ZyXEL G-220 v3

802.11g Wireless USB Adapter

User's Guide

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Edition 1

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About This User's Guide

Congratulations on your purchase of the ZyXEL G-220 v3 802.11g Wireless USB Adapter.

Your G-220 v3 is easy to install and configure.

About This User's Guide

This manual is designed to guide you through the configuration of your G-220 v3 for its various applications.

Related Documentation

- Supporting Disk

  Refer to the included CD for support documents.
- Quick Start Guide

  The Quick Start Guide is designed to help you get up and running right away. They contain hardware installation/connection information.
- ZyXEL Glossary and Web Site

  Please refer to www.zyxel.com for an online glossary of networking terms and additional support documentation.

User Guide Feedback

Help us help you. E-mail all User Guide-related comments, questions or suggestions for improvement to techwriters@zyxel.com.tw or send regular mail to The Technical Writing Team, ZyXEL Communications Corp., 6 Innovation Road II, Science-Based Industrial Park, Hsinchu, 300, Taiwan. Thank you.

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your G-220 v3.

Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The ZyXEL G-220 v3 may be referred to as the "G-220 v3", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The G-220 v3 icon is not an exact representation of your G-220 v3.

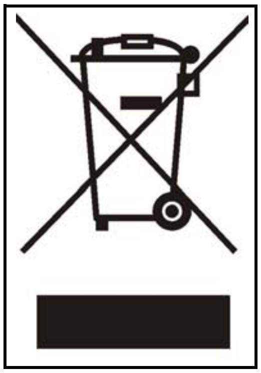
Graphics Icons Key

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).

This product is recyclable. Dispose of it properly.



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Certifications

Federal Communications Commission (FCC) Interference Statement

The device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operations.

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

If this equipment does cause harmful interference to radio/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:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and the receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

- This device has been tested to the FCC exposure requirements (Specific Absorption Rate).
- Testing was performed on laptop computers with antennas at 0mm spacing. The maximum SAR value is: 1.53W/kg. The device must not be collocated with any other antennas or transmitters.
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- IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.

注意 ！

依據　低功率電波輻射性電機管理辦法

第十二條　經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device has been designed for the WLAN 2.4 GHz network throughout the EC region and Switzerland, with restrictions in France.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Viewing Certifications

1 Go to http://www.zyxel.com.

2 Select your product from the drop-down list box on the ZyXEL home page to go to that product's page.

3 Select the certification you wish to view from this page.

Trade Name　Model Number

FC　Tested To Comply
With FCC Standards

FOR HOME OR OFFICE USE

ZyXEL Limited Warranty

ZyXEL warrants to the original end user (purchaser) that this product is free from any defects in materials or workmanship for a period of up to two (2) years from the date of purchase. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, ZyXEL will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal or higher value, and will be solely at the discretion of ZyXEL. This warranty shall not apply if the product has been modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

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To obtain the services of this warranty, contact ZyXEL's Service Center for your Return Material Authorization number (RMA). Products must be returned Postage Prepaid. It is recommended that the unit be insured when shipped. Any returned products without proof of purchase or those with an out-dated warranty will be repaired or replaced (at the discretion of ZyXEL) and the customer will be billed for parts and labor. All repaired or replaced products will be shipped by ZyXEL to the corresponding return address, Postage Paid. This warranty gives you specific legal rights, and you may also have other rights that vary from country to country.

Online Registration

Register your product online to receive e-mail notices of firmware upgrades and information at www.zyxel.com for global products, or at www.us.zyxel.com for North American products.

Customer Support

Please have the following information ready when you contact customer support.

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

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	sales@zyxel.com	+1-714-632-0858	ftp.us.zyxel.com	

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	sales@zyxel.co.uk	+44-1344 303034	ftp.zyxel.co.uk	

+” is the (prefix) number you enter to make an international telephone call.

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CHAPTER 1
Getting Started

This chapter introduces the G-220 v3 and prepares you to use the ZyXEL utility.

1.1 About Your G-220 v3

The G-220 v3 is an IEEE 802.11b/g compliant wireless LAN adapter. You can also use the ZyXEL utility to turn your G-220 v3 into an access point (AP). The ZyXEL utility is a tool that helps you configure your G-220 v3. See the appendix for detailed product specifications.

1.2 Application Overview

This section describes some network applications for the G-220 v3.

1.2.1 Windows Vista Users

At the time of writing these functions are not yet available on Windows Vista:

- AP Mode (Section 2.3 on page 34)
- Encryption Settings - 802.1x and WPA/WPA2 - PEAP and TLS options (Section 4.3.1.3 on page 58). Please see Section 4.6 on page 71 for help on configuring these options on Vista
- Ad-hoc channel and wireless mode settings (Section 4.4.1 on page 64)
- Advanced Properties on Adapter screen (Section 4.5 on page 68)

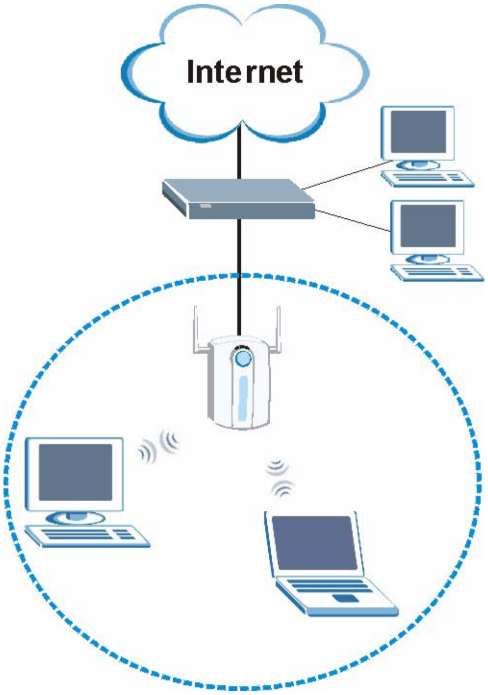
1.2.2 Station Mode

The G-220 v3 is in wireless station mode by default. When the G-220 v3 works as a wireless station (wireless client), you can either set the network type to **Infrastructure** and connect to an AP or use **Ad-Hoc** mode and connect to a peer computer (another wireless device in Ad-Hoc mode).

1.2.2.1 Infrastructure

To connect to a network via an access point (AP), set the G-220 v3 network type to **Infrastructure**. Through the AP, you can access the Internet or the wired network behind the AP.

Figure 1 Application: Infrastructure

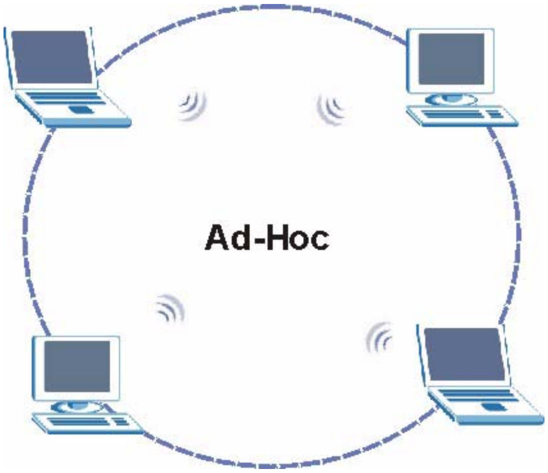


1.2.2.2 Ad-Hoc

To set up a small independent wireless workgroup without an AP, use **Ad-Hoc**.

Ad-Hoc does not require an AP or a wired network. Two or more wireless clients communicate directly to each other.

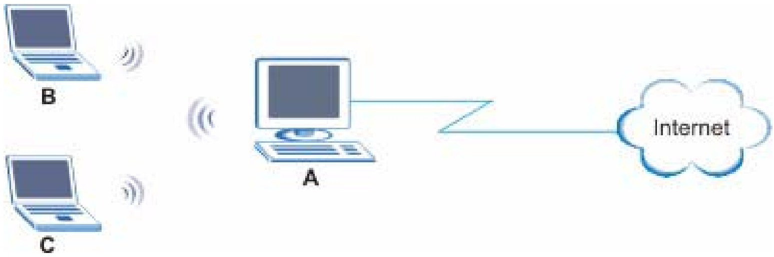
Figure 2 Application: Ad-Hoc



1.2.3 Access Point Mode

You can also set the G-220 v3 to access point mode. In access point mode, your G-220 v3 functions as an access point. This allows you to set up your wireless networks without using a dedicated AP. The following figure shows a network example.

Figure 3 Application: Access Point Mode

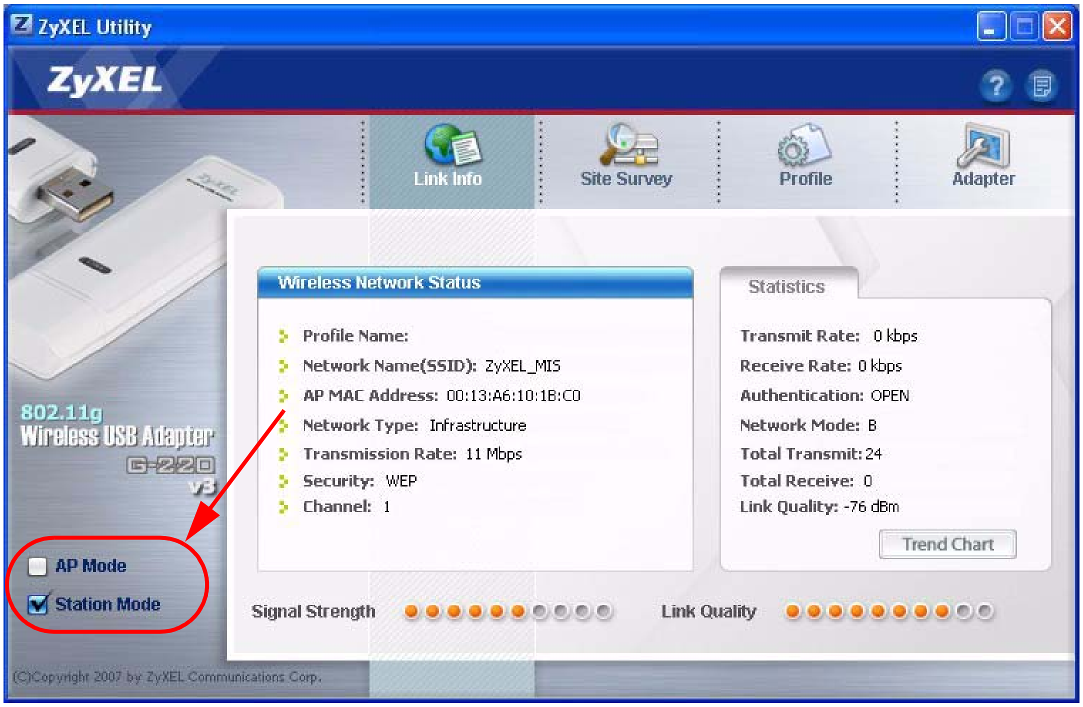


In the example, the G-220 v3 is installed on computer **A** and set to operate in access point mode. Computer **A** provides an Internet connection to the wireless LAN, so wireless stations **B** and **C** can access the Internet.

1.2.4 Changing G-220 v3 Mode

To change between the modes, select either **Station Mode** or **AP Mode** in any ZyXEL utility screens.

Figure 4 ZyXEL Utility: Change Modes



Wireless Network Status

- Profile Name:
- Network Name(SSID): ZyXEL_MIS
- AP MAC Address: 00:13:A6:10:1B:C0
- Network Type: Infrastructure
- Transmission Rate: 11 Mbps
- Security: WEP
- Channel: 1

Statistics

Transmit Rate: 0 kbps
Receive Rate: 0 kbps
Authentication: OPEN
Network Mode: B
Total Transmit: 24
Total Receive: 0
Link Quality: -76 dBm

□ AP Mode
☑ Station Mode

Signal Strength ●●●●●●○○○○

Link Quality ●●●●●●●●●○○

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Note: Wait for about five seconds for the ZyXEL utility to complete the mode change. The current mode is indicated by the color of the check box.

1.3 G-220 v3 Hardware and Utility Installation

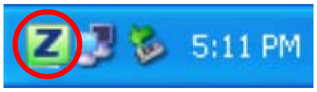
Follow the instructions in the Quick Start Guide to install the ZyXEL utility and make hardware connections.

1.3.1 ZyXEL Utility Icon

After you install and start the ZyXEL utility, an icon for the ZyXEL utility appears in the system tray.

Note: The ZyXEL utility system tray icon displays only when the G-220 v3 is installed properly. When you use the ZyXEL utility, it automatically disables WZC.

Figure 5 ZyXEL Utility: System Tray Icon



The color of the ZyXEL utility system tray icon indicates the status of the G-220 v3. Refer to the following table for details.

Table 1 ZyXEL Utility: System Tray Icon

COLOR	DESCRIPTION
Red	The G-220 v3 is operating in wireless station mode but is not connected to a wireless network.
Green	The G-220 v3 is operating in wireless station mode and connected to a wireless network.
Pale Blue	The G-220 v3 is operating in access point mode.

1.4 Configuration Methods

To configure your G-220 v3, use one of the following applications:

- Wireless Zero Configuration (WZC) (the Windows XP wireless configuration tool)
- ZyXEL Utility (required when you want to use the G-220 v3 as an access point)
- Odyssey Client Manager (not supplied)

  Refer to the Odyssey Client Manager documentation for more information.

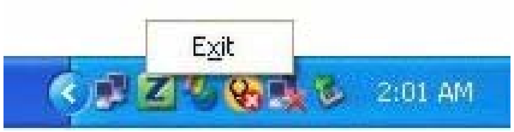
Note: Do NOT use WZC or the Odyssey Client Manager at the same time you use the ZyXEL utility.

1.4.1 Enabling WZC

Note: When you use the ZyXEL utility, it automatically disables WZC.

If you want to use WZC to configure the G-220 v3, you need to disable the ZyXEL utility by right-clicking the utility icon (Z) in the system tray and selecting **Exit**.

Figure 6 Enable WZC



Refer to the appendices for information on how to use WZC to manage the G-220 v3.

To re-activate the ZyXEL utility, double-click the (Z) icon on your desktop or click **Start** > **Programs** > **ZyXEL G-220 v3 Wireless Adapter Utility** > **ZyXEL G-220 v3 Wireless Adapter Utility.**

1.4.2 Accessing the ZyXEL Utility

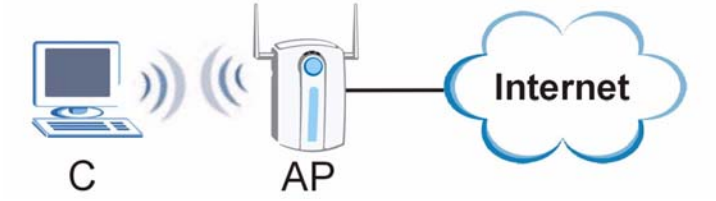
Double-click on the ZyXEL wireless LAN utility icon in the system tray to open the ZyXEL utility. The ZyXEL utility screens are similar in all Microsoft Windows versions. Screens for Windows XP are shown in this User’s Guide.

Note: Click the ? icon (located in the top right corner) to display the online help window.

CHAPTER 2 Tutorial

The following sections show you how to join a wireless network using the ZyXEL utility, as in the following diagrams. The wireless client is labeled **C** and the access point is labeled **AP**.

Figure 7 Infrastructure Network



There are three ways to connect the wireless client (the G-220 v3 in station mode) to a network.

- Configure nothing and leave the wireless client to automatically scan for and connect to any available network that has no wireless security configured.
- Manually connect to a network (see Section 2.1 on page 29).
- Configure a profile to have the wireless client automatically connect to a specific network or peer computer (see Section 2.2 on page 31).

This chapter also includes a simple example of how to configure the G-220 v3 as an AP using the ZyXEL utility. See Section 2.3 on page 34 for more information.

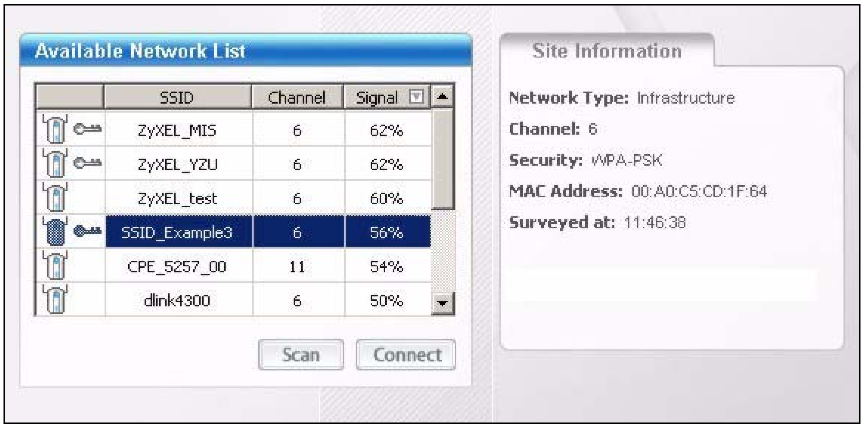
2.1 Connecting to a Wireless LAN

This example illustrates how to manually connect your wireless client to an access point (AP) which is configured for WPA-PSK security and connected to the Internet. Before you connect to the access point, you must know its Service Set IDentity (SSID) and WPA-PSK pre-shared key. In this example, the SSID is “SSID_Example3” and the pre-shared key is “ThisismyWPA-PSKpre-sharedkey” in the AP.

After you install the ZyXEL utility and then insert the wireless client, follow the steps below to connect to a network using the **Site Survey** screen.

1 Open the ZyXEL utility and click the **Site Survey** tab to open the screen as shown next.

Figure 8 ZyXEL Utility: Site Survey



Available Network List

SSID	Channel	Signal
ZyXEL_MIS	6	62%
ZyXEL_YZU	6	62%
ZyXEL_test	6	60%
SSID_Example3	6	56%
CPE_5257_00	11	54%
dlink4300	6	50%

Site Information

Network Type: Infrastructure

Channel: 6

Security: WPA-PSK

MAC Address: 00:A0:C5:CD:1F:64

Surveyed at: 11:46:38

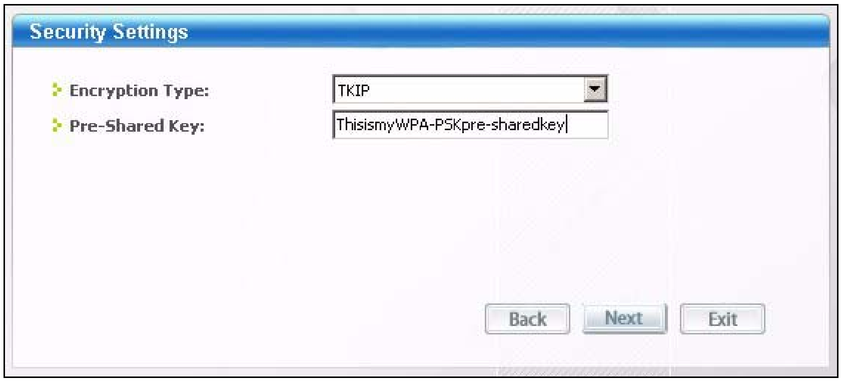
2 The wireless client automatically searches for available wireless networks. Click **Scan** if you want to search again. If no entry displays in the **Available Network List**, that means there is no wireless network available within range. Make sure the AP or peer computer is turned on, or move the wireless client closer to the AP or peer computer. See Table 5 on page 55 for detailed field descriptions.

3 To connect to an AP or peer computer, either click an entry in the list and then click **Connect** or double-click an entry (with a SSID of **SSID_Examples3** in this example).

4 When you try to connect to an AP with security configured, a window will pop up prompting you to specify the security settings. Enter the pre-shared key and leave the encryption type at the default setting.

Use the **Next** button to move on to the next screen. You can use the **Back** button at any time to return to the previous screen, or the **Exit** button to return to the **Site Survey** screen.

Figure 9 ZyXEL Utility: Security Settings



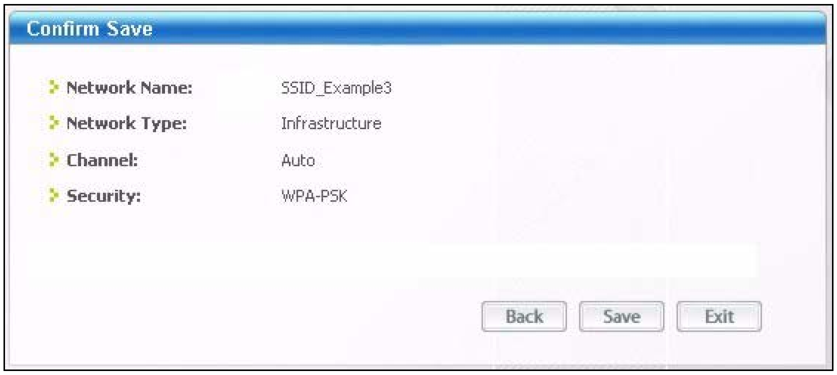
Security Settings

Encryption Type: TKIP

Pre-Shared Key: ThisismyWPA-PSKpre-sharedkey

5 The **Confirm Save** window appears. Check your settings and click **Save** to continue.

Figure 10 ZyXEL Utility: Confirm Save

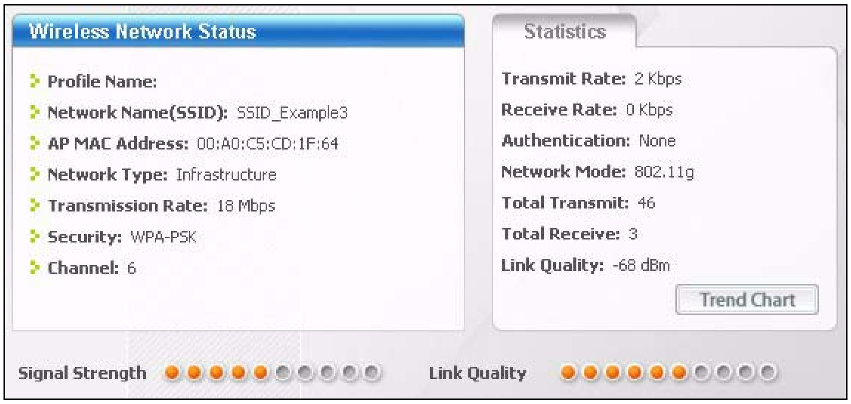


Confirm Save

- Network Name: SSID_Example3
- Network Type: Infrastructure
- Channel: Auto
- Security: WPA-PSK

6 The ZyXEL utility returns to the **Link Info** screen while it connects to the wireless network using your settings. When the wireless link is established, the ZyXEL utility icon in the system tray turns green and the **Link Info** screen displays details of the active connection. Check the network information in the **Link Info** screen to verify that you have successfully connected to the selected network. If the wireless client is not connected to a network, the fields in this screen remain blank. See Table 3 on page 52 for detailed field descriptions.

