buffer Available`	Data is being sent to the UART at a rate faster than it can clear its receive buffers, and data is being lost.	Enable flow control for the serial application. If using the the *serial port menu system* for configuration, flow control is not enabled in the CB 1000. Enter data slower to avoid getting this error while in the serial port configuration system.

Configuration Error Code	Error Code Explanation	Corrective Action
Any other errors		Contact Technical Support, before continuing.

Appendix B Customer Support

Symbol Technologies provides its customers with prompt and accurate customer support. Use the Symbol Support Center as the primary contact for any technical problem, question or support issue involving Symbol products.

If the Symbol Customer Support specialists cannot solve a problem, access to all technical disciplines within Symbol becomes available for further assistance and support. Symbol Customer Support responds to calls by email, telephone or fax within the time limits set forth in individual contractual agreements.

When contacting Symbol Customer Support, please provide the following information:

- serial number of unit
- model number or product name
- software type and version number.

B.1 North American Contacts

Inside North America, contact Symbol by:

- Symbol Technologies, Inc.
  One Symbol Plaza
  Holtsville, New York 11742-1300
  Telephone: 1-516-738-2400/1-800-SCAN 234
  Fax: 1-516-738-5990
- Symbol Support Center:
  - telephone: 1-800-653-5350
  - fax: (516) 563-5410
  - Email: support@symbol.com

B.2 International Contacts

Outside North America, contact Symbol by:

- Symbol Technologies Technical Support
  12 Oaklands Park
  Berkshire, RG41 2FD, United Kingdom
  Tel: 011-44-118-945-7000 or
  1-516-738-2400 ext. 6213

B.3 Additional Information

Obtain additional information by contacting Symbol at:

- 1-800-722-6234, inside North America
- +1-516-738-5200, in/outside North America
- http://www.symbol.com/

Appendix C Regulatory Compliance

To comply with U.S. and international regulatory requirements, the following information has been included. The document applies to the complete line of Symbol products. Some of the labels shown, and statements applicable to other devices might not apply to all products.

C.1 Radio Frequency Interference Requirements

This device has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the Federal Communications Commissions Rules and Regulation. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

However, there is no guarantee that interference will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to

correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

C.1.1 Radio Frequency Interference Requirements - Canada

This Class A digital apparatus meets the requirements of the Canadian Interference- Causing Equipment Regulations.

C.2 CE Marking & European Union Compliance

Products intended for sale within the European Union are marked with the CEMark which indicates compliance to applicable Directives and European Normes (EN), as follows. Amendments to these Directives or ENs are included: Normes (EN), as follows.

C.2.1 Applicable Directives:

- Electromagnetic Compatibility Directive 89/336/EEC
- Low Voltage Directive 73/23/EEC

C.2.2 Applicable Standards:

- EN 55 022 - Limits and Methods of Measurement of Radio Interference Characteristics of Information technology Equipment
- EN 50 082-1 - Electromagnetic Compatibility - Generic Immunity Standard, Part 1: Residential, commercial, Light Industry
- IEC 801.2 - Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment Part 2: Electrostatic Discharge Requirements
- IEC 801.3 - Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment Part 3: Radiated Electromagnetic Field Requirements
- IEC 801.4 - Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment Part 4: Electrical Fast Transients Requirements
- EN 60 950 + Amd 1 + Amd 2 - Safety of Information Technology Equipment Including Electrical Business Equipment
- EN 60 825-1 (EN 60 825) - Safety of Devices Containing Lasers

C.3 RF Devices

Symbol's RF products are designed to be compliant with the rules and regulations in the locations into which they are sold and will be labeled as required. The majority of Symbol's RF devices are type approved and do not require the user to obtain license or authorization before using the equipment. Any changes or modifications to Symbol Technologies equipment not expressly approved by Symbol Technologies could void the user's authority to operate the equipment.

C.4 Telephone Devices (Modems)

C.4.1 United States

If this product contains an internal modem it is compliant with Part 68 of the Federal Communications Commission Rules and Regulations and there will be a label on the product showing the FCC ID Number and the REN, Ringer Equivalence Number. The REN is used to determine the quantity of devices which maybe connected to the telephone line. Excessive RENs on the telephone line may result in the device not ringing in response to an incoming call. In most but not all areas, the sum of the RENs should not exceed 5.0. To be certain of the number of devices that may be connected to the line, as determined by the total number of RENs, contact the telephone company to determine the maximum REN for the calling area.

If the modem causes harm to the telephone network, the telephone company will notify you in advance; however, if advance notice is not practical, you will be notified as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its acilities, equipment, operations or procedures that could affect the operation of the modem. If this happens the telephone company will provide advance notice so you may make any necessary modifications to maintain uninterrupted service.

C.4.2 Canada

If this product contains an internal modem it is compliant with CS-03 of Industry Canada and there will be a Canadian certification number (CANADA: _____) on a label on the outside of the product. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a

single-line, individual service maybe extended by means of a certified convector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

User should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

User should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop which is used by the device, to prevent overloading. The termination of a loop may consist of any combination of devices, subject only to the requirement that the total of the Load Numbers of all devices not exceed 100.

The Load Number is located on a label on the product.

Contact your local Symbol Technologies, Inc., representative for service and support;

Symbol Technologies, Inc.,
Canadian Sales and Service
2540 Matheson Boulevard East
Mississauga, Ontario
Canada L4W 4Z2
Phone - 905 629 7226

C.5 Laser Devices

Symbol products using lasers comply with US 21CFR1040.10, Subchapter J and IEC825/EN 60 825 (or IEC825-1/EN 60 825-1, depending on the date of manufacture). The laser classification is marked one of the labels on the product.

Class 1 Laser devices are not considered to be hazardous when used for their intended purpose. The following statement is required to comply with US and international regulations:

Use of controls, adjustments or performance of procedures other than those specified herein may result in hazardous visible or invisible laser light exposure.

Class 2 laser scanners use a low power, visible light diode. As with any very bright light source, such as the sun, the user should avoid staring directly into the light beam. Momentary exposure to a Class 2 laser is not known to be harmful.

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