Figure 11 ZyXEL Utility: Link Info



Wireless Network Status

- Profile Name:
- Network Name(SSID): SSID_Example3
- AP MAC Address: 00:A0:C5:CD:1F:64
- Network Type: Infrastructure
- Transmission Rate: 18 Mbps
- Security: WPA-PSK
- Channel: 6

Statistics

Transmit Rate: 2 Kbps
Receive Rate: 0 Kbps
Authentication: None
Network Mode: 802.11g
Total Transmit: 46
Total Receive: 3
Link Quality: -68 dBm

7 Open your Internet browser and enter http://www.zyxel.com or the URL of any other web site in the address bar. If you are able to access the web site, your wireless connection is successfully configured. If you cannot access the web site, check the Troubleshooting section of this User's Guide or contact your network administrator if necessary.

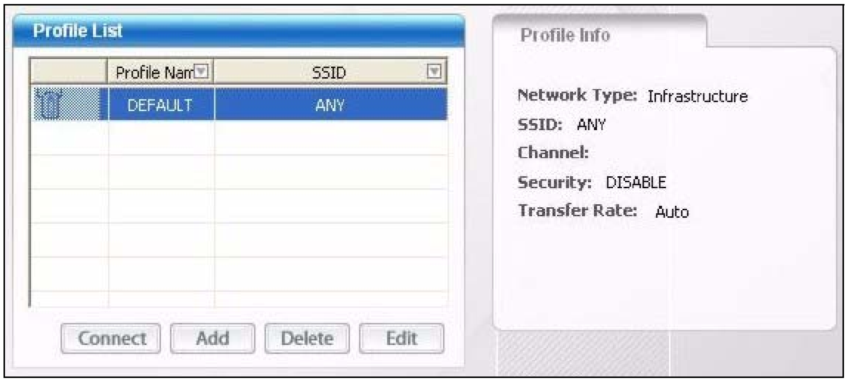
2.2 Creating and Using a Profile

A profile lets you automatically connect to the same wireless network every time you use the ZyXEL utility. You can also configure different profiles for different networks, for example if you connect a notebook computer to wireless networks at home and at work.

This example illustrates how to set up a profile and connect the wireless client to an access point configured for WPA-PSK security. In this example, the SSID is "SSID_Example3" and the pre-shared key is "ThisismyWPA-PSKpre-sharedkey" in the AP. You have chosen the profile name "PN_Example3".

1 Open the ZyXEL utility and click the **Profile** tab to open the screen as shown. Click **Add** to configure a new profile.

Figure 12 ZyXEL Utility: Profile



Profile List

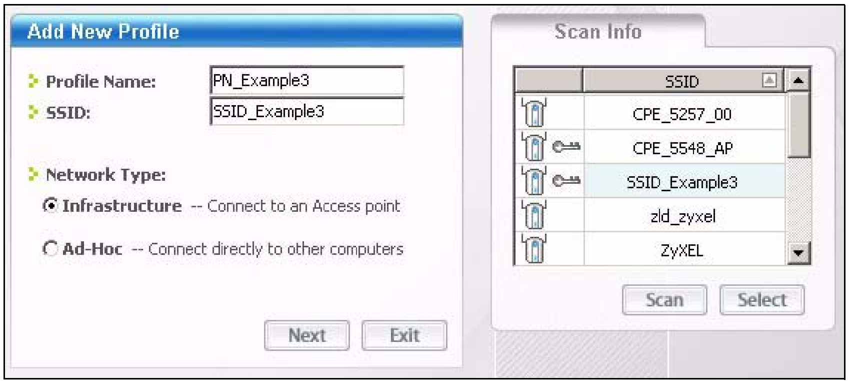
	Profile Name	SSID
	DEFAULT	ANY

Profile Info

Network Type: Infrastructure
SSID: ANY
Channel:
Security: DISABLE
Transfer Rate: Auto

2 The **Add New Profile** screen appears. The wireless client automatically searches for available wireless networks, which are displayed in the **Scan Info** box. You can also configure your profile for a wireless network that is not in the list.

Figure 13 ZyXEL Utility: Add New Profile



Add New Profile

Profile Name: PN_Example3
SSID: SSID_Example3

Network Type:
● Infrastructure -- Connect to an Access point
○ Ad-Hoc -- Connect directly to other computers

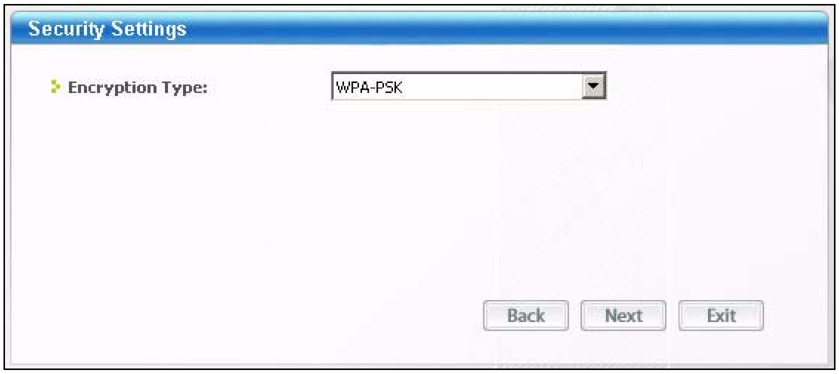
Scan Info

	SSID
	CPE_5257_00
	CPE_5548_AP
	SSID_Example3
	zld_zyxel
	ZyXEL

3 Give the profile a descriptive name (of up to 32 printable ASCII characters). Select **Infrastructure** and either manually enter or select the AP's SSID in the **Scan Info** table and click **Select**.

4 Choose the same encryption method as the AP to which you want to connect (In this example, WPA-PSK).

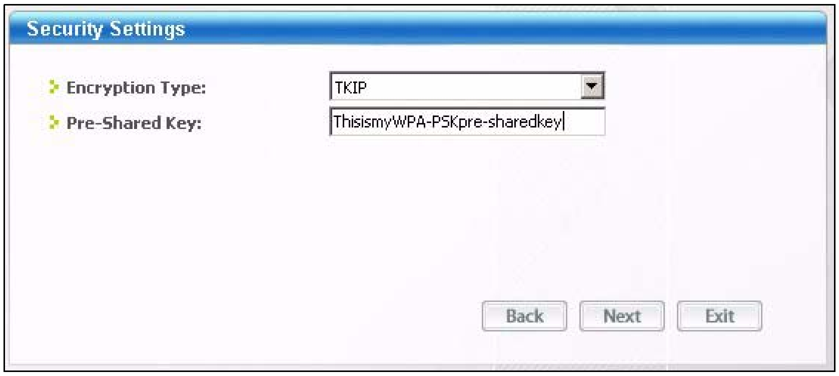
Figure 14 ZyXEL Utility: Profile Security



Encryption Type: WPA-PSK

5 This screen varies depending on the encryption method you selected in the previous screen. In this example, enter the pre-shared key and leave the encryption type at the default setting.

Figure 15 ZyXEL Utility: Profile Encryption

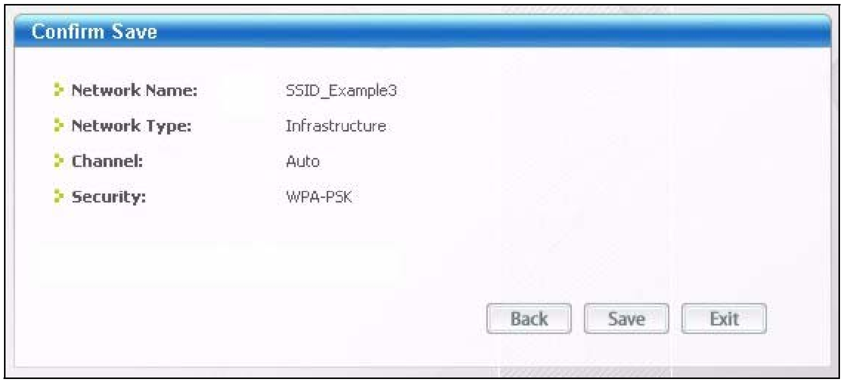


Encryption Type: TKIP

Pre-Shared Key: ThisismyWPA-PSKpre-sharedkey

6 Verify the profile settings in the ready-only screen. Click **Save** to save and go to the next screen.

Figure 16 ZyXEL Utility: Profile Confirm Save



Network Name: SSID_Example3

Network Type: Infrastructure

Channel: Auto

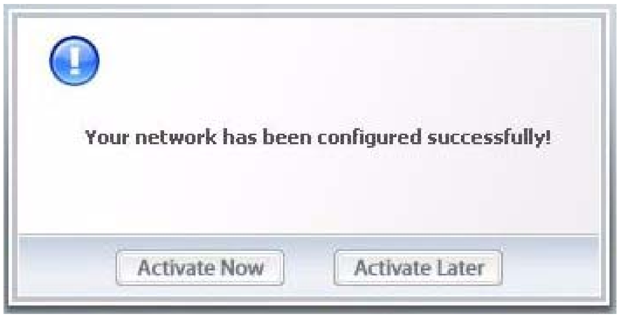
Security: WPA-PSK

7 Click **Activate Now** to use the new profile immediately. Otherwise, click the **Activate Later** button to go back to the **Profile List** screen.

If you clicked **Activate Later** you can select the profile from the list in the **Profile** screen and click **Connect** to activate it.

Note: Only one profile can be activated and used at any given time.

Figure 17 ZyXEL Utility: Profile Activate



Your network has been configured successfully!

8 When you activate the new profile, the ZyXEL utility goes to the **Link Info** screen while it connects to the AP using your settings. When the wireless link is established, the ZyXEL utility icon in the system tray turns green and the **Link Info** screen displays details of the active connection.

9 Make sure the selected AP in the active profile is connected to the Internet. Open your Internet browser, enter http://www.zyxel.com or the URL of any other web site in the address bar and press ENTER. If you are able to access the web site, your new profile is successfully configured.

10 If you cannot access the Internet, go back to the **Profile** screen. Select the profile you are using and click **Edit**. Check the details you entered previously. Also, refer to the Troubleshooting section of this User's Guide or contact your network administrator if necessary.

2.3 Configuring the G-220 v3 as an AP

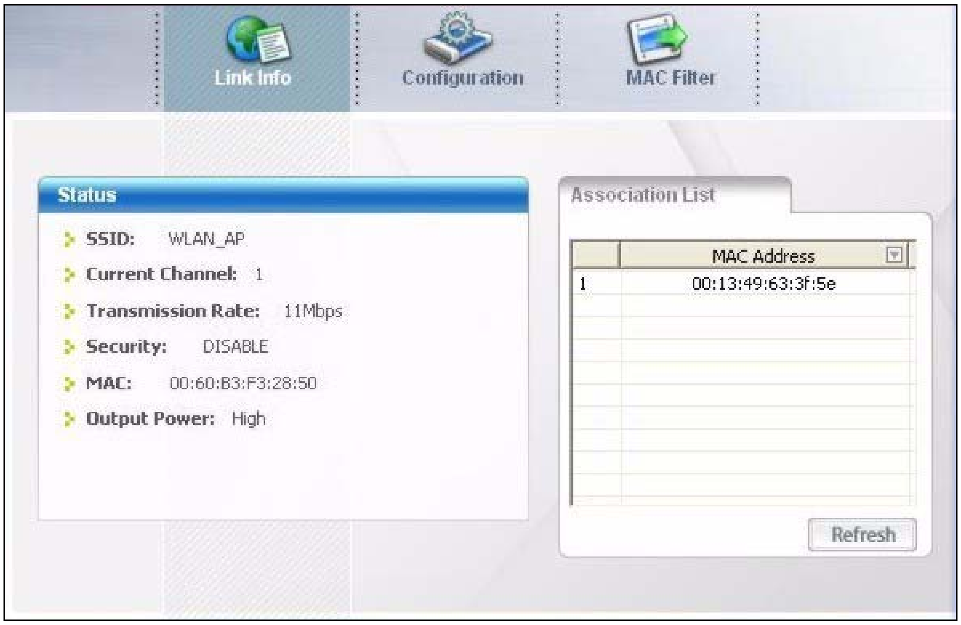
In access point mode, your G-220 v3 allows you to set up your wireless network without using a dedicated AP. Refer to Section 1.2.4 on page 25 and Chapter 5 on page 75 for more information.

Note: At the time of writing this feature is not available on Windows Vista.
Note: With WZC, you cannot use the G-220 v3 as an access point.

After you install the ZyXEL utility and then insert the G-220 v3, follow the steps below to set up your G-220 v3 as an AP.

1 Select **AP Mode** in any utility screen and wait for five seconds. The screen changes and displays as next. Under **Status**, you can view the current settings on the G-220 v3. In the **Association List**, you can see if any wireless clients have connected to your G-220 v3.

Figure 18 ZyXEL Utility: AP: Link Info



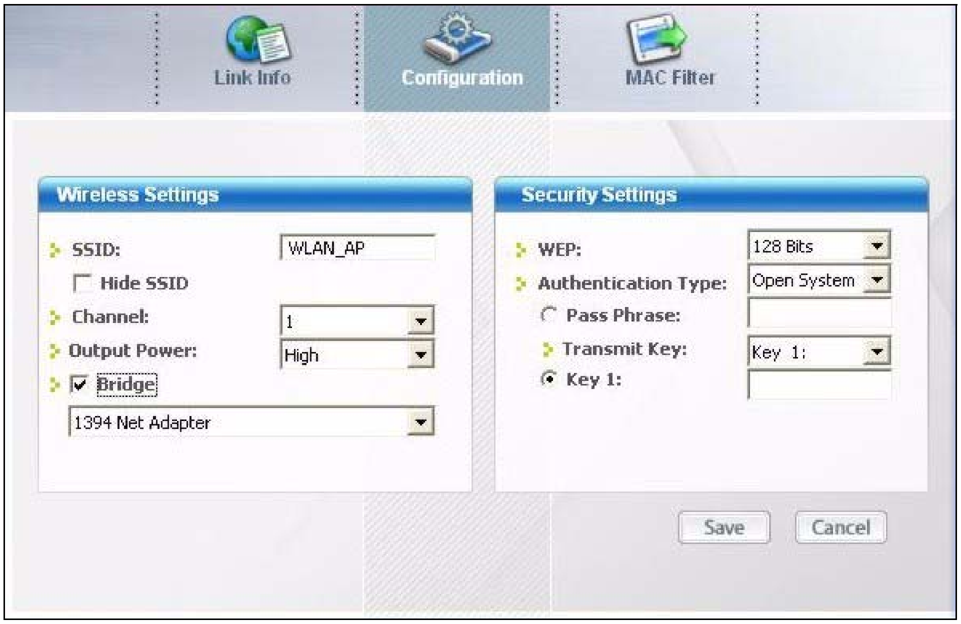
- SSID: WLAN_AP
- Current Channel: 1
- Transmission Rate: 11Mbps
- Security: DISABLE
- MAC: 00:60:B3:F3:28:50
- Output Power: High

	MAC Address
1	00:13:49:63:3f:5e

2 If you want to change the SSID and enable wireless security for your G-220 v3, click the **Configuration** tab and refer to Section 5.3 on page 77 for detailed field descriptions.

Note: You can only use WEP when the G-220 v3 is in AP mode.

Figure 19 ZyXEL Utility: AP: Configuration



- SSID: WLAN_AP
- □ Hide SSID
- Channel: 1
- Output Power: High
- ☑ Bridge
- 1394 Net Adapter

- WEP: 128 Bits
- Authentication Type: Open System
- ○ Pass Phrase:
- Transmit Key: Key 1:
- ● Key 1:

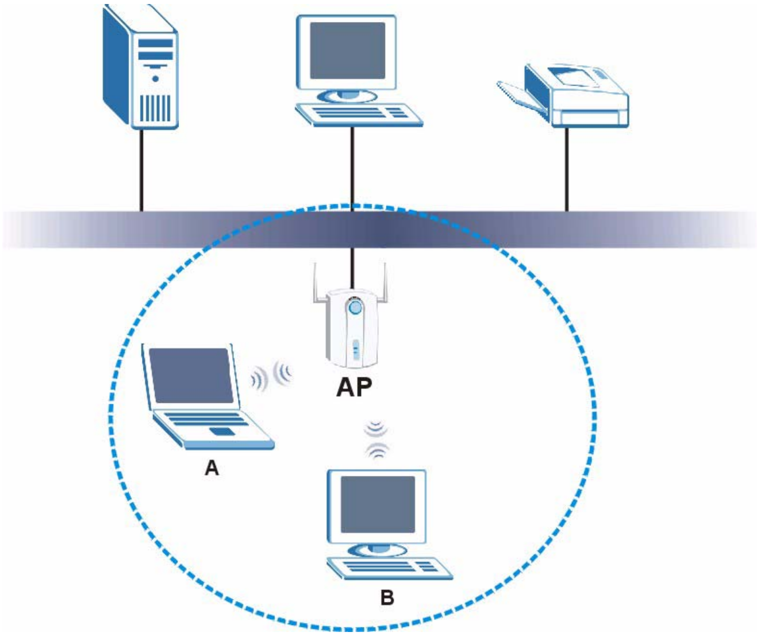
CHAPTER 3 Wireless LAN Network

This chapter provides background information on wireless LAN network.

3.1 Wireless LAN Overview

The following figure provides an example of a wireless network with an AP. See Figure 2 on page 24 for an Ad Hoc network example.

Figure 20 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices **A** and **B** are called wireless clients. The wireless clients use the access point (AP) to interact with other devices (such as the printer) or with the Internet

Every wireless network must follow these basic guidelines.

- Every device in the same wireless network must use the same SSID.

  The SSID is the name of the wireless network. It stands for Service Set IDentity.

- If two wireless networks overlap, they should use a different channel.

  Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.

- Every device in the same wireless network must use security compatible with the AP or peer computer.

  Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

3.2 Wireless LAN Security

Wireless LAN security is vital to your network to protect wireless communications.

Configure the wireless LAN security using the **Configuration** or the **Profile Security Setting** screen. If you do not enable any wireless security on your G-220 v3, the G-220 v3's wireless communications are accessible to any wireless networking device that is in the coverage area.

Note: You can only use WEP encryption if you set the G-220 v3 to Ad-hoc or AP mode.

See the appendices for more detailed information about wireless security.

3.2.1 Hide SSID

Normally, the G-220 v3 in AP mode acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the G-220 v3 in AP mode does not broadcast the SSID. In addition, you should change the default SSID to something that is difficult to guess.

This type of security is fairly weak, however, because there are ways for unauthorized wireless devices to get the SSID. In addition, unauthorized wireless devices can still see the information that is sent in the wireless network.

3.2.2 MAC Address Filter

Every device that can use a wireless network has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each device in the wireless network, see the device's User's Guide or other documentation.

You can use the MAC address filter to tell the G-220 v3 in AP mode which devices are allowed or not allowed to use the wireless network. If a device is allowed to use the wireless network, it still has to have the correct information (SSID, channel, and security). If a device is not allowed to use the wireless network, it does not matter if it has the correct information.

[1] Some wireless devices, such as scanners, can detect wireless networks but cannot use wireless networks. These kinds of wireless devices might not have MAC addresses.

[2] Hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

This type of security does not protect the information that is sent in the wireless network. Furthermore, there are ways for unauthorized wireless devices to get the MAC address of an authorized device. Then, they can use that MAC address to use the wireless network.

3.2.3 User Authentication and Encryption

You can make every user log in to the wireless network before they can use it. This is called user authentication. However, every wireless client in the wireless network has to support IEEE 802.1x to do this.

Wireless networks can use encryption to protect the information that is sent in the wireless network. Encryption is like a secret code. If you do not know the secret code, you cannot understand the message.

3.2.3.1 WEP

3.2.3.1.1 Data Encryption

WEP (Wired Equivalent Privacy) encryption scrambles all data packets transmitted between the G-220 v3 and the AP or other wireless stations to keep network communications private. Both the wireless stations and the access points must use the same WEP key for data encryption and decryption.

There are two ways to create WEP keys in your G-220 v3.

- Automatic WEP key generation based on a “password phrase” called a passphrase. The passphrase is case sensitive. You must use the same passphrase for all WLAN adapters with this feature in the same WLAN.

  For WLAN adapters without the passphrase feature, you can still take advantage of this feature by writing down the four automatically generated WEP keys from the **Security Settings** screen of the ZyXEL utility and entering them manually as the WEP keys in the other WLAN adapter(s).

- Enter the WEP keys manually.

  Your G-220 v3 allows you to configure up to four 64-bit, 128-bit or 256-bit WEP keys and only one key is used as the default key at any one time.

3.2.3.1.2 Authentication Type

The IEEE 802.11b/g standard describes a simple authentication method between the wireless stations and AP. Three authentication types are defined: **Auto**, **Open System** and **Shared Key**.

- Open System mode is implemented for ease-of-use and when security is not an issue. The wireless station and the AP or peer computer do not share a secret key. Thus the wireless stations can associate with any AP or peer computer and listen to any transmitted data that is not encrypted.

- Shared Key mode involves a shared secret key to authenticate the wireless station to the AP or peer computer. This requires you to enable the wireless LAN security and use same settings on both the wireless station and the AP or peer computer.
- Auto authentication mode allows the G-220 v3 to switch between the open system and shared key modes automatically. Use the auto mode if you do not know the authentication mode of the other wireless stations.

3.2.3.2 IEEE 802.1x

The IEEE 802.1x standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication can be done using an external RADIUS server.

3.2.3.2.1 EAP Authentication

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. The G-220 v3 supports EAP-TLS, EAP-TTLS and EAP-PEAP.

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

3.2.3.3 WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

3.3 WiFi Protected Setup

Your G-220 v3 supports WiFi Protected Setup (WPS), which is an easy way to set up a secure wireless network. WPS is an industry standard specification, defined by the WiFi Alliance.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Each WPS connection works between two devices. Both devices must support WPS (check each device's documentation to make sure).

Depending on the devices you have, you can either press a button (on the device itself, or in its configuration utility) or enter a PIN (a unique Personal Identification Number that allows one device to authenticate the other) in each of the two devices. When WPS is activated on a device, it has two minutes to find another device that also has WPS activated. Then, the two devices connect and set up a secure network by themselves.

3.3.1 Push Button Configuration

WPS Push Button Configuration (PBC) is initiated by pressing a button on each WPS-enabled device, and allowing them to connect automatically. You do not need to enter any information.

Not every WPS-enabled device has a physical WPS button. Some may have a WPS PBC button in their configuration utilities instead of or in addition to the physical button.

Take the following steps to set up WPS using the button.

1. Ensure that the two devices you want to set up are within wireless range of one another.
2. Look for a WPS button on each device. If the device does not have one, log into its configuration utility and locate the button (see the device's User's Guide for how to do this - for the G-220 v3, see Section 4.5 on page 68).
3. Press the button on one of the devices (it doesn't matter which).
4. Within two minutes, press the button on the other device. The registrar sends the network name (SSID) and security key through an secure connection to the enrollee.

If you need to make sure that WPS worked, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

3.3.2 PIN Configuration

Each WPS-enabled device has its own PIN (Personal Identification Number). This may either be static (it cannot be changed) or dynamic (in some devices you can generate a new PIN by clicking on a button in the configuration interface).

Use the PIN method instead of the push-button configuration (PBC) method if you want to ensure that the connection is established between the devices you specify, not just the first two devices to activate WPS in range of each other. However, you need to log into the configuration interfaces of both devices to use the PIN method.

When you use the PIN method, you must enter the PIN from one device (usually the wireless client) into the second device (usually the Access Point or wireless router). Then, when WPS is activated on the first device, it presents its PIN to the second device. If the PIN matches, one device sends the network and security information to the other, allowing it to join the network.

Take the following steps to set up a WPS connection between an access point or wireless router (referred to here as the AP) and a client device using the PIN method.

1. Ensure WPS is enabled on both devices.
2. Access the WPS section of the AP’s configuration interface. See the device’s User’s Guide for how to do this.
3. Look for the client’s WPS PIN; it will be displayed either on the device, or in the WPS section of the client’s configuration interface (see the device’s User’s Guide for how to find the WPS PIN - for the G-220 v3, see Section 3.3.1 on page 41).
4. Enter the client’s PIN in the AP’s configuration interface.

Note: If the client device’s configuration interface has an area for entering another device’s PIN, you can either enter the client’s PIN in the AP, or enter the AP’s PIN in the client - it does not matter which.

5. Start WPS on both devices within two minutes.

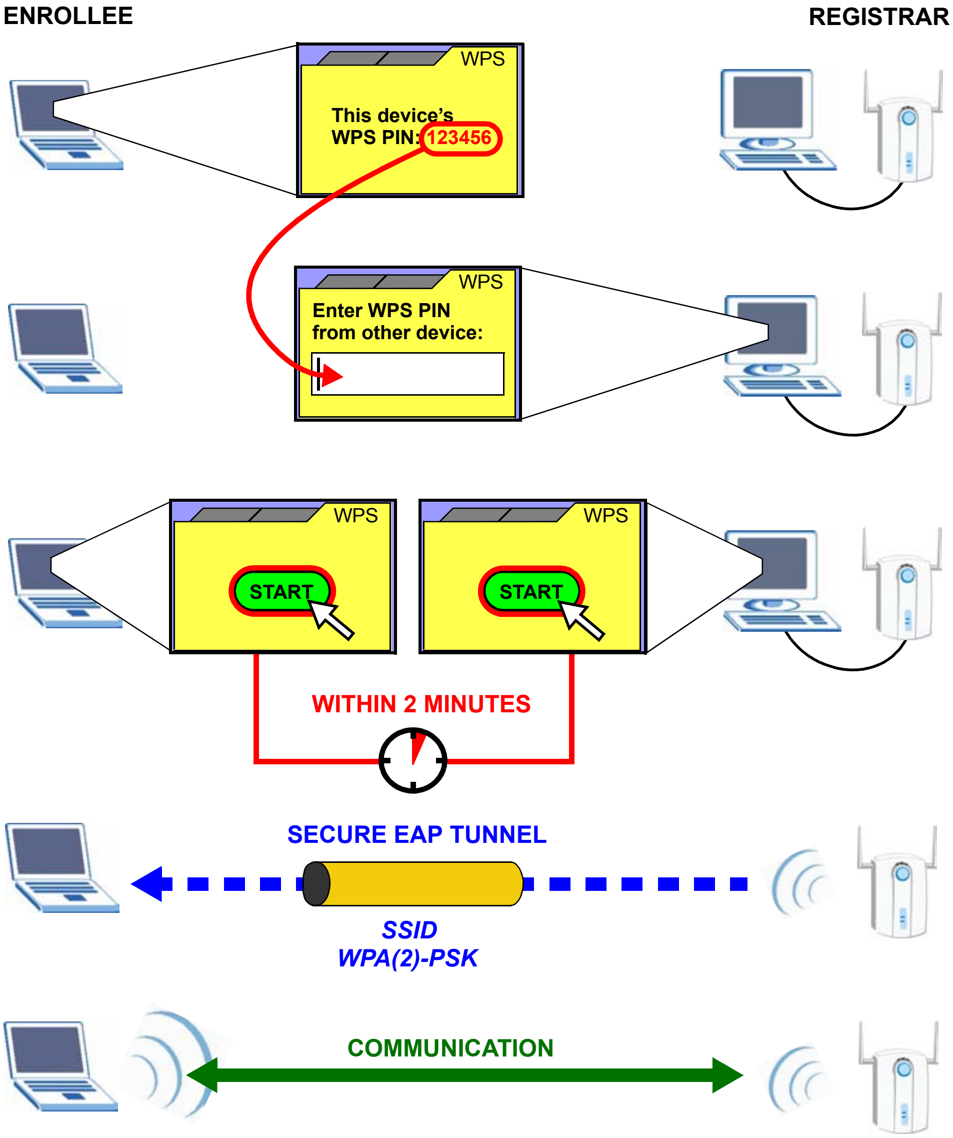
Note: Use the configuration utility to activate WPS, not the push-button on the device itself.

6. On a computer connected to the wireless client, try to connect to the Internet. If you can connect, WPS was successful.

   If you cannot connect, check the list of associated wireless clients in the AP’s configuration utility. If you see the wireless client in the list, WPS was successful.

The following figure shows a WPS-enabled wireless client (installed in a notebook computer) connecting to the WPS-enabled AP via the PIN method.

Figure 21 Example WPS Process: PIN Method

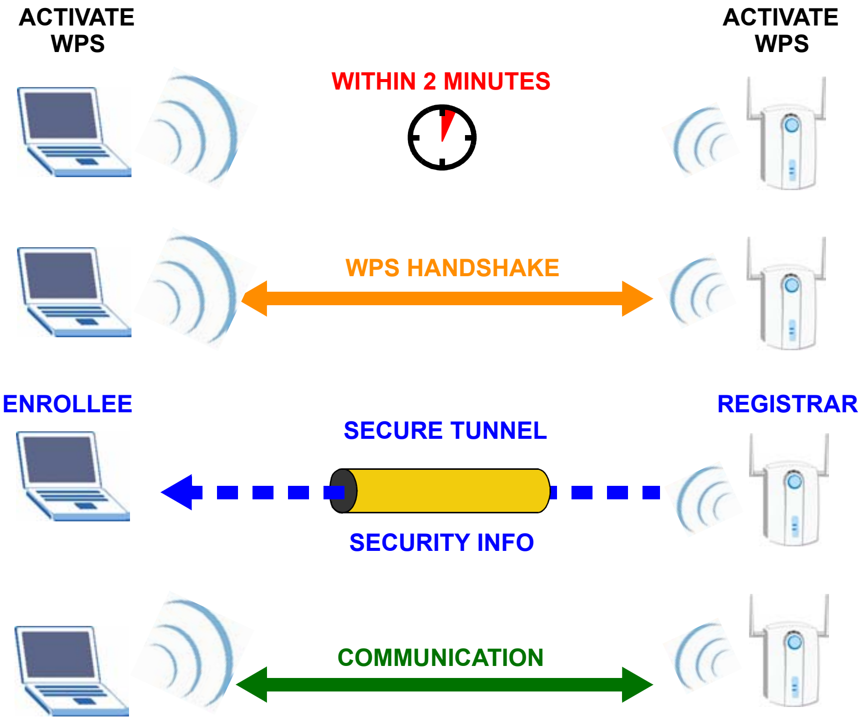


3.3.3 How WPS Works

When two WPS-enabled devices connect, each device must assume a specific role. One device acts as the registrar (the device that supplies network and security settings) and the other device acts as the enrollee (the device that receives network and security settings. The registrar creates a secure EAP (Extensible Authentication Protocol) tunnel and sends the network name (SSID) and the WPA-PSK or WPA2-PSK pre-shared key to the enrollee. Whether WPA-PSK or WPA2-PSK is used depends on the standards supported by the devices. If the registrar is already part of a network, it sends the existing information. If not, it generates the SSID and WPA(2)-PSK randomly.

The following figure shows a WPS-enabled client (installed in a notebook computer) connecting to a WPS-enabled access point.

Figure 22 How WPS works



The roles of registrar and enrollee last only as long as the WPS setup process is active (two minutes). The next time you use WPS, a different device can be the registrar if necessary.

The WPS connection process is like a handshake; only two devices participate in each WPS transaction. If you want to add more devices you should repeat the process with one of the existing networked devices and the new device.

Note that the access point (AP) is not always the registrar, and the wireless client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled wireless clients.

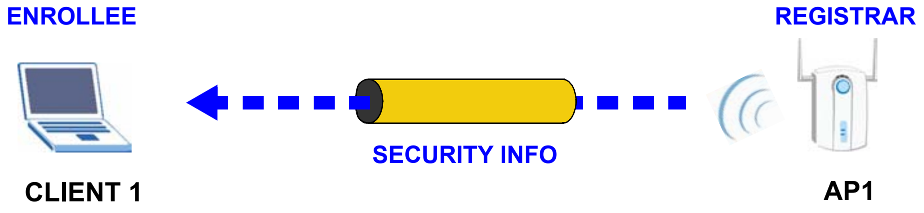
By default, a WPS devices is “unconfigured”. This means that it is not part of an existing network and can act as either enrollee or registrar (if it supports both functions). If the registrar is unconfigured, the security settings it transmits to the enrollee are randomly-generated. Once a WPS-enabled device has connected to another device using WPS, it becomes “configured”. A configured wireless client can still act as enrollee or registrar in subsequent WPS connections, but a configured access point can no longer act as enrollee. It will be the registrar in all subsequent WPS connections in which it is involved. If you want a configured AP to act as an enrollee, you must reset it to its factory defaults.

3.3.3.1 Example WPS Network Setup

This section shows how security settings are distributed in an example WPS setup.

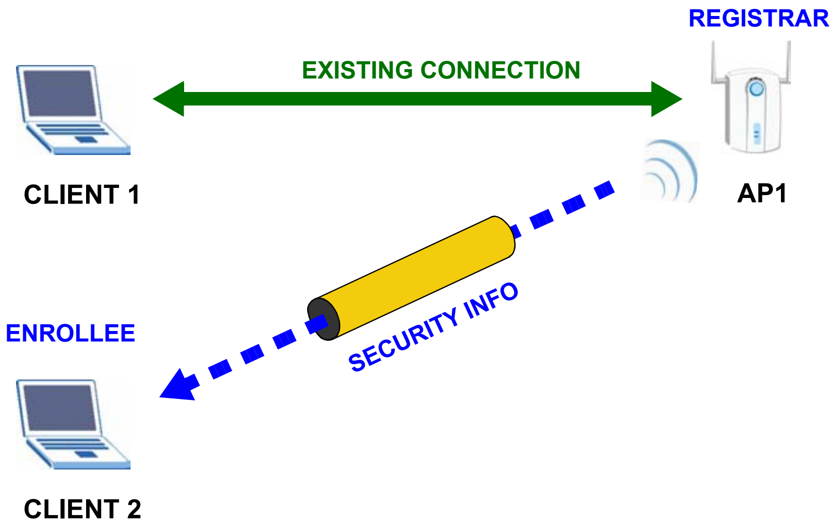
The following figure shows an example network. In step **1**, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information to set up the network, since it is unconfigured and has no existing information.

Figure 23 WPS: Example Network Step 1



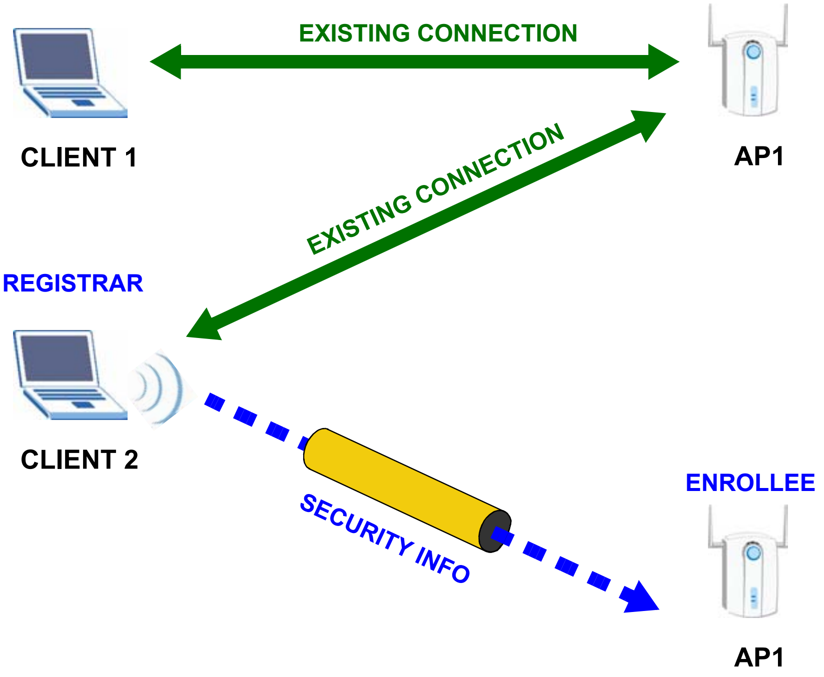
In step **2**, you add another wireless client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the registrar, since it is configured (it already has security information for the network). **AP1** supplies the existing security information to **Client 2**.

Figure 24 WPS: Example Network Step 2



In step 3, you add another access point (**AP2**) to your network. **AP2** is out of range of **AP1**, so you cannot use **AP1** for the WPS handshake with the new access point. However, you know that **Client 2** supports the registrar function, so you use it to perform the WPS handshake instead.

Figure 25 WPS: Example Network Step 3



3.3.4 Limitations of WPS

WPS has some limitations of which you should be aware.

- WPS works in Infrastructure networks only (where an AP and a wireless client communicate). It does not work in Ad-Hoc networks (where there is no AP).
- When you use WPS, it works between two devices only. You cannot enroll multiple devices simultaneously, you must enroll one after the other.

  For instance, if you have two enrollees and one registrar you must set up the first enrollee (by pressing the WPS button on the registrar and the first enrollee, for example), then check that it successfully enrolled, then set up the second device in the same way.
- WPS works only with other WPS-enabled devices. However, you can still add non-WPS devices to a network you already set up using WPS.

  WPS works by automatically issuing a randomly-generated WPA-PSK or WPA2-PSK pre-shared key from the registrar device to the enrollee device. Whether the network uses WPA-PSK or WPA2-PSK depends on the device. You can check the configuration interface of the registrar device to discover the key the network is using (if the device supports this feature). Then, you can enter the key into the non-WPS device and join the network as normal (the non-WPS device must also support WPA-PSK or WPA2-PSK).
- When you use the PBC method, there is a short period (from the moment you press the button on one device to the moment you press the button on the other device) when any WPS-enabled device could join the network. This is because the registrar has no way of identifying the “correct” enrollee, and cannot differentiate between your enrollee and a rogue device. This is a possible way for a hacker to gain access to a network.

You can easily check to see if this has happened. WPS works between only two devices simultaneously, so if another device has enrolled your device will be unable to enroll, and will not have access to the network. If this happens, open the access point's configuration interface and look at the list of associated clients (usually displayed by MAC address). It does not matter if the access point is the WPS registrar, the enrollee, or was not involved in the WPS handshake; a rogue device must still associate with the access point to gain access to the network. Check the MAC addresses of your wireless clients (usually printed on a label on the bottom of the device). If there is an unknown MAC address you can remove it or reset the AP.

3.4 Introduction to OTIST

In a wireless network, the wireless clients must have the same SSID and security settings as the access point (AP) or wireless router (we will refer to both as "AP" here) in order to associate with it. Traditionally this meant that you had to configure the settings on the AP and then manually configure the exact same settings on each wireless client.

OTIST (One-Touch Intelligent Security Technology) allows you to transfer your AP's SSID and WEP or WPA-PSK security settings to wireless clients that support OTIST and are within transmission range. You can also choose to have OTIST generate a WPA-PSK key for you if you didn't configure one manually.

3.4.1 Enabling OTIST

You must enable OTIST on both the AP and wireless client before you start transferring settings.

We use the P-334WT in this guide as the example AP. Screens may vary slightly for your ZyXEL devices.

Note: The AP and wireless client(s) MUST use the same **Setup key**.

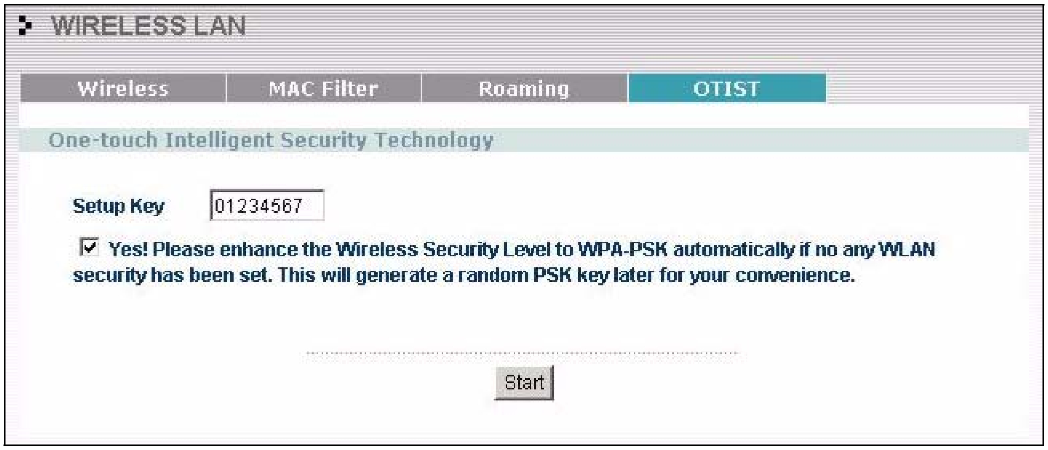
3.4.1.1 AP

On the P-334WT, you can enable OTIST using the **Reset** button or the web configurator. If you use the **Reset** button, the default (01234567) or previous saved (through the web configurator) **Setup key** is used to encrypt the settings that you want to transfer.

Hold in the **Reset** button for one or two seconds.

Note: If you hold in the **Reset** button too long, the device may reset to the factory defaults!

In the web configurator, go to the **Wireless LAN** main screen and then select **OTIST**. To change the **Setup key**, enter zero to eight printable characters. To have OTIST automatically generate a WPA-PSK key, select the **Yes** check box. If you manually configured a WEP key or a WPA-PSK key and you also selected this check box, then the key you manually configured is used.



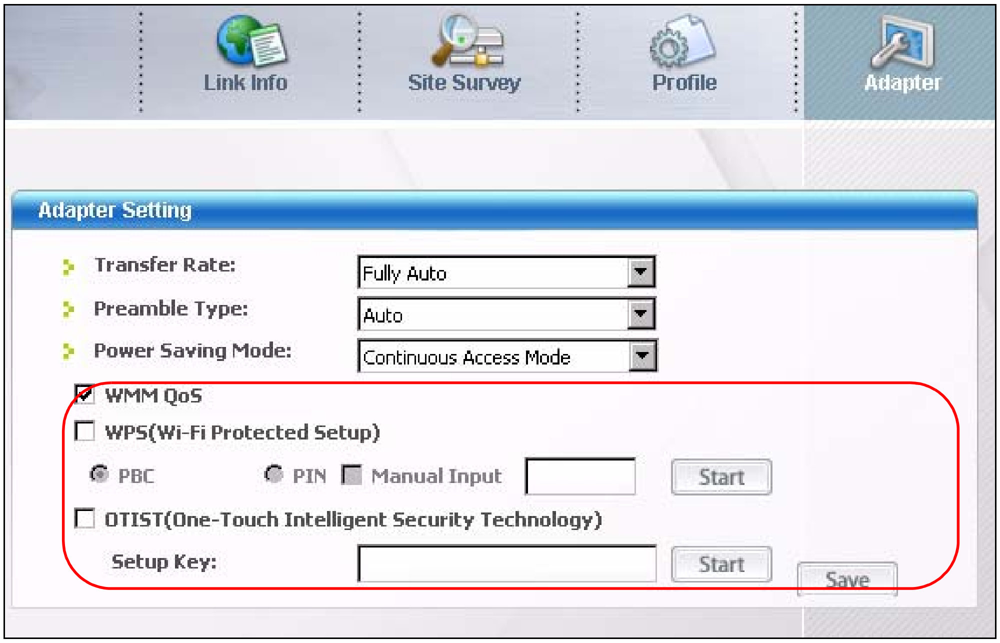
One-touch Intelligent Security Technology

Setup Key 01234567

☑ Yes! Please enhance the Wireless Security Level to WPA-PSK automatically if no any WLAN security has been set. This will generate a random PSK key later for your convenience.

3.4.1.2 Wireless Client

Start the ZyXEL utility and click the **Adapter** tab. Select the **OTIST** check box, enter the same **Setup Key** as your AP’s and click **Save**.



Transfer Rate: Fully Auto

Preamble Type: Auto

Power Saving Mode: Continuous Access Mode

☑ WMM QoS

☐ WPS(Wi-Fi Protected Setup)

● PBC ○ PIN ☐ Manual Input

☐ OTIST(One-Touch Intelligent Security Technology)

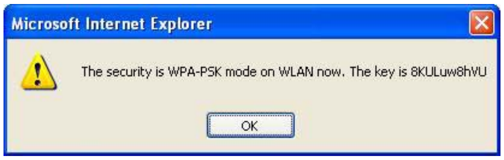
Setup Key:

3.4.2 Starting OTIST

Note: You must click **Start** in the AP **OTIST** web configurator screen and in the wireless client(s) **Adapter** screen all within three minutes (at the time of writing). You can start OTIST in the wireless clients and AP in any order but they must all be within range and have OTIST enabled.

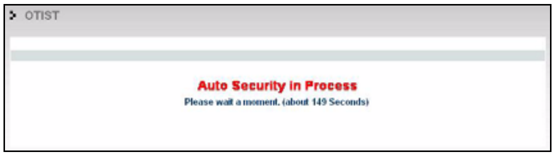
See the user's guide for more information.

1 In the AP, a web configurator screen pops up showing you the security settings to transfer. After reviewing the settings, click **OK**.


Microsoft Internet Explorer

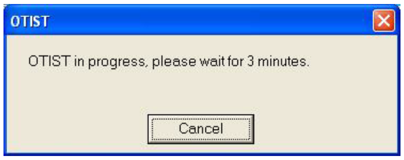
The security is WPA-PSK mode on WLAN now. The key is 8KULuw8hVU

2 This screen appears while OTIST settings are being transferred. It closes when the transfer is complete.


OTIST

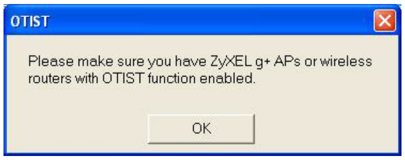
Auto Security in Process

Please wait a moment. (about 149 Seconds)


OTIST

OTIST in progress, please wait for 3 minutes.

- In the wireless client, you see this screen if it can't find an OTIST-enabled AP (with the same **Setup key**). Click **OK** to go back to the ZyXEL utility main screen.

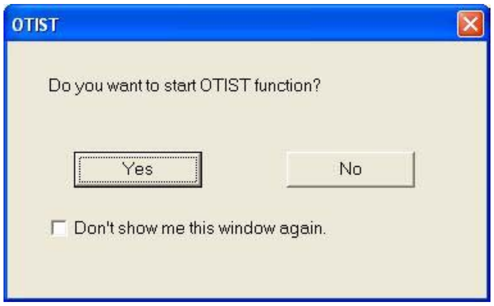

OTIST

Please make sure you have ZyXEL g+ APs or wireless routers with OTIST function enabled.

- If there is more than one OTIST-enabled AP within range, you see a screen asking you to select one AP to get settings from.

3.4.3 Notes on OTIST

1 If you enabled OTIST in the wireless client, you see this screen each time you start the utility. Click **Yes** for it to search for an OTIST-enabled AP.


OTIST

Do you want to start OTIST function?

2 If an OTIST-enabled wireless client loses its wireless connection for more than ten seconds, it will search for an OTIST-enabled AP for up to one minute. (If you manually have the wireless client search for an OTIST-enabled AP, there is no timeout; click **Cancel** in the OTIST progress screen to stop the search.)

3 When the wireless client finds an OTIST-enabled AP, you must still click **Start** in the AP **OTIST** web configurator screen or hold in the **Reset** button (for one or two seconds) for the AP to transfer settings.

4 If you change the SSID or the keys on the AP after using OTIST, you need to run OTIST again or enter them manually in the wireless client(s).

5 If you configure OTIST to generate a WPA-PSK key, this key changes each time you run OTIST. Therefore, if a new wireless client joins your wireless network, you need to run OTIST on the AP and ALL the wireless clients again.

CHAPTER 4 Wireless Station Mode Configuration

This chapter shows you how to configure your G-220 v3 in wireless station mode. See Chapter 5 on page 75 for how to configure the G-220 v3 in access point mode.

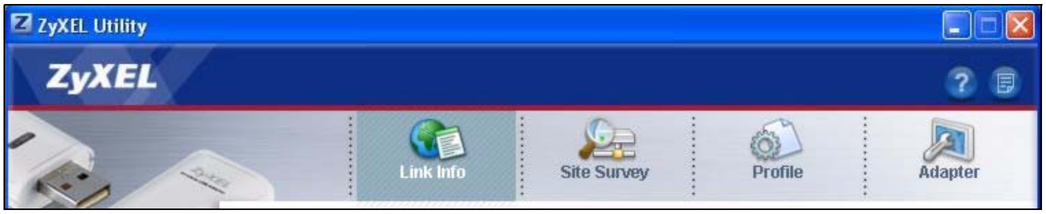
4.1 Wireless Station Mode Overview

To set your G-220 v3 in wireless station mode, select **Station Mode** in any utility screen (refer to Section 1.2.4 on page 25).

4.1.1 ZyXEL Utility Screen Summary

This section describes the ZyXEL utility screens when the G-220 v3 is in station mode.

Figure 26 ZyXEL Utility Menu Summary: Station Mode



The following table describes the menus.

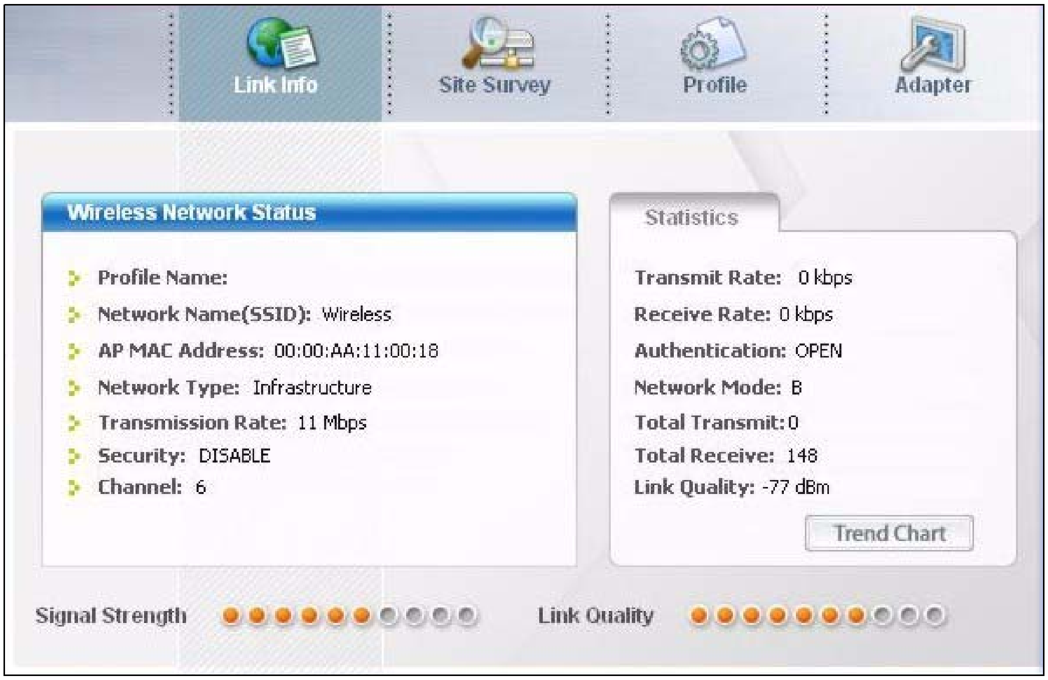
Table 2 ZyXEL Utility Menu Summary: Station Mode

TAB	DESCRIPTION
Station Mode	
Link Info	Use this screen to see your current connection status, configuration and data rate statistics.
Site Survey	Use this screen to • scan for a wireless network • configure wireless security (if activated on the selected network). • connect to a wireless network.
Profile	Use this screen to add, delete, edit or activate a profile with a set of wireless and security settings.
Adaptor	Use this screen to configure a transfer rate, enable power saving and use OTIST (One-Touch Intelligent Security Technology).

4.2 The Link Info Screen

When the ZyXEL utility starts, the **Link Info** screen displays, showing the current configuration and connection status of your G-220 v3.

Figure 27 Station Mode: Link Info



Wireless Network Status

- Profile Name:
- Network Name(SSID): Wireless
- AP MAC Address: 00:00:AA:11:00:18
- Network Type: Infrastructure
- Transmission Rate: 11 Mbps
- Security: DISABLE
- Channel: 6

Statistics

Transmit Rate: 0 kbps
Receive Rate: 0 kbps
Authentication: OPEN
Network Mode: B
Total Transmit: 0
Total Receive: 148
Link Quality: -77 dBm

Signal Strength ●●●●●●○○○○

Link Quality ●●●●●●●○○○

The following table describes the labels in this screen.

Table 3 Station Mode: Link Info

LABEL	DESCRIPTION
AP Mode Station Mode	Use the check box to set the G-220 v3 to operate in wireless station or access point mode. Refer to Section 1.2.4 on page 25 for more information.
Wireless Network Status	
Profile Name	This is the name of the profile you are currently using.
Network Name (SSID)	The SSID identifies the wireless network to which a wireless station is associated. This field displays the name of the wireless device to which the G-220 v3 is associated.
AP MAC Address	This field displays the MAC address of the AP or peer computer to which the G-220 v3 is associated.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the wireless network.
Transmission Rate	This field displays the current transmission rate of the G-220 v3 in megabits per second (Mbps).
Security	This field displays whether data encryption is activated (**WEP** (WEP or 802.1x), **TKIP** (WPA/WPA-PSK/WPA2/WPA2-PSK), **AES** (WPA/WPA-PSK/WPA2/WPA2-PSK)) or inactive (**DISABLE**).

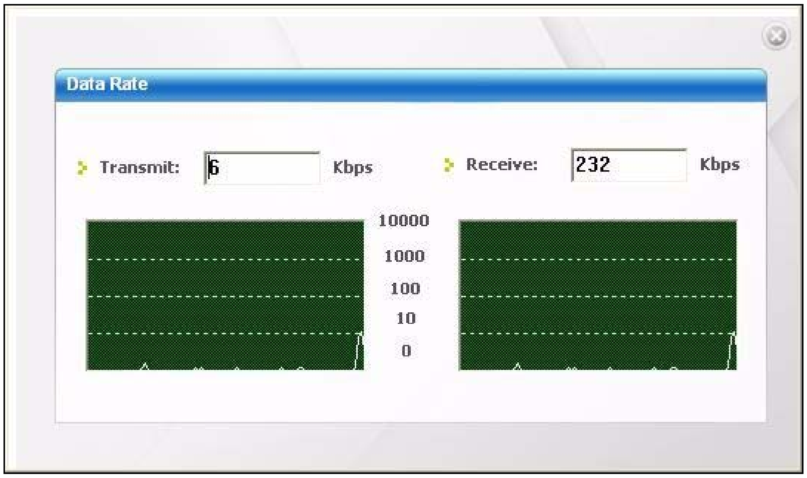
Table 3 Station Mode: Link Info (continued)

LABEL	DESCRIPTION
Channel	This field displays the radio channel the G-220 v3 is currently using.
Status	This field displays the authentication type of the wireless network.
Statistics	
Transmit Rate	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive Rate	This field displays the current data receiving rate in kilobits per second (Kbps).
Authentication	This field displays the authentication method of the G-220 v3.
Network Mode	This field displays the wireless standard (**B** or **G**) of the AP or peer computer.
Total Transmit	This field displays the total number of data frames transmitted.
Total Receive	This field displays the total number of data frames received.
Link Quality	This field displays the signal strength of the G-220 v3.
Trend Chart	Click this button to display the real-time statistics of the data rate in kilobits per second (Kbps).
Signal Strength	The status bar shows the strength of the signal. The signal strength is mainly depending on the antenna output power and the distance between your G-220 v3 and the AP or peer computer.
Link Quality	The status bar shows the quality of wireless connection. This refers to the percentage of packets transmitted successfully. If there are too many wireless stations in a wireless network, collisions may occur which could result in a loss of messages even though you have high signal strength.

4.2.1 Trend Chart

Click **Trend Chart** in the **Link Info** screen to display a screen as shown below. Use this screen to view real-time data traffic statistics.

Figure 28 Station Mode: Link Info: Trend Chart



Data Rate

Transmit: 6 Kbps

Receive: 232 Kbps

The following table describes the labels in this screen.

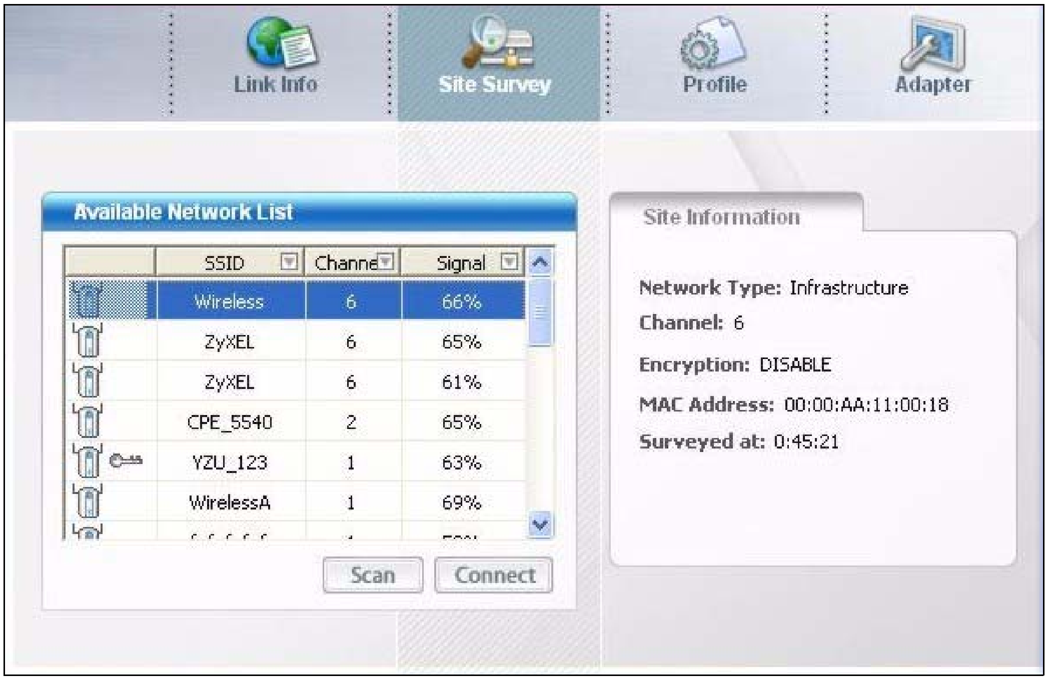
Table 4 Station Mode: Link Info: Trend Chart

	DESCRIPTION
Transmit	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive	This field displays the current data receiving rate in kilobits per second (Kbps).

4.3 The Site Survey Screen

Use the **Site Survey** screen to scan for and connect to a wireless network automatically.

Figure 29 Station Mode: Site Survey



	SSID	Channel	Signal
	Wireless	6	66%
	ZyXEL	6	65%
	ZyXEL	6	61%
	CPE_5540	2	65%
🔑	YZU_123	1	63%
	WirelessA	1	69%

Network Type: Infrastructure
Channel: 6
Encryption: DISABLE
MAC Address: 00:00:AA:11:00:18
Surveyed at: 0:45:21

The following table describes the labels in this screen.

Table 5 Station Mode: Site Survey

	DESCRIPTION
Available Network List	Click a column heading to sort the entries.
, , or	denotes that the wireless device is in infrastructure mode and the wireless security is activated. denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set IDentifier) of each wireless device.
Channel	This field displays the channel number used by each wireless device.
Signal	This field displays the signal strength of each wireless device.
Scan	Click **Scan** to search for available wireless devices within transmission range.
Connect	Click **Connect** to associate to the selected wireless device.
Site Info	Click an entry in the **Available Network List** table to display the information of the selected wireless device.
Network Type	This field displays the network type (**Infrastructure** or **Ad Hoc**) of the wireless device.
Channel	This field displays the channel number used by each wireless device.
Encryption	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).
MAC address	This field displays the MAC address of the wireless device.
Surveyed at	This field displays the time when the wireless device is scanned.

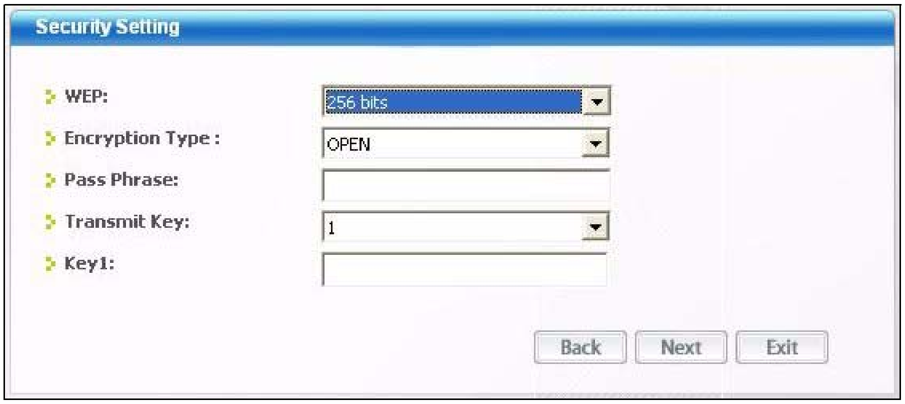
4.3.1 Security Settings

When you configure the G-220 v3 to connect to a network with wireless security activated and the security settings are disabled on the G-220 v3, the screen varies according to the encryption method used by the selected network.

Note: At the time of writing some security settings are not functional on Windows Vista. Please see Section 4.6 on page 71 for more help.

4.3.1.1 WEP Encryption

Figure 30 Station Mode: Security Setting: WEP



Security Setting

WEP: 256 bits

Encryption Type : OPEN

Pass Phrase:

Transmit Key: 1

Key1:

The following table describes the labels in this screen.

Table 6 Station Mode: Security Setting: WEP

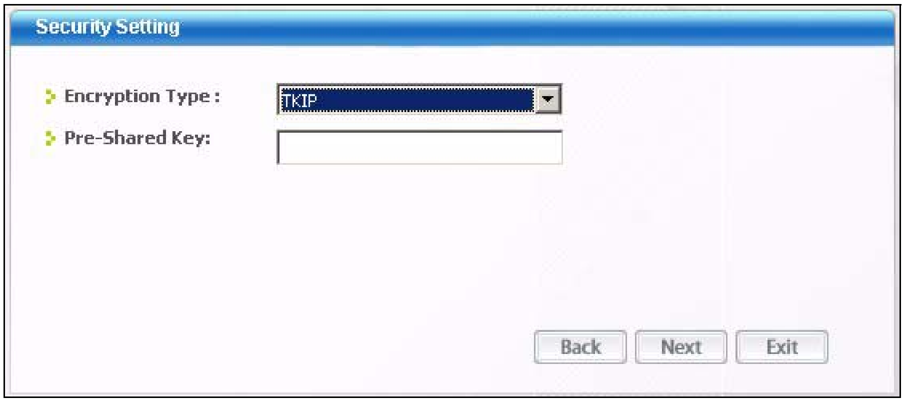
LABEL	DESCRIPTION
Security Settings	
WEP	Select **64 Bits**, **128 Bits** or **256 Bits** to activate WEP encryption and then fill in the related fields.
Encryption Type	Select an authentication method. Choices are **SHARED** and **OPEN**. Refer to Section 3.2.3.1.2 on page 39 for more information.
Pass Phrase	Enter a passphrase of up to 63 case-sensitive printable characters. As you enter the passphrase, the G-220 v3 automatically generates four different WEP keys and displays it in the key field below. Refer to Section 3.2.3.1.1 on page 39 for more information. At the time of writing, you cannot use passphrase to generate 256-bit WEP keys.
Transmit Key	Select a default WEP key to use for data encryption. The key displays in the field below.

Table 6 Station Mode: Security Setting: WEP (continued)

LABEL	DESCRIPTION
Key x (where x is a number between 1 and 4)	Select this option if you want to manually enter the WEP keys. Enter the WEP key in the field provided. If you select **64 Bits** in the **WEP** field. Enter either 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 11AA22BB33) for HEX key type. or Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for ASCII key type. If you select **128 Bits** in the **WEP** field, Enter either 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 00112233445566778899AABBCC) for HEX key type or Enter 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey12345678) for ASCII key type. If you select **256 Bits** in the **WEP** field, Enter either 58 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0000111122223333444455556666777788889999AAAABBBBCCCC000011) for HEX key type or Enter 29 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey11112222333344445555678) for ASCII key type. **Note:** The values for the WEP keys must be set up exactly the same on all wireless devices in the same wireless LAN. ASCII WEP keys are case sensitive.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 61.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.2 WPA-PSK/WPA2-PSK

Figure 31 Station Mode: Security Setting: WPA-PSK/WPA2-PSK


Security Setting

Encryption Type : TKIP

Pre-Shared Key:

The following table describes the labels in this screen.

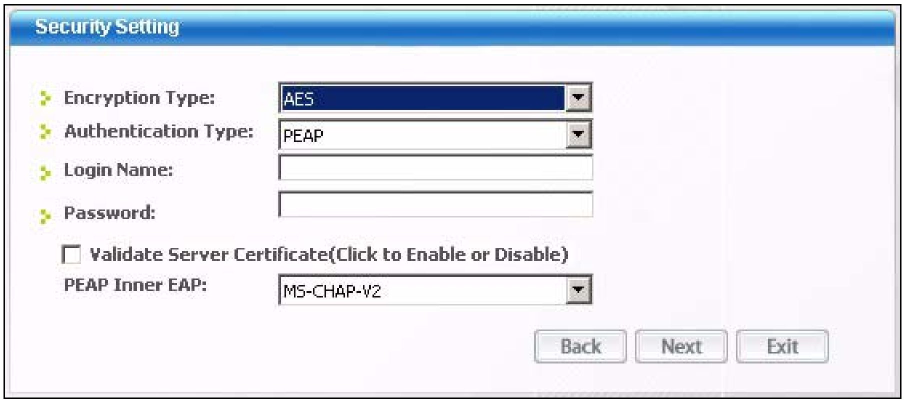
Table 7 Station Mode: Security Setting: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (**TKIP** or **AES**) for data encryption. Refer to Section 3.2.3.3 on page 40 for more information.
Pre-Shared Key	Type a pre-shared key (same as the AP or peer device) of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols) or 64 hexadecimal characters.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 61.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.3 WPA/WPA2

Note: At the time of writing this section is less functional on Windows Vista. Please see Section 4.6 on page 71 for more information on how to configure the security settings.

Figure 32 Station Mode: Security Settings: WPA/WPA2


Security Setting

Encryption Type: AES

Authentication Type: PEAP

Login Name:

Password:

□ Validate Server Certificate(Click to Enable or Disable)

PEAP Inner EAP: MS-CHAP-V2

The following table describes the labels in this screen.

Table 8 Station Mode: Security Setting: WPA/WPA2

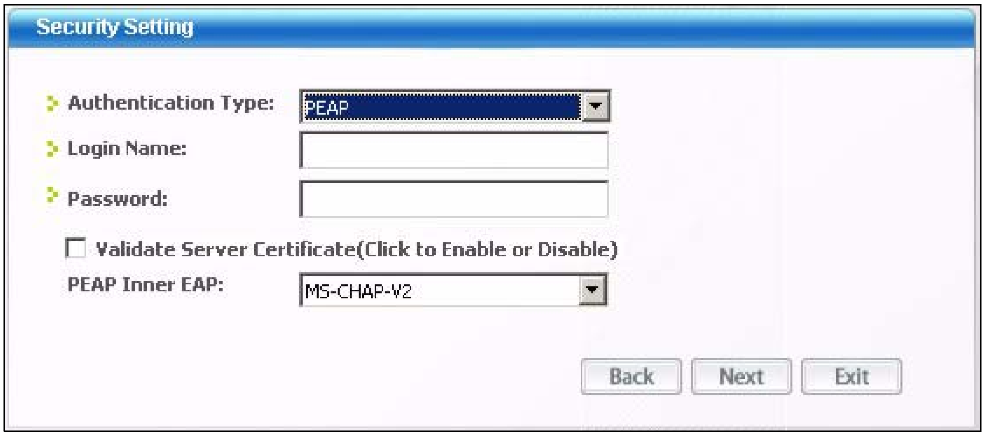
LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (**TKIP** or **AES**) for data encryption. Refer to Section 3.2.3.3 on page 40 for more information.
Authentication Type	The type of authentication you use depends on the RADIUS server or AP. Select an authentication method from the drop down list. Options are **TLS** and **PEAP**.
Login Name	Enter a user name. This is the user name that you or an administrator set up on a RADIUS server. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Password	This field is not available when you select **TLS** in the **Authentication Type** field. Enter the password associated with the user name above. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Certificate	This field is only available when you select **TLS** in the **Authentication Type** field. Click **Browse** to select a certificate. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Validate Server Certificate	Select the check box to check the certificate of the authentication server.
PEAP Inner EAP	This field is only available when you select **PEAP** in the **Authentication Type** field. The PEAP method used by the RADIUS server or AP for client authentication is **MS CHAP v2**.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 61.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.4 IEEE 802.1x

Configure IEEE 802.1x security with various authentication methods in this screen.

Note: At the time of writing this section is less functional on Windows Vista. Please see Section 4.6 on page 71 for more information on how to configure the security settings.

Figure 33 Station Mode: Security Setting: 802.1x



Security Setting

Authentication Type: PEAP

Login Name:

Password:

□ Validate Server Certificate(Click to Enable or Disable)

PEAP Inner EAP: MS-CHAP-V2

The following table describes the labels in this screen.

Table 9 Station Mode: Security Settings: IEEE 802.1x

LABEL	DESCRIPTION
Authentication Type	The type of authentication you use depends on the RADIUS server or AP. Select an authentication method from the drop down list. Options are **TLS** and **PEAP**.
Login Name	Enter a user name. This is the user name that you or an administrator set up on a RADIUS server. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Password	This field is not available when you select **TLS** in the **Authentication Type** field. Enter the password associated with the user name above. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Certificate	This field is only available when you select **TLS** in the **Authentication Type** field. Click **Browse** to select a certificate. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information. **Note:** At the time of writing this field is not available on Windows Vista. Please see Section 4.6 on page 71 for more information.
Validate Server Certificate	Select the check box to check the certificate of the authentication server.

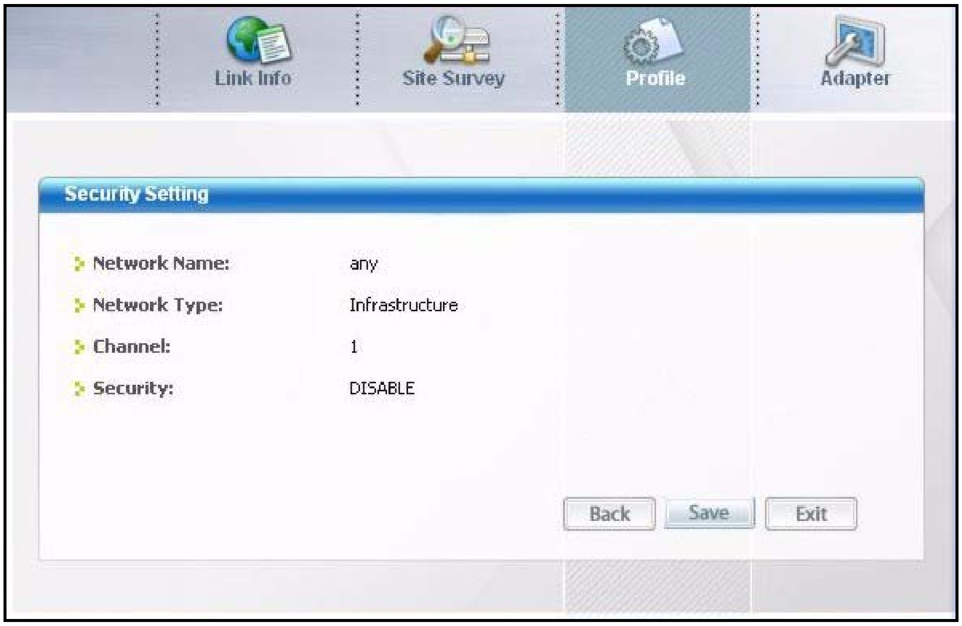
Table 9 Station Mode: Security Settings: IEEE 802.1x

LABEL	DESCRIPTION
PEAP Inner EAP	This field is only available when you select **PEAP** in the **Authentication Type** field. The PEAP method used by the RADIUS server or AP for client authentication is **MS CHAP v2**.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 61.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.2 Confirm Save Screen

Use this screen to confirm and save the security settings.

Figure 34 Confirm Save Screen



Network Name: any

Network Type: Infrastructure

Channel: 1

Security: DISABLE

The following table describes the labels in this screen.

Table 10 Confirm Save Screen

LABEL	DESCRIPTION
Security Setting	
Network Name	This field displays the **SSID** previously entered.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the wireless device.
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).

Table 10 Confirm Save Screen

LABEL	DESCRIPTION
Back	Click **Back** to return to the previous screen.
Save	Click **Save** to save the changes back to the G-220 v3 and display the **Link Info** screen.
Exit	Click **Exit** to discard changes and return to the **Site Survey** screen.

4.4 The Profile Screen

A profile is a set of wireless parameters that you need to connect to a wireless network. With a profile activated, each time you start the G-220 v3, it automatically scans for the specific SSID and joins that network with the pre-defined wireless security settings. If the specified network is not available, the G-220 v3 cannot connect to a network.

If you do not configure and activate a profile, each time you start the G-220 v3, the G-220 v3 uses the default profile to connect to any available network with security disabled.

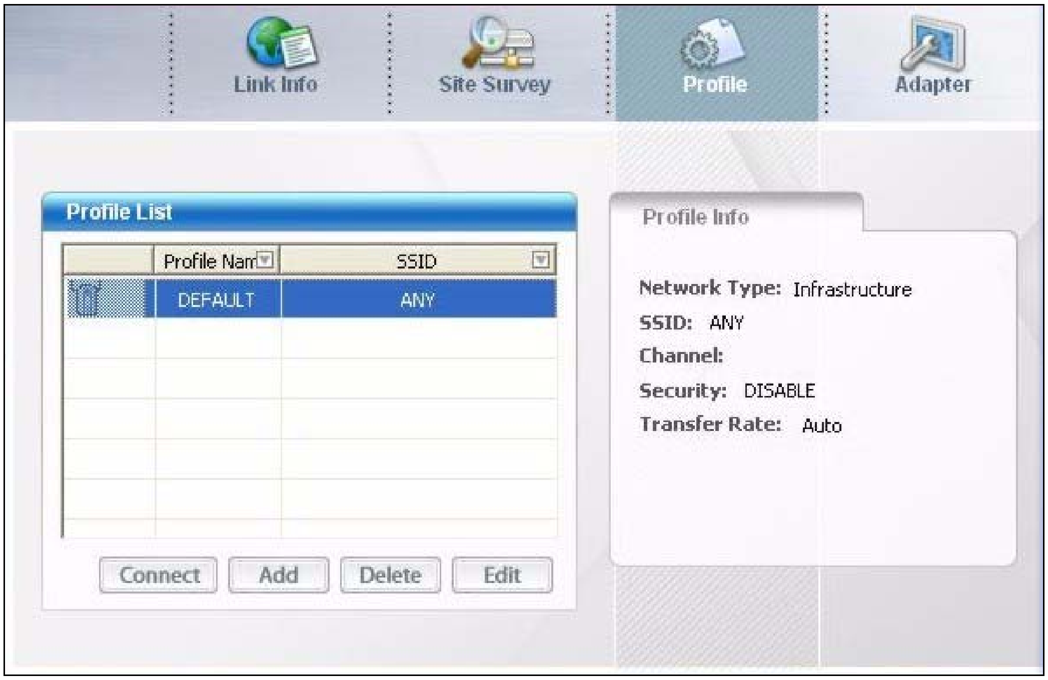
The default profile is a profile that allows you to connect to any SSID without security.

Click the **Profile** tab in the ZyXEL utility program to display the **Profile** screen as shown next.

The profile function allows you to save the wireless network settings in this screen, or use one of the pre-configured network profiles.

Note: The procedure to configure certain profiles is different in Windows Vista. See Section 4.6 “Security Settings in Windows Vista” on page 71 for more information.

Figure 35 Station Mode: Profile



Profile Name	SSID
DEFAULT	ANY

Network Type: Infrastructure
SSID: ANY
Channel:
Security: DISABLE
Transfer Rate: Auto

The following table describes the labels in this screen.

Table 11 Station Mode: Profile

LABEL	DESCRIPTION
Profile List	Click a column heading to sort the entries.
, , or	denotes that the wireless device is in infrastructure mode and the wireless security is activated. denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
Profile Name	This is the name of the pre-configured profile.
SSID	This is the SSID of the wireless network to which the selected profile associate.
Connect	To use and activate a previously saved network profile, select a pre-configured profile name in the table and click **Connect**.
Add	To add a new profile into the table, click **Add**.
Delete	To delete an existing wireless network configuration, select a profile in the table and click **Delete**.
Edit	To edit an existing wireless network configuration, select a profile in the table and click **Edit**.
Profile Info	The following fields display detail information of the selected profile in the **Profile List** table.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the profile.
SSID	This field displays the SSID (Service Set IDentifier) of the profile.

Table 11 Station Mode: Profile (continued)

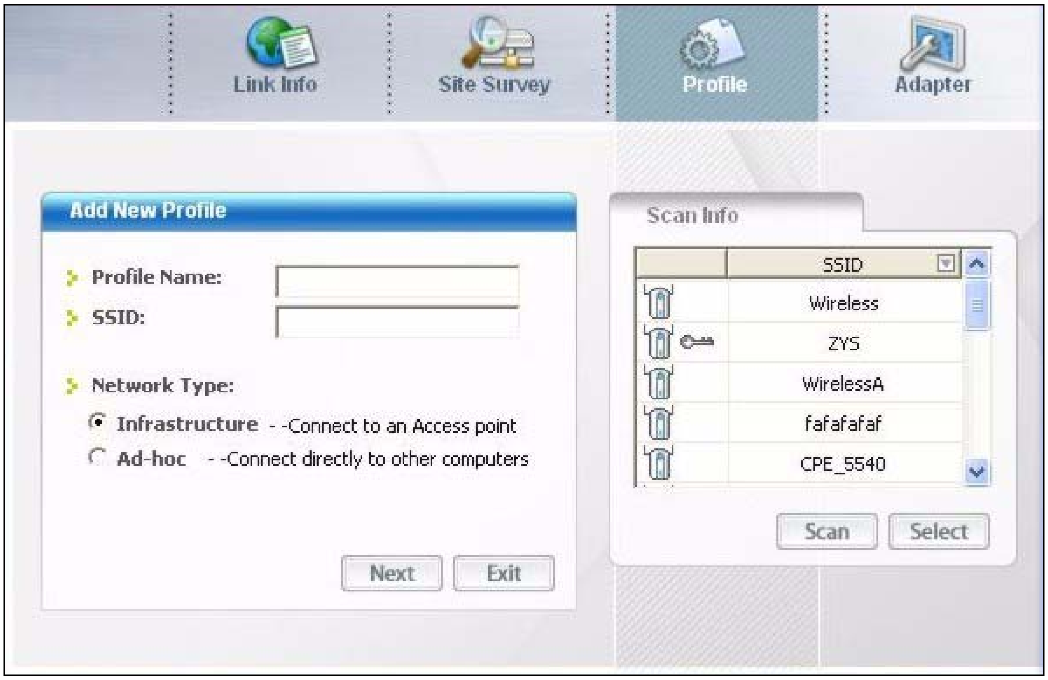
LABEL	DESCRIPTION
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).
Transmission Rate	This field displays the transmission speed of the selected profile in megabits per second (Mbps).

4.4.1 Adding a New Profile

Follow the steps below to add a new profile.

- Click **Add** in the **Profile** screen. An **Add New Profile** screen displays as shown next. Click **Next** to continue.

Figure 36 Station Mode: Profile: Add a New Profile



Add New Profile

Profile Name:

SSID:

Network Type:

● Infrastructure - -Connect to an Access point

○ Ad-hoc - -Connect directly to other computers

Scan Info

	SSID
	Wireless
	ZYS
	WirelessA
	fafafafaf
	CPE_5540

The following table describes the labels in this screen.

Table 12 Station Mode: Profile: Add a New Profile

LABEL	DESCRIPTION
Add New Profile	
Profile Name	Enter a descriptive name in this field.
SSID	Select an available wireless device in the **Scan Info** table and click **Select**, or enter the SSID of the wireless device to which you want to associate in this field manually. Otherwise, enter **Any** to have the G-220 v3 associate to any AP or roam between any infrastructure wireless networks.

Table 12 Station Mode: Profile: Add a New Profile (continued)

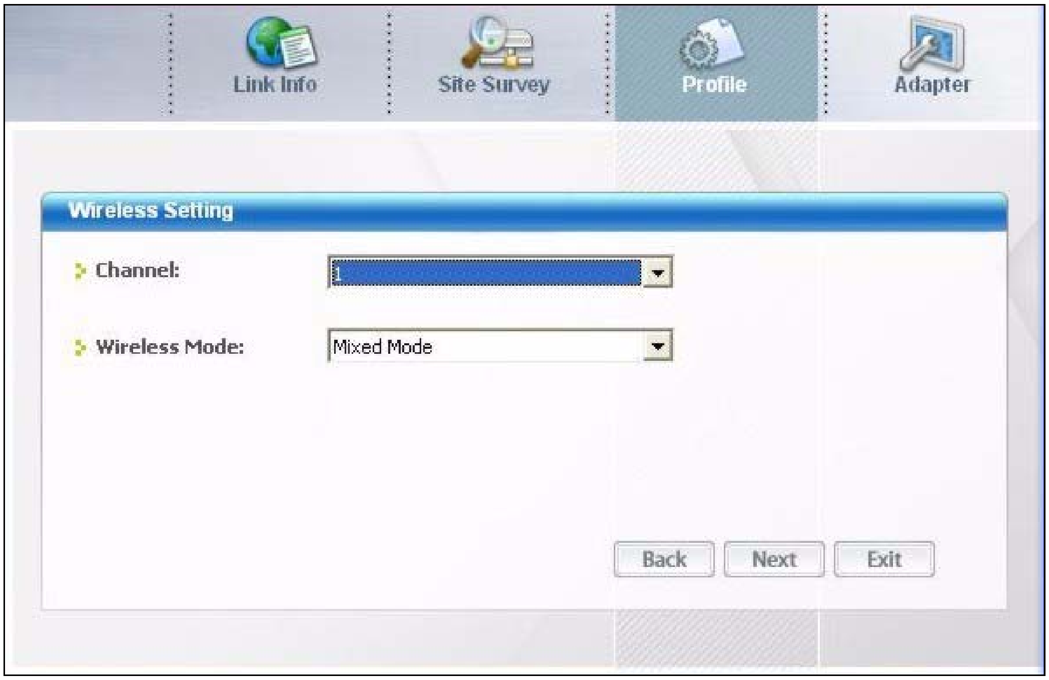
LABEL	DESCRIPTION
Network Type	Select **Infrastructure** to associate to an AP. Select **Ad-Hoc** to associate to a peer computer.
Next	Click **Next** to go to the next screen.
Exit	Click **Exit** to go back to the previous screen without saving.
Scan Info	This table displays the information of the available wireless networks within the transmission range.
📡🔑 , 📡 , 💳🔑 or 💳	📡🔑 denotes that the wireless device is in infrastructure mode and the wireless security is activated. 📡 denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. 💳🔑 denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. 💳 denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set IDentifier) of each AP or peer device.
Scan	Click **Scan** to search for available wireless devices within transmission range.
Select	Select an available wireless device in the table and click **Select** to add it to this profile. Whenever you activate this profile, the G-220 v3 associates to the selected wireless network only.

- If you select the **Infrastructure** network type in the previous screen, skip to the next step. If you select the **Ad-Hoc** network type in the previous screen, a screen displays as follows. Select a channel number and wireless LAN mode and click **Next** to continue.

Note: To associate to an ad-hoc network, you must use the same channel as the peer computer.

Note: At the time of writing the Ad-hoc channel and wireless mode select is not available on Windows Vista.

Figure 37 Station Mode: Profile: Select a Channel



Channel: 1

Wireless Mode: Mixed Mode

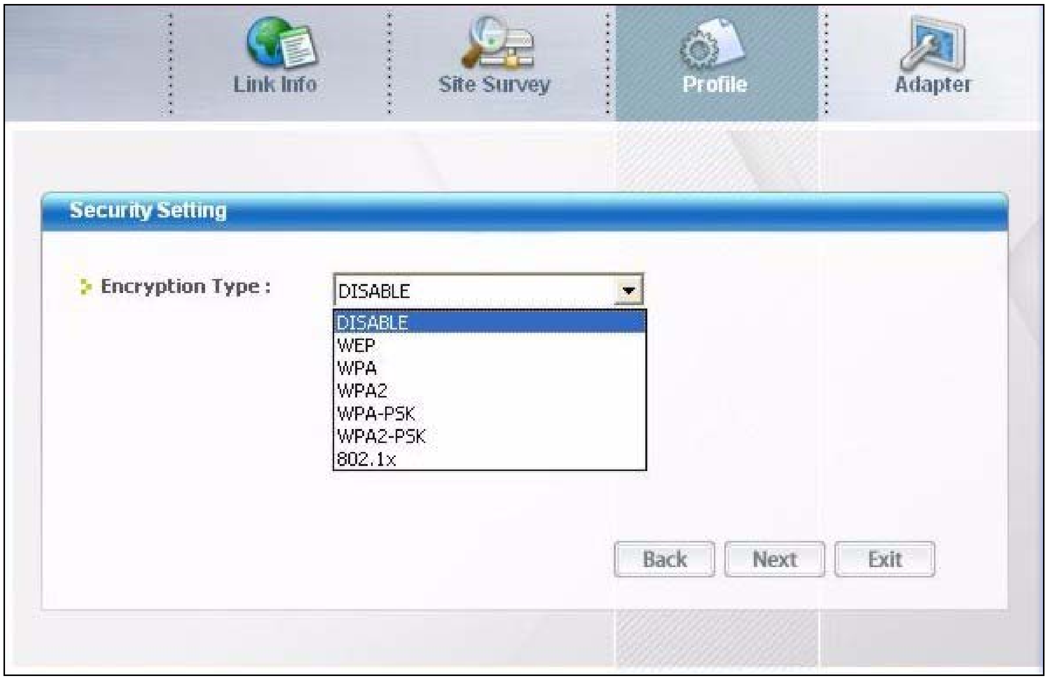
The following table describes the labels in this screen.

Table 13 Station Mode: Profile: Select a Channel

	DESCRIPTION
Wireless Settings	
Channel	Select a channel number from the drop-down list box. To associate to an ad-hoc network, you must use the same channel as the peer computer.
Wireless Mode	Select **Mixed Mode** to have the G-220 v3 connect to either an IEEE 802.11g or IEEE 802.11b wireless device. Select **G Only** to have the G-220 v3 connect to an IEEE 802.11g wireless device only and vice versa. Select **B Only** to have the G-220 v3 connect to an IEEE 802.11b wireless device only and vice versa.

- If you select **Infrastructure** network type in the first screen, select **WEP**, **WPA**, **WPA2**, **WPA-PSK**, **WPA2-PSK** or **802.1x** from the drop-down list box to enable data encryption. If you select **Ad-Hoc** network type in the first screen, you can only use **WEP** encryption method. Otherwise, select **DISABLE** to allow the G-220 v3 to communicate with the access points or other peer wireless computers without any data encryption.

Figure 38 Station Mode: Profile: Wireless Settings

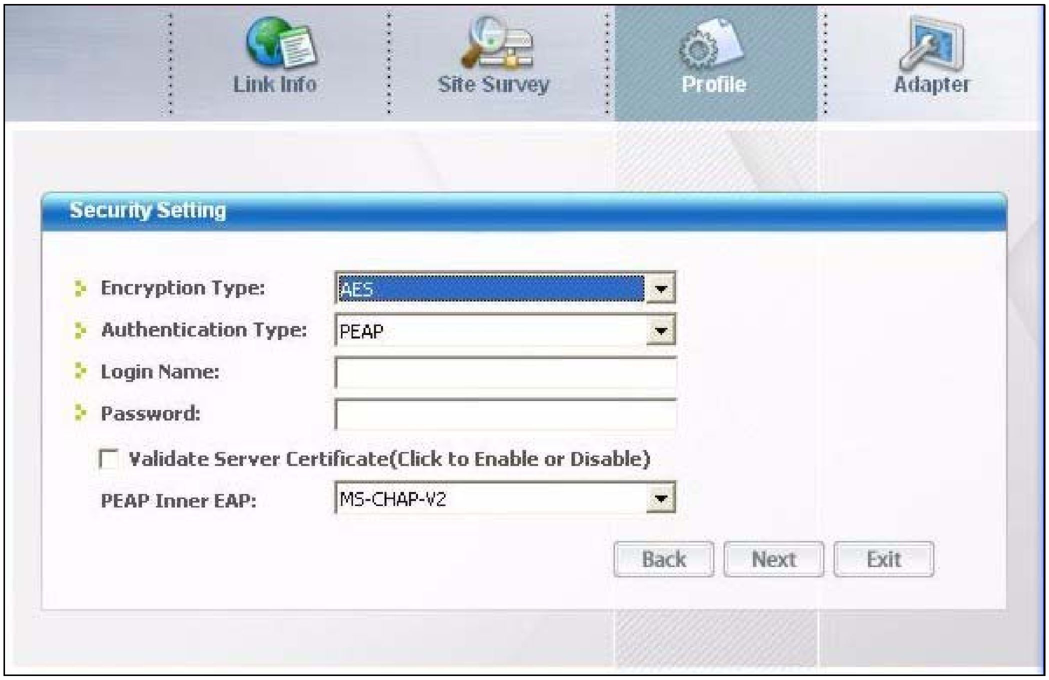


Security Setting

Encryption Type : DISABLE

- The screen varies depending on the encryption method you select in the previous screen. The settings must be exactly the same on the APs or other peer wireless computers as they are on the G-220 v3. Refer to Section 4.3.1 on page 55 for detailed information on wireless security configuration.

Figure 39 Station Mode: Profile: Security Settings



Security Setting

Encryption Type: AES

Authentication Type: PEAP

Login Name:

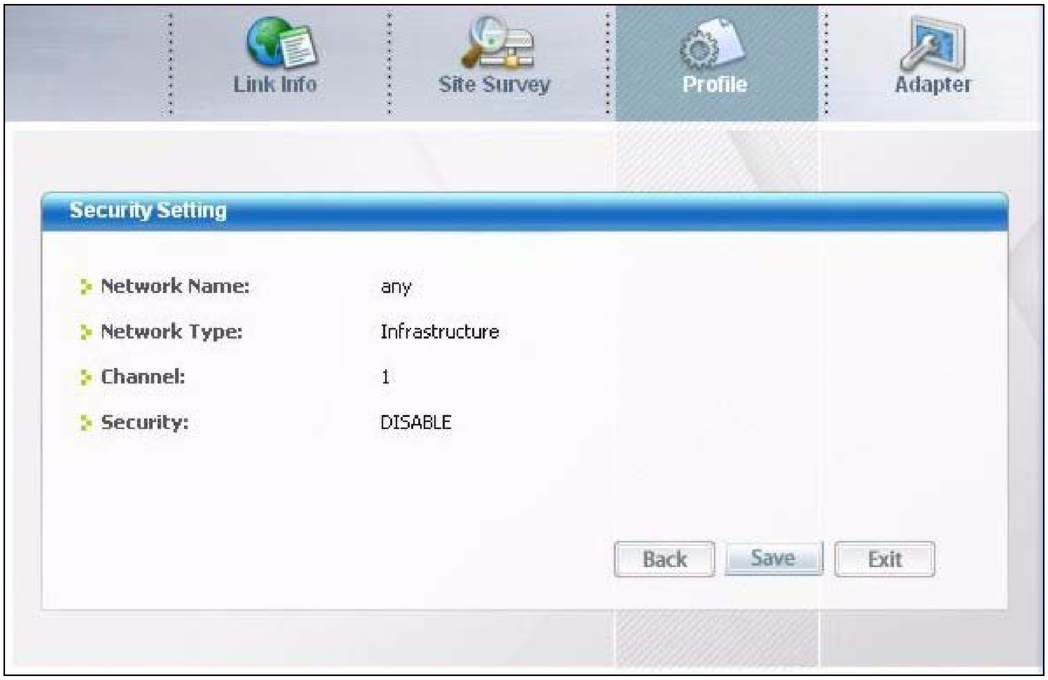
Password:

□ Validate Server Certificate(Click to Enable or Disable)

PEAP Inner EAP: MS-CHAP-V2

- This read-only screen shows a summary of the new profile settings. Verify that the settings are correct. Click **Save** to save and go to the next screen. Click **Back** to return to the previous screen. Otherwise, click **Exit** to go back to the **Profile** screen without saving.

Figure 40 Station Mode: Profile: Confirm New Settings



Network Name: any

Network Type: Infrastructure

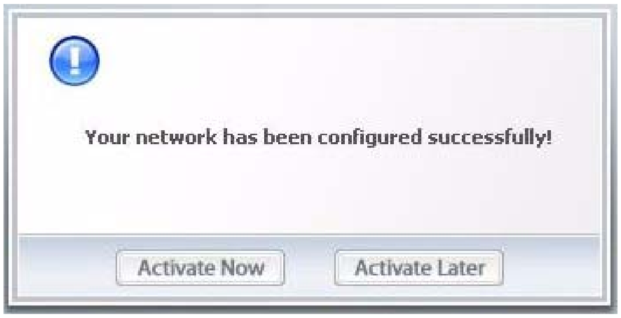
Channel: 1

Security: DISABLE

- To use this network profile, click the **Activate Now** button. Otherwise, click the **Activate Later** button. You can activate only one profile at a time.

Note: Once you activate a profile, the ZyXEL utility will use that profile the next time it is started.

Figure 41 Station Mode: Profile: Activate the Profile



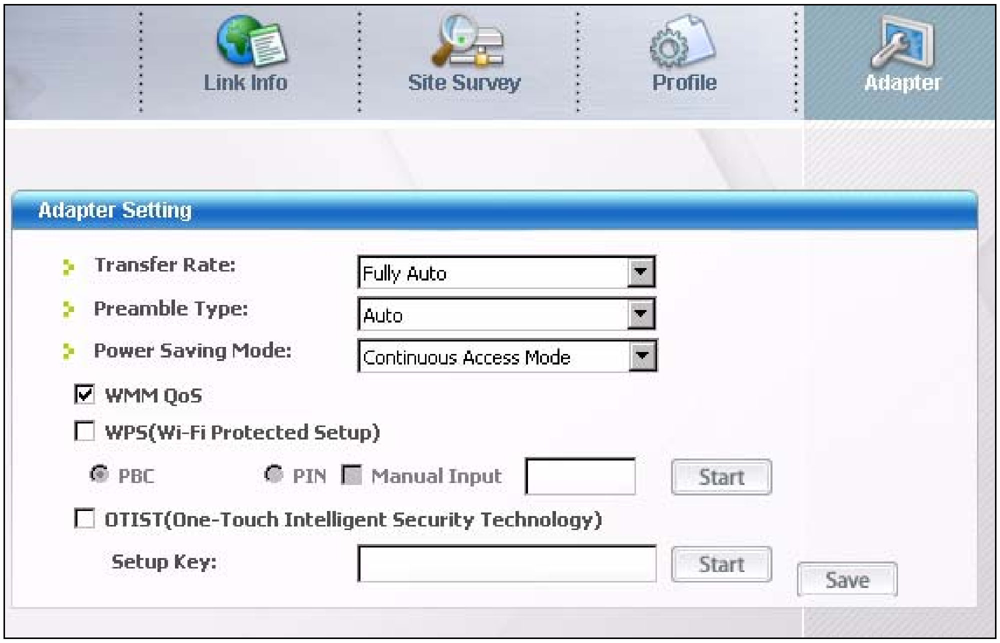
Your network has been configured successfully!

4.5 The Adapter Screen

To set the advanced features on the G-220 v3, click the **Adapter** tab.

Note: At the time of writing **Transfer Rate**, **Preamble Types**, **Power Saving Mode** and **WMM QoS** are not available on Windows Vista.

Figure 42 Station Mode: Adapter



Adapter Setting

Transfer Rate: Fully Auto

Preamble Type: Auto

Power Saving Mode: Continuous Access Mode

☑ WMM QoS

☐ WPS(Wi-Fi Protected Setup)

● PBC ○ PIN ☐ Manual Input

☐ OTIST(One-Touch Intelligent Security Technology)

Setup Key:

The following table describes the labels in this screen.

Table 14 Station Mode: Adapter

LABEL	DESCRIPTION
Adapter Setting	
Transfer Rate	In most networking scenarios, the factory default **Fully Auto** setting is the most efficient and allows your G-220 v3 to operate at the highest possible transmission (data) rate. If you want to select a specific transmission rate, select one that the AP or peer wireless device supports. **Note:** With USB1.0/1.1, the G-220 v3 can only transmit at up to 11Mbps. **Note:** At the time of writing this field is not available on Windows Vista.
Preamble Type	Preamble is used to signal that data is coming to the receiver. Select the preamble type that the AP uses. **Short** preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11b/g compliant wireless adapters support **Long** preamble, but not all support short preamble. Select **Auto** to have the G-220 v3 automatically use short preamble when all access point or wireless stations support it; otherwise the G-220 v3 uses long preamble. **Note:** The G-220 v3 and the access point or wireless stations MUST use the same preamble mode in order to communicate. **Note:** At the time of writing this field is not available on Windows Vista.

Table 14 Station Mode: Adapter (continued)

LABEL	DESCRIPTION
Power Saving Mode	Select **Maximum Power Save** or **Fast Power Save** to save power (especially for notebook computers). This forces the G-220 v3 to go to sleep mode when it is not transmitting data. When you select **Continuous Access Mode**, the G-220 v3 will never go to sleep mode. **Note:** At the time of writing this field is not available on Windows Vista.
WMM QoS	WMM (Wi-Fi MultiMedia) QoS (Quality of Service) allows you to prioritize wireless traffic according to the delivery requirements of individual services. To do this, you must enable WMM QoS on both the AP and wireless clients. Select this check box to enable WMM QoS on the G-220 v3. **Note:** At the time of writing this field is not available on Windows Vista.
WPS (Wi-Fi Protected Setup)	Select this to enable Wi-fi Protected Setup on the G-220 v3.
PBC	Select this to use the PBC (Push-Button Configuration) WPS mode. When you use the PBC mode you do not use a PIN.
PIN	Select this to use the PIN (Personal Identification Number) WPS mode. Use this option when you want to enter the G-220 v3's PIN in another WPS-enabled device. The PIN will be displayed in the field on the right. Click PIN again to generate a new PIN.
Manual Input	Select this check box to manually enter the PIN into the field on the right. This could be a PIN from another WPS-enabled device or a PIN you will type into the other WPS-enabled device.
Start	Click **Start** once you have selected the PBC or PIN settings. A screen will appear that states the WPS is in progress. You must now start WPS on the other WPS-enabled device within two minutes or the connection will time out. If the two WPS devices connect you will receive a successful connection message.
OTIST (One-Touch Intelligent Security Technology)	Select this check box to enable OTIST.
Setup Key	Enter the same setup key (up to eight printable characters) as the ZyXEL AP or wireless router to which you want to associate. The default OTIST setup key is "01234567". **Note:** If you change the OTIST setup key on the ZyXEL AP or wireless router, you must also make the same change here.
Start	Click **Start** to encrypt the wireless security data using the setup key and have the ZyXEL AP or wireless router set your G-220 v3 to use the same wireless settings as the ZyXEL AP or wireless router. You must also activate and start OTIST on the ZyXEL AP or wireless router all within three minutes.
Save	Click **Save** to save the changes back to the G-220 v3 and return to the **Link Info** screen.

4.6 Security Settings in Windows Vista

When you use the G-220 v3 in Windows Vista, the procedure for setting up WPA, WPA2 and 802.1x security settings is different from that of other operating systems (other security types are not affected).

The procedures for setting up WPA, WPA2 or 802.1x in Vista are the same. However, the procedure differs depending on whether you use PEAP (Protected Extensible Authentication Protocol) or TLS (Transport Layer Security) encryption. Consult your network administrator if you are unsure which type of encryption to use.

See section Section 4.6.1 "Using PEAP in Vista" on page 71 to use PEAP, or see section Section 4.6.2 "Using TLS in Vista" on page 72 to use TLS.

4.6.1 Using PEAP in Vista

Take the following steps to set up WPA, WPA2 or 802.1x security using PEAP in Windows Vista.

1 Either select the AP to which you want to connect in the **Site Survey** screen (see Section 4.3 on page 54), or configure a profile in the normal way (see Section 4.4 on page 62).

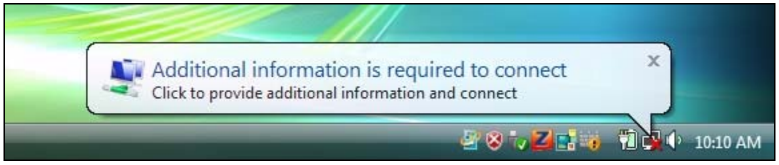
2 In the **WPA**, **WPA2** or **802.1x** security screen (see Section 4.3.1.3 on page 58 and Section 4.3.1.4 on page 59), select **PEAP** as the **EAP Type**. Note that the **Login Name** and **Password** fields are greyed-out (not available).

3 Click **Next**.

4 In the **Summary** screen that appears, click **Save**.

5 A message similar to the following appears in the bottom-right of your screen. Click the message.

Figure 43 Vista Security: Additional Information Required

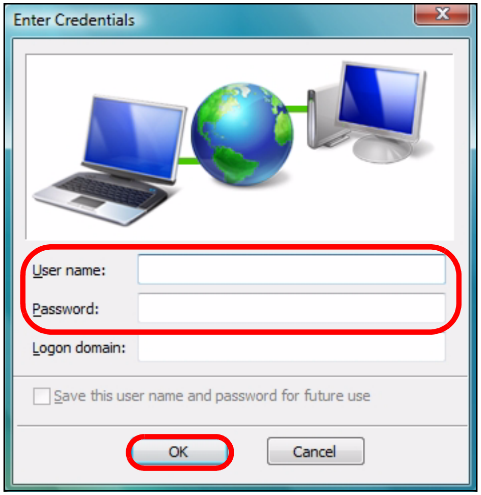


Additional information is required to connect

Click to provide additional information and connect

6 The **Enter Credentials** screen displays. Enter your **User name** and **Password** for the network to which you want to connect.

Figure 44 Vista Security: Enter Credentials


Enter Credentials

User name:

Password:

Logon domain:

□ Save this user name and password for future use

Note: If you are not sure what to enter, contact your network administrator.

7 Click **OK**. The **Enter Credentials** screen disappears and the G-220 v3 tries to connect to the network. The ZyXEL utility’s **Link Info** screen displays, showing the connection status (see Section 4.2 on page 52). If the **Link Info** screen displays an active connection, you have successfully completed the procedure.

4.6.2 Using TLS in Vista

Take the following steps to set up WPA, WPA2 or 802.1x security using TLS in Windows Vista.

1 Either select the AP to which you want to connect in the **Site Survey** screen (see Section 4.3 “The Site Survey Screen” on page 54), or configure a profile (see Section 4.4 “The Profile Screen” on page 62) in the normal way.

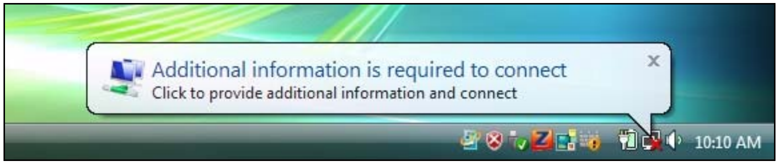
2 In the **WPA**, **WPA2** or **802.1x** security screen, select **TLS** as the **EAP Type**. Note that the **Login Name** and **Certificate** fields are greyed-out (not available).

3 Click **Next**.

4 In the **Summary** screen, click **Save**.

5 A message similar to the following appears in the bottom-right of your screen. Click the message.

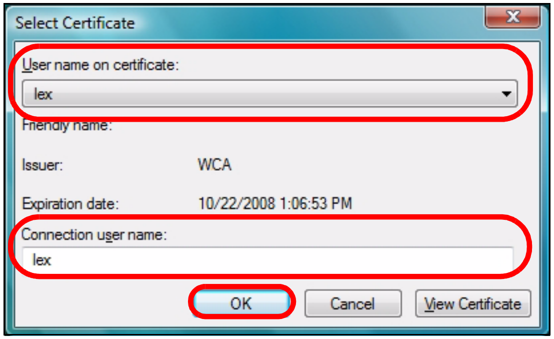
Figure 45 Vista Security: Additional Information Required


Additional information is required to connect

Click to provide additional information and connect

6 The **Select Certificate** screen displays. Select the certificate you want to use in order to authenticate with the server, and enter your username.

Figure 46 Vista Security: Select Certificate



Note: If you do not have the right certificate, or are not sure which certificate you should use, contact your network administrator.

7 Click **OK**. The **Select Certificate** screen disappears and the G-220 v3 tries to connect to the network. The ZyXEL utility’s **Link Info** screen displays, showing the connection status (see Section 4.2 on page 52). If the **Link Info** screen displays an active connection, you have successfully completed the procedure.

CHAPTER 5 Access Point Mode Configuration

This chapter shows you how to configure your G-220 v3 in access point mode.

5.1 Access Point Mode Introduction

To set your G-220 v3 as an Access Point (AP), select **AP Mode** in any utility screen (refer to Section 1.2.4 on page 25).

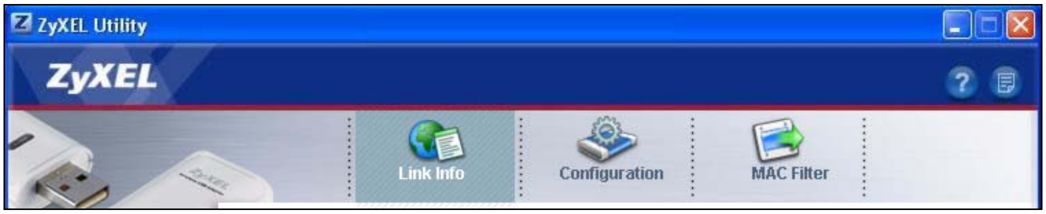
In access point mode, your G-220 v3 functions as an access point. This allows you to set up your wireless networks without using a dedicated AP.

Note: At the time of writing this function is not available on Windows Vista.

5.1.1 ZyXEL Utility Screen Summary

This section describes the ZyXEL utility screens when the G-220 v3 is in AP mode.

Figure 47 ZyXEL Utility Menu Summary: AP Mode



The following table describes the menus.

Table 15 ZyXEL Utility Menu Summary: AP Mode

TAB	DESCRIPTION
AP Mode	
Link Info	Use this screen to see your current connection status, configuration and data rate statistics.
Configuration	Use this screen to configure wireless LAN settings.
MAC Filter	Use this screen to configure which computer(s) you want access to the wireless LAN through the G-220 v3.

5.1.2 Additional Setup Requirements

To bridge your wired and wireless network using the G-220 v3, the following requirements must be met:

1 The G-220 v3 must be installed on a computer connected to the wired network.

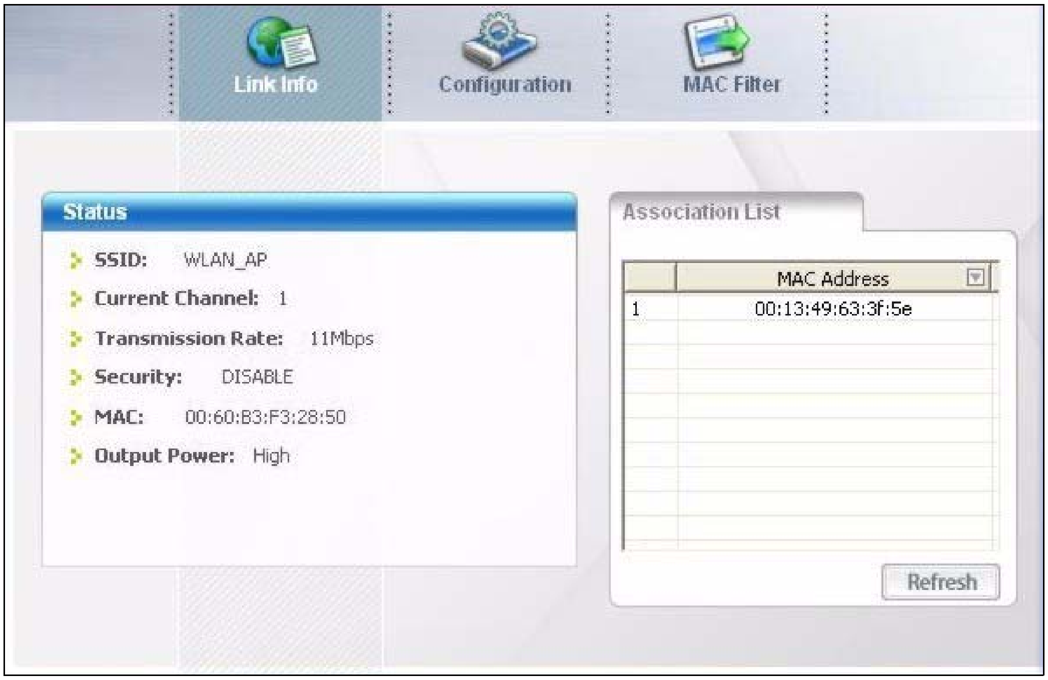
2 Either bridge the two interfaces (wireless and wired) on the computer (using the **Configuration** screen of the ZyXEL utility in Windows XP) or configure network sharing (refer to Appendix B on page 89 for an example).

3 Set the wireless station's IP address to be dynamic if you want the wireless stations to access the wired network or the Internet through the G-220 v3. Refer to Appendix E on page 111 for how to configure your computer's IP address.

5.2 The Link Info Screen

Select the **AP Mode** check box and wait for about five seconds to display the screen as shown.

Figure 48 Access Point Mode: Link Info



Status

- SSID: WLAN_AP
- Current Channel: 1
- Transmission Rate: 11Mbps
- Security: DISABLE
- MAC: 00:60:B3:F3:28:50
- Output Power: High

	MAC Address
1	00:13:49:63:3f:5e

The following table describes the labels in this screen.

Table 16 Access Point Mode: Link Info

LABEL	DESCRIPTION
Status	
SSID	This field displays the name that identifies your G-220 v3 in the wireless LAN network.

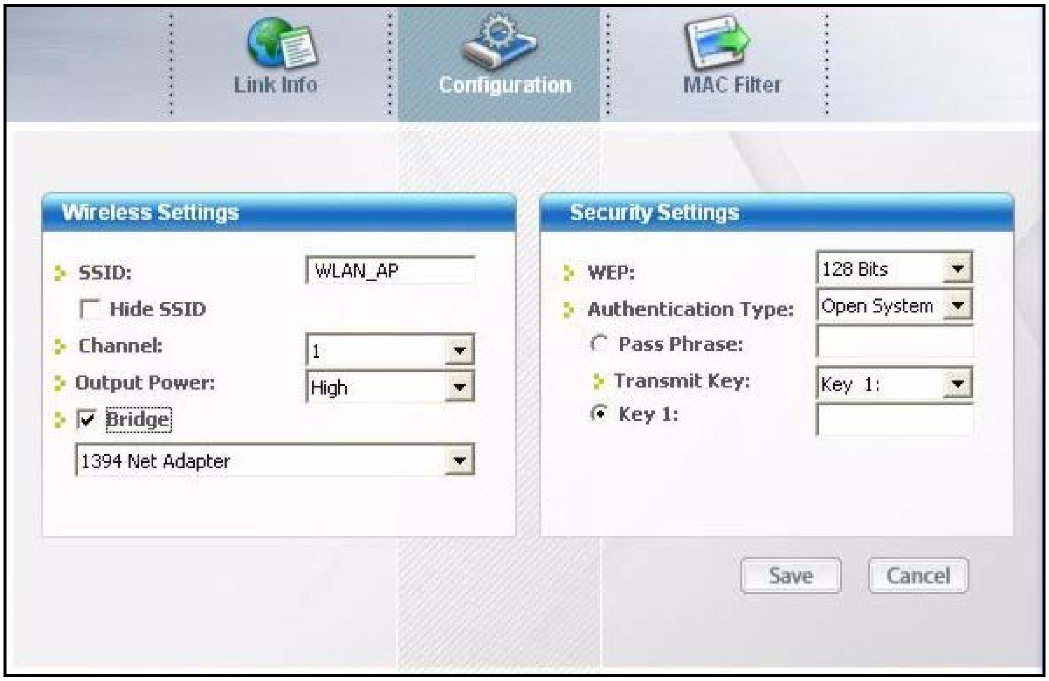
Table 16 Access Point Mode: Link Info (continued)

LABEL	DESCRIPTION
Current Channel	This field displays the radio channel the G-220 v3 is currently using.
Transmission Rate	This field displays the current transmission rate of the G-220 v3 in megabits per second (Mbps).
Security	This field shows whether data encryption is activated (**WEP**) or inactive (**DISABLE**).
MAC	This field displays the MAC address of the G-220 v3.
Output Power	This field shows the strength of the G-220 v3's antenna gain or transmission power.
Association List	This table lists up to 16 wireless clients that are currently connected to the G-220 v3.
-	denotes a wireless client without WEP security. denotes a wireless client with WEP security enabled.
MAC Address	This field displays the MAC addresses of a wireless client that is currently connected to the G-220 v3.
Refresh	Click **Refresh** to update this screen.

5.3 The Configuration Screen

Click **Configuration** in the ZyXEL utility screen to display the screen as shown.

Figure 49 Access Point Mode: Configuration



SSID: WLAN_AP
□ Hide SSID
Channel: 1
Output Power: High
☑ Bridge
1394 Net Adapter

WEP: 128 Bits
Authentication Type: Open System
○ Pass Phrase:
Transmit Key: Key 1:
● Key 1:

The following table describes the labels in this screen.

Table 17 Access Point Mode: Configuration

LABEL	DESCRIPTION
Wireless Settings	
SSID	The SSID identifies the wireless network to which a wireless station is associated. Wireless stations associating to the access point (the G-220 v3) must have the same SSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN.
Hide SSID	Select this check box to hide the SSID so an intruder cannot obtain the SSID through scanning using a site survey tool.
Channel	Set the operating frequency/channel depending on your geographical region.
Output Power	Set this field if you need to conserve power consumption (especially for notebook computers). This control changes the strength of the G-220 v3’s antenna gain or transmission power. Antenna gain, measured in dBm (decibel relative units compared to milliwatts), is the increase in coverage. Higher antenna gain improves the range of the signal for better communications. Select **High** to set the G-220 v3’s antenna to transmit at 17-dBm. Select **Medium-High** to set the G-220 v3’s antenna to transmit at 15-dBm. Select **Medium-Low** to set the G-220 v3’s antenna to transmit at 13-dBm. Select **Low** to set the G-220 v3’s antenna to transmit at 11-dBm. This allows for the least power consumption.
Bridge	Select the check box and an Ethernet adapter (network interface card (NIC)) on your computer from the drop-down list box. This allows you to connect your wireless network to the specified wired network.
Security Settings	
WEP	Select **64 Bits**, **128 Bits** or **256 Bits** to activate WEP encryption and then fill in the related fields. Select **Disable** to deactivate the WEP encryption.
Authentication Type	Select an authentication method. Choices are **Auto**, **Shared Key** and **Open System**. Refer to Section 3.2.3.1.2 on page 39 for more information.
Pass Phrase	When you select the radio button, enter a passphrase of up to 63 case-sensitive printable characters. As you enter the passphrase, the G-220 v3 automatically generates four different WEP key and displays it in the key field below. Refer to Section 3.2.3.1 on page 39 for more information. At the time of writing, you cannot use passphrase to generate 256-bit WEP keys.
Transmit Key	Select a default WEP key to use for data encryption. The key displays in the field below.

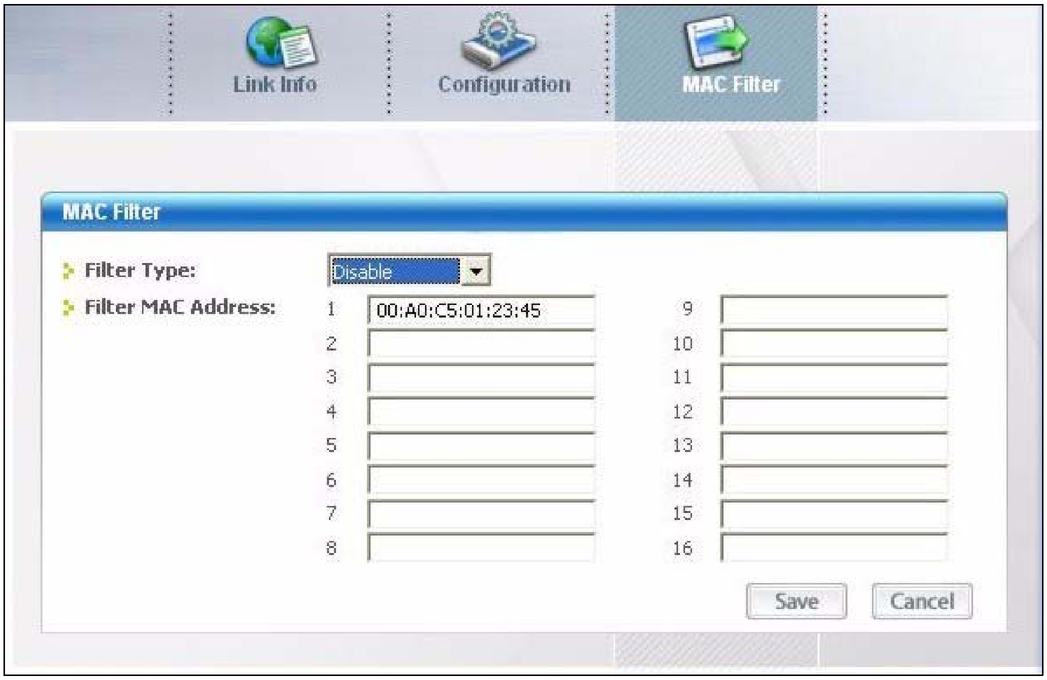
Table 17 Access Point Mode: Configuration (continued)

LABEL	DESCRIPTION
Key x (where x is a number between 1 and 4)	Select this option if you want to manually enter the WEP keys. Enter the WEP key in the field provided. If you select **64 Bits** in the **WEP** field. Enter either 10 hexadecimal digits in the range of “A-F”, “a-f” and “0-9” (for example, 11AA22BB33) for HEX key type or Enter 5 ASCII characters (case sensitive) ranging from “a-z”, “A-Z” and “0-9” (for example, MyKey) for ASCII key type. If you select **128 Bits** in the **WEP** field, Enter either 26 hexadecimal digits in the range of “A-F”, “a-f” and “0-9” (for example, 00112233445566778899AABBCC) for HEX key type or Enter 13 ASCII characters (case sensitive) ranging from “a-z”, “A-Z” and “0-9” (for example, MyKey12345678) for ASCII key type. If you select **256 Bits** in the **WEP** field, Enter either 58 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0000111122223333444455556666777788889999AAAABBBBCCCC000011) for HEX key type or Enter 29 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey111122223333444455556678) for ASCII key type. **Note:** The values for the WEP keys must be set up exactly the same on all wireless devices in the same wireless LAN. ASCII WEP keys are case sensitive.
Save	Click **Save** to save the changes.
Cancel	Click **Cancel** to discard the changes.

5.4 The MAC Filter Screen

The **MAC Filter** screen allows you to configure the G-220 v3 to give exclusive access to (**Accept**) devices or exclude devices from (**Reject**) connecting to the G-220 v3. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the device(s) to configure this screen.

Figure 50 Access Point Mode: MAC Filter



Filter Type: Disable

Filter MAC Address:

1	00:A0:C5:01:23:45	9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	

The following table describes the labels in this screen.

Table 18 Access Point Mode: MAC Filter

	DESCRIPTION
Filter Type	Define the filter action for the list of MAC addresses in the MAC address filter table. Select **Disable** to deactivate the MAC filter feature. Select **Reject** to block access to the G-220 v3, MAC addresses not listed will be allowed to access the G-220 v3. Select **Accept** to permit access to the G-220 v3, MAC addresses not listed will be denied access to the G-220 v3.
Filter MAC Address 1-16	Specify the MAC address(es) of the wireless station(s) that is allowed or denied association to the G-220 v3. Enter six pairs of hexadecimal digits (separated by colons) in the range of “A-F”, “a-f” and “0-9” (for example, 00:A0:C5:00:00:02). If you enter an invalid MAC address, once you click **Save** to save the values, a warning screen will be displayed.
Save	Click **Save** to save the changes back to the G-220 v3.
Cancel	Click **Cancel** to discard the changes.

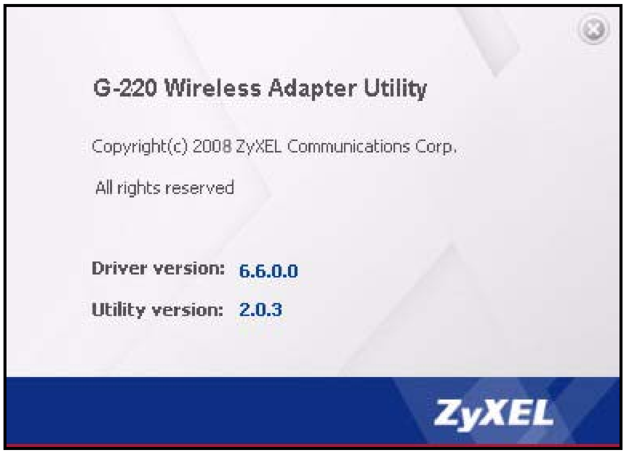
CHAPTER 6 Maintenance

This chapter describes how to uninstall or upgrade the ZyXEL utility.

6.1 The About Screen

The **About** screen displays driver and utility version numbers of the G-220 v3. To display the screen as shown below, click the about (🗐) button.

Figure 51 About



G-220 Wireless Adapter Utility

Copyright(c) 2008 ZyXEL Communications Corp.

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Driver version: 6.6.0.0

Utility version: 2.0.3

The following table describes the read-only fields in this screen.

Table 19 About

	DESCRIPTION
Driver Version	This field displays the version number of the G-220 v3 driver.
Utility Version	This field displays the version number of the ZyXEL utility.

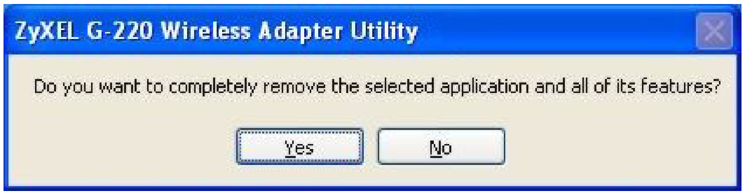
6.2 Uninstalling the ZyXEL Utility

Follow the steps below to remove (or uninstall) the ZyXEL utility from your computer.

1 Click **Start** > **Programs** > **ZyXEL G-220 v3 Wireless Adapter Utility** > **Uninstall ZyXEL G-220 v3 Wireless Adapter Utility**.

2 When prompted, click **OK** or **Yes** to remove the driver and the utility software.

Figure 52 Uninstall: Confirm

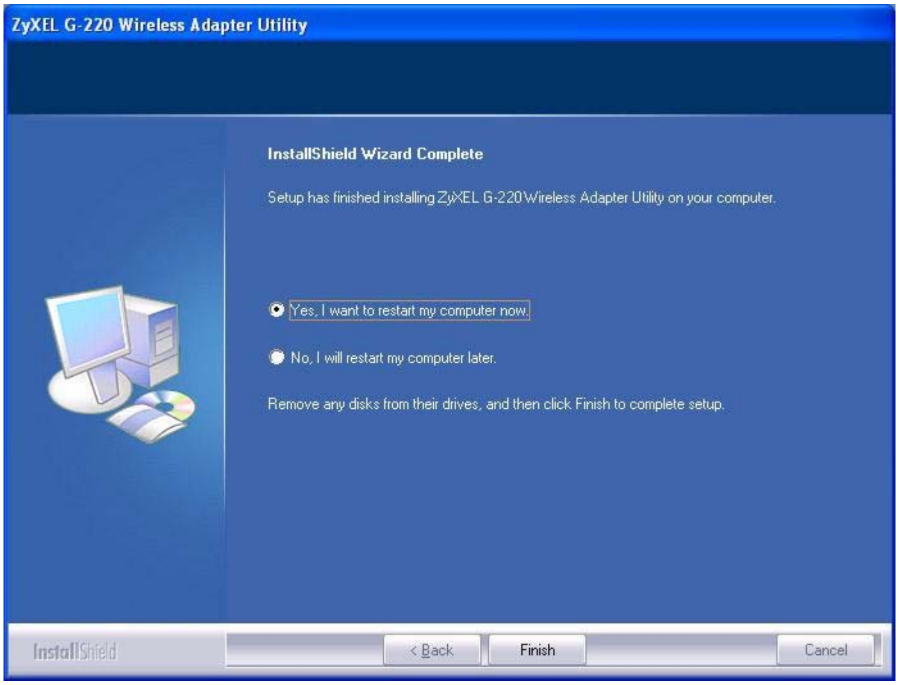


ZyXEL G-220 Wireless Adapter Utility

Do you want to completely remove the selected application and all of its features?

3 Click **Finish** to complete uninstalling the software and restart the computer when prompted.

Figure 53 Uninstall: Finish



ZyXEL G-220 Wireless Adapter Utility

InstallShield Wizard Complete

Setup has finished installing ZyXEL G-220 Wireless Adapter Utility on your computer.

● Yes, I want to restart my computer now.

○ No, I will restart my computer later.

Remove any disks from their drives, and then click Finish to complete setup.

6.3 Upgrading the ZyXEL Utility

Note: Before you uninstall the ZyXEL utility, take note of your current wireless configurations.

To perform the upgrade, follow the steps below.

1 Download the latest version of the utility from the ZyXEL web site and save the file on your computer.

2 Follow the steps in Section 6.2 on page 81 to remove the current ZyXEL utility from your computer.

3 Restart your computer when prompted.

4 Disconnect the G-220 v3 from your computer.

5 Double-click on the setup program for the new utility to start the ZyXEL utility installation.

6 Insert the G-220 v3 and check the version numbers in the **About** screen to make sure the new utility is installed properly.

CHAPTER 7 Troubleshooting

This chapter covers potential problems and the possible remedies. After each problem description, some instructions are provided to help you to diagnose and to solve the problem.

7.1 Problems Starting the ZyXEL Utility

Table 20 Troubleshooting Starting ZyXEL Utility

	CORRECTIVE ACTION
Cannot start the ZyXEL Wireless LAN utility	Make sure the G-220 v3 is properly inserted and the LED(s) is on. Refer to the Quick Start Guide for the LED descriptions. Use the **Device Manager** to check for possible hardware conflicts. Click **Start**, **Settings**, **Control Panel**, **System**, **Hardware** and **Device Manager**. Verify the status of the G-220 v3 under **Network Adapter**. (Steps may vary depending on the version of Windows). Install the G-220 v3 in another computer. If the error persists, you may have a hardware problem. In this case, you should contact your local vendor.
The ZyXEL utility icon does not display.	If you install the Funk Odyssey Client software on the computer, uninstall (remove) both the Funk Odyssey Client software and ZyXEL utility, and then install the ZyXEL utility again after restarting the computer.

7.2 Problem Connecting to an Access Point

Table 21 Troubleshooting Access Point Connection Problem

	CORRECTIVE ACTION
When using the Windows XP configuration tool, cannot scan for or connect to any access points.	The G-220 v3 might still be operating in access point mode. This results when you set the G-220 v3 to operate in access point mode using the ZyXEL utility, close the ZyXEL utility and then use the Windows XP configuration tool. Before you use the Windows XP configuration tool, make sure you set the G-220 v3 to operate in station mode before you close and exit the ZyXEL utility.

7.3 Problem with the Link Quality

Table 22 Troubleshooting Link Quality

	CORRECTIVE ACTION
The link quality and/or signal strength is poor all the time.	Search and connect to another AP with a better link quality using the **Site Survey** screen. Move your computer closer to the AP or the peer computer(s) within the transmission range. There may be too much radio interference (for example microwave or another AP using the same channel) around your wireless network. Lower the output power of each AP. Make sure there are not too many wireless stations connected to a wireless network.

7.4 Problems Communicating With Other Computers

Table 23 Troubleshooting Communication Problem

	CORRECTIVE ACTION
In wireless station mode, the computer with the G-220 v3 installed cannot communicate with the other computer(s).	In Infrastructure Mode • Make sure that the AP and the associated computers are turned on and working properly. • Make sure the G-220 v3 computer and the associated AP use the same SSID. • Change the AP and the associated wireless clients to use another radio channel if interference is high. • Make sure that the computer and the AP share the same security option and key. Verify the settings in the **Profile Security Setting** screen. • If you are using WPA(2) or WPA(2)-PSK security, try changing your encryption type from TKIP to AES or vice versa. In Ad-Hoc (IBSS) Mode • Verify that the peer computer(s) is turned on. • Make sure the G-220 v3 computer and the peer computer(s) are using the same SSID and channel. • Make sure that the computer and the peer computer(s) share the same security settings. • Change the wireless clients to use another radio channel if interference is high.
In access point mode, the wireless station(s) cannot associate to the G-220 v3.	Verify that the computer with the G-220 v3 installed is turned on. Make sure the wireless station(s) uses the same SSID as the G-220 v3. Make sure the wireless station(s) uses the same security settings. Verify that the wireless station(s) is not blocked in the **MAC Filter** screen.

APPENDIX A

Product Specifications

Table 24 Product Specifications

PHYSICAL AND ENVIRONMENTAL	
Product Name	ZyXEL G-202 802.11g Wireless USB Adapter
Interface	USB 2.0 compatible
Standards	IEEE 802.11b IEEE 802.11g
Network Architectures	Infrastructure Ad-Hoc
Operating Frequencies	2.412-2.472GHz
Operating Channels	IEEE 802.11b: 11 Channels (North America and Taiwan) IEEE 802.11g: 11 Channels (North America and Taiwan) IEEE 802.11b: 13 Channels (Europe) IEEE 802.11g: 13 Channels (Europe)
Data Rate	IEEE 802.11b: 11, 5.5, 2, 1Mbps IEEE 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps
Modulation	IEEE 802.11g: Orthogonal Frequency Division Multiplexing (64QAM, 16QAM, QPSK and BPSK) IEEE 802311b: PBCC, Direct Sequence Spread Spectrum (CCK, DQPSK, DBPSK).
Operating Temperature	0 ~ 50 degrees Centigrade
Storage Temperature	-30 ~ 60 degrees Centigrade
Operating Humidity	20 ~ 95% (non-condensing)
Storage Humidity	20 ~ 95% (non-condensing)
Power	IEEE 802.11g: TX: 450mA RX: 345mA IEEE 802.11b: TX: 450mA RX: 345mA
Voltage	5V
Weight	21 g
Dimension	(W) 81 mm × (D) 27 mm × (H) 13 mm
RADIO SPECIFICATIONS	
Media Access Protocol	IEEE 802.11
Frequency	2.4 ~ 2.484GHz (Industrial Scientific Medical Band)
Channels	1~11 Channels (USA, Canada and Taiwan) 1~13 Channels (Europe)
Data Rate	IEEE 802.11g (OFDM): 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11b: 1, 2, 5.5, 11 Mbps

Table 24 Product Specifications (continued)

Modulation	IEEE 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps (OFDM) IEEE 802.11b: 11, 5.5 Mbps (CCK), 2 Mbps (DQPSK), 1 Mbps (DBPSK)
Output Power	21 dBm (max.) at 11Mbps CCK, QPSK, BPSK 19 dBm (max.) at 54Mbps OFDM
RX Sensitivity	IEEE 802.11g (OFDM): 54 Mbps: < -70 dBm IEEE 802.11b (CCK): 11 Mbps: < -85 dBm
SOFTWARE SPECIFICATIONS	
Device Drivers	Microsoft Windows 98 Second Edition, Windows ME, Windows 2000, Windows XP, Windows Vista
Security	64/128/256-bit WEP WPA/WPA-PSK/WPA2/WPA2-PSK IEEE 802.1x
Roaming	IEEE 802.11b/g compliant

APPENDIX B
Access Point Mode Setup Example

This example uses the network sharing feature in Windows 2000 to bridge the wired and wireless network when you set the G-220 v3 in access point (AP) mode.

Refer to Chapter 5 on page 75 for setup methods and requirements.

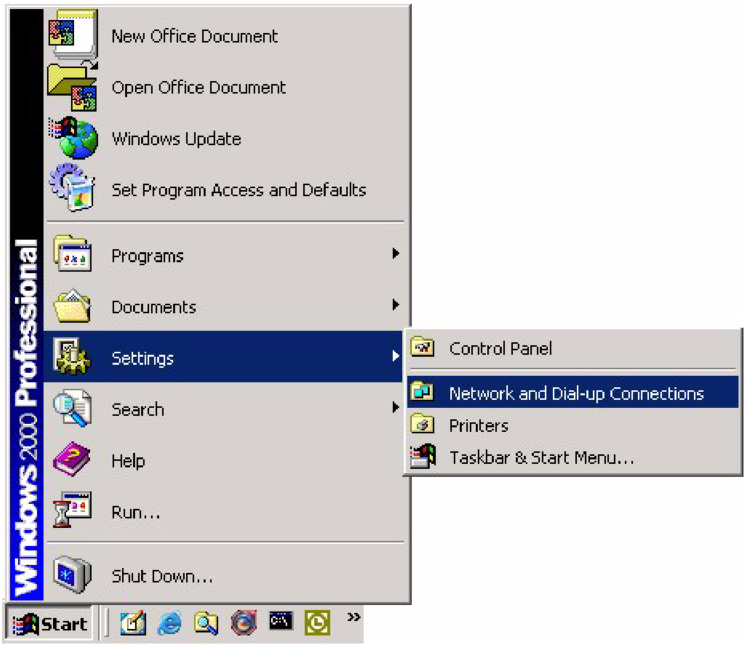
Steps may vary depending on your Windows version. You may need to install additional software in Windows 98 Second Edition and Windows ME.

Configuring the Computer on Which You Install the G-220 v3

1 Refer to Section 1.2.4 on page 25 to set the G-220 v3 to operate in AP mode.

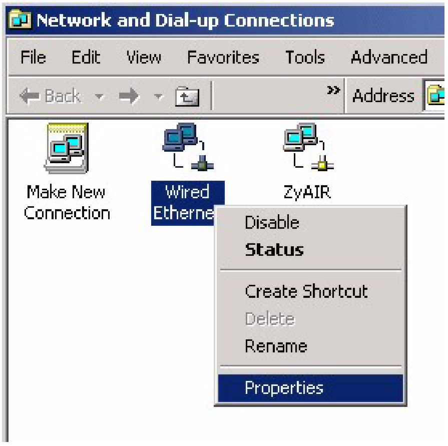
2 Click **Start**, **Settings**, **Network and Dial-up Connections** (or click **Start**, **Settings**, **Control Panel** and double-click **Network and Dial-up Connections**).

Figure 54 Windows 2000: Start



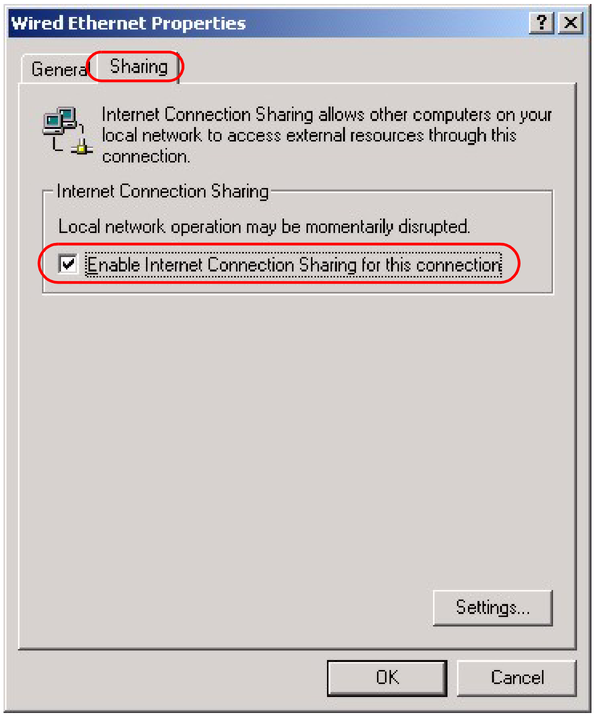
3 Right-click on the icon for your wired Ethernet adapter and click **Properties**.

Figure 55   Windows 2000: Network and Dial-up Connections



4 A **Properties** screen displays. Click the **Sharing** tab and select **Enable Internet Connection Sharing for this connection**. Click **OK**.

Figure 56   Windows 2000: Network Properties



Internet Connection Sharing allows other computers on your local network to access external resources through this connection.

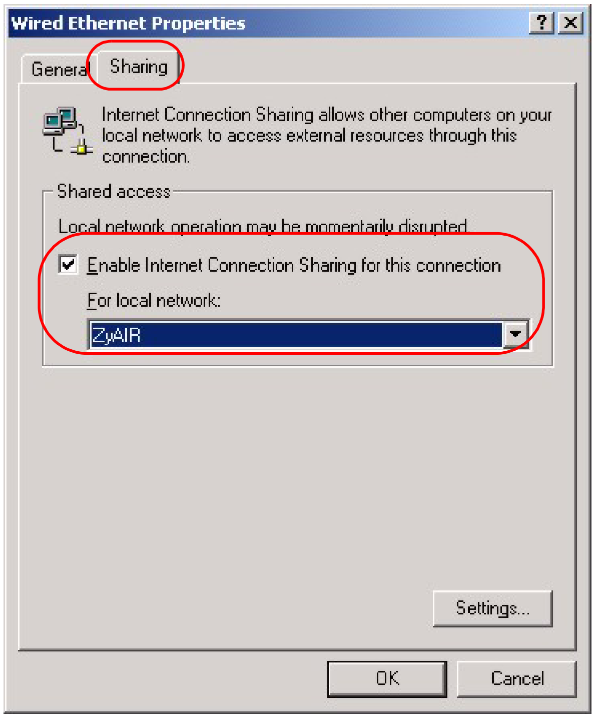
Internet Connection Sharing

Local network operation may be momentarily disrupted.

☑ Enable Internet Connection Sharing for this connection

If there is more than one network adapter on the computer, select **Enable Internet Connection Sharing for this connection** and select the network adapter to which you want to share network access.

Figure 57 WIndows 2000: Network Properties: Select Network Adapter



Internet Connection Sharing allows other computers on your local network to access external resources through this connection.

Shared access

Local network operation may be momentarily disrupted.

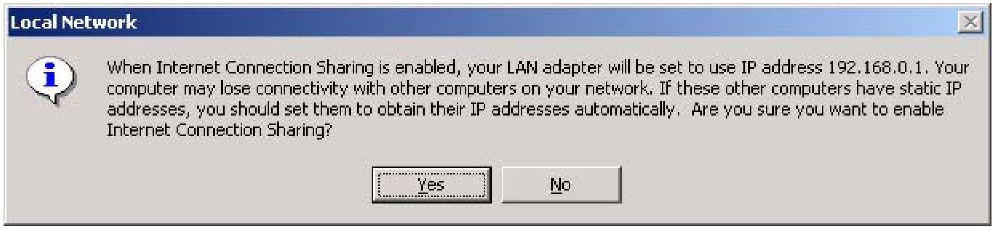
☑ Enable Internet Connection Sharing for this connection

For local network:

ZyAIR

5 A notice screen displays. Click **Yes**.

Figure 58 Windows 2000: Local Network



When Internet Connection Sharing is enabled, your LAN adapter will be set to use IP address 192.168.0.1. Your computer may lose connectivity with other computers on your network. If these other computers have static IP addresses, you should set them to obtain their IP addresses automatically. Are you sure you want to enable Internet Connection Sharing?

Configuring the Wireless Station Computer

Refer to Appendix E on page 111 for more information on how to set up the wireless station computer(s) IP address.

APPENDIX C
Management with Wireless Zero Configuration

This appendix shows you how to manage your G-220 v3 using the Windows XP wireless zero configuration tool.

Be sure you have the Windows XP service pack 2 installed on your computer. Otherwise, you should at least have the Windows XP service pack 1 already on your computer and download the support patch for WPA from the Microsoft web site.

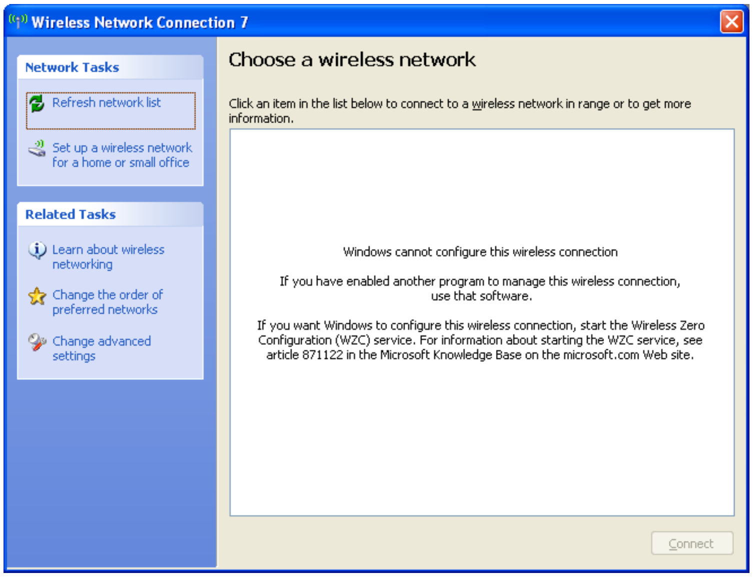
Windows XP SP2 screen shots are shown unless otherwise specified. Click the help icon (?) in most screens, move the cursor to the item that you want the information about and click to view the help.

Activating Wireless Zero Configuration

Make sure the **Use Windows to configure my wireless network settings** check box is selected in the **Wireless Network Connection Properties** screen. Refer to Appendix C on page 71.

If you see the following screen, refer to article 871122 on the Microsoft web site for information on starting WZC.

Figure 59 Windows XP SP2: WZC Not Available


Wireless Network Connection 7
Network Tasks
Refresh network list
Set up a wireless network for a home or small office
Related Tasks
Learn about wireless networking
Change the order of preferred networks
Change advanced settings
Choose a wireless network
Connect

Click an item in the list below to connect to a wireless network in range or to get more information.

Windows cannot configure this wireless connection

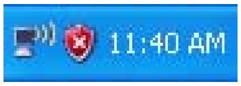
If you have enabled another program to manage this wireless connection, use that software.

If you want Windows to configure this wireless connection, start the Wireless Zero Configuration (WZC) service. For information about starting the WZC service, see article 871122 in the Microsoft Knowledge Base on the microsoft.com Web site.

Connecting to a Wireless Network

1 Double-click the network icon for wireless connections in the system tray to open the Wireless Network Connection Status screen.

Figure 60 Windows XP SP2: System Tray Icon



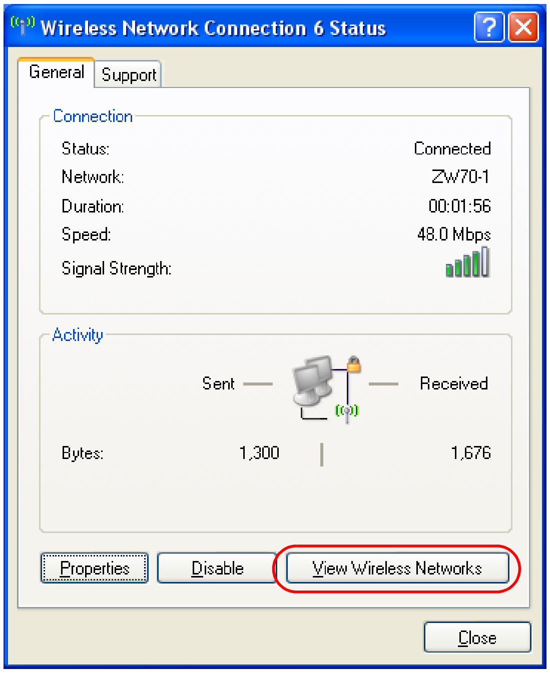
The type of the wireless network icon in Windows XP SP2 indicates the status of the G-220 v3. Refer to the following table for details.

Table 25 Windows XP SP2: System Tray Icon

ICON	DESCRIPTION
🖥	The G-220 v3 is connected to a wireless network.
🖥	The G-220 v3 is in the process of connecting to a wireless network.
⚠	The connection to a wireless network is limited because the network did not assign a network address to the computer.
✗	The G-220 v3 is not connected to a wireless network.

2 Windows XP SP2: In the **Wireless Network Connection Status** screen, click **View Wireless Networks** to open the **Wireless Network Connection** screen.

Figure 61 Windows XP SP2: Wireless Network Connection Status



Wireless Network Connection 6 Status

General | Support

Connection

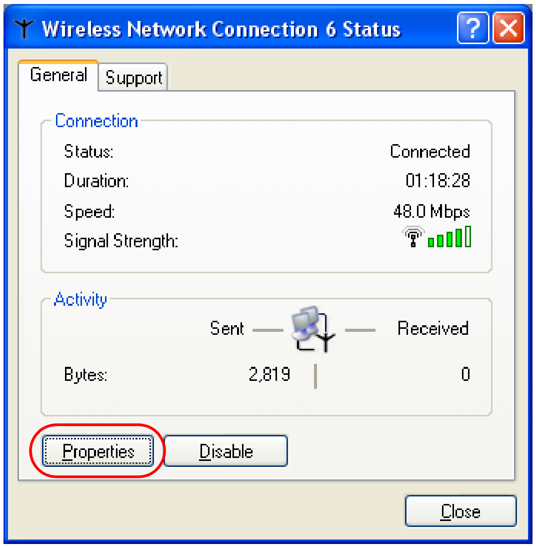
Status:	Connected
Network:	ZW70-1
Duration:	00:01:56
Speed:	48.0 Mbps
Signal Strength:	

Activity

	Sent	Received
Bytes:	1,300	1,676

Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the **Wireless Network Connection Properties** screen.

Figure 62 Windows XP SP1: Wireless Network Connection Status

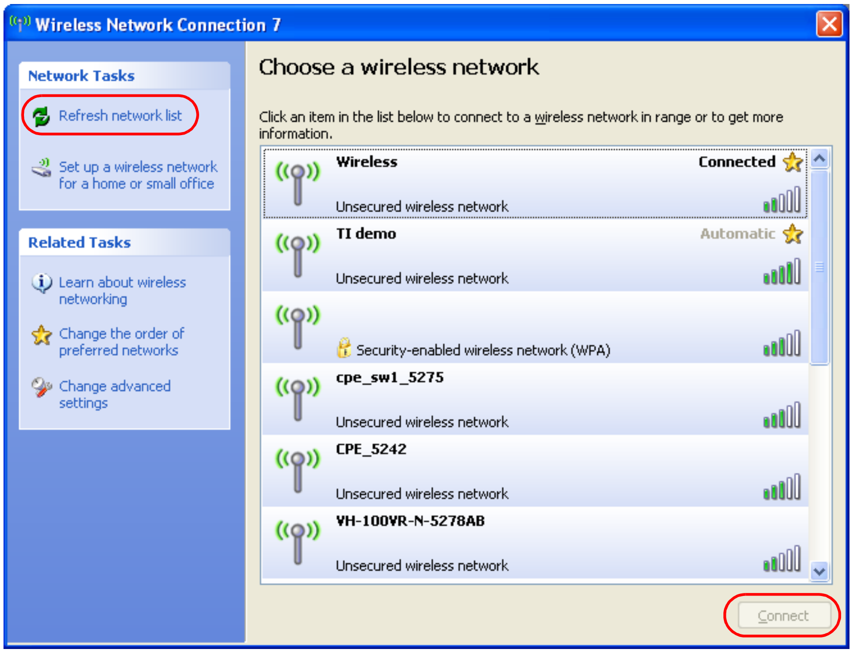


Status: Connected
Duration: 01:18:28
Speed: 48.0 Mbps
Signal Strength:

Sent — Received
Bytes: 2,819 | 0

3 Windows XP SP2: Click **Refresh network list** to reload and search for available wireless devices within transmission range. Select a wireless network in the list and click **Connect** to join the selected wireless network.

Figure 63 Windows XP SP2: Wireless Network Connection


Wireless Network Connection 7
Network Tasks
Refresh network list
Set up a wireless network for a home or small office
Related Tasks
Learn about wireless networking
Change the order of preferred networks
Change advanced settings
Connect

Choose a wireless network

Click an item in the list below to connect to a wireless network in range or to get more information.

Wireless — Connected
Unsecured wireless network

TI demo — Automatic
Unsecured wireless network

Security-enabled wireless network (WPA)

cpe_sw1_5275
Unsecured wireless network

CPE_5242
Unsecured wireless network

VH-100VR-N-5278AB
Unsecured wireless network

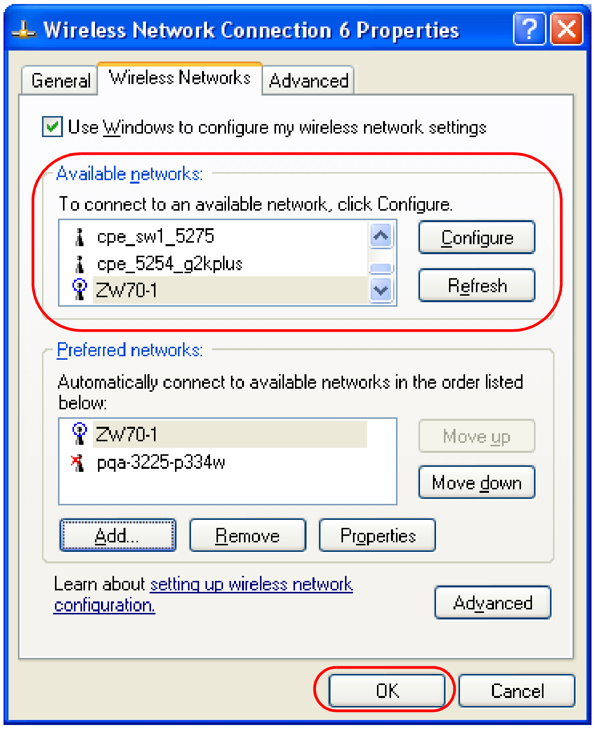
The following table describes the icons in the wireless network list.

Table 26 Windows XP SP2: Wireless Network Connection

	DESCRIPTION
🔒	This denotes that wireless security is activated for the wireless network.
★	This denotes that this wireless network is your preferred network. Ordering your preferred networks is important because the G-220 v3 tries to associate to the preferred network first in the order that you specify. Refer to the section on ordering the preferred networks for detailed information.
📶	This denotes the signal strength of the wireless network. Move your cursor to the icon to see details on the signal strength.

Windows XP SP1: Click **Refresh** to reload and search for available wireless devices within transmission range. Select a wireless network in the **Available networks** list, click **Configure** and set the related fields to the same security settings as the associated AP to add the selected network into the **Preferred** networks table. Click **OK** to join the selected wireless network. Refer to the section on security settings (discussed later) for more information.

Figure 64 Windows XP SP1: Wireless Network Connection Properties



Wireless Network Connection 6 Properties

General | Wireless Networks | Advanced

☑ Use Windows to configure my wireless network settings

Available networks:

To connect to an available network, click Configure.

- cpe_sw1_5275
- cpe_5254_g2kplus
- ZW70-1

Configure | Refresh

Preferred networks:

Automatically connect to available networks in the order listed below:

- ZW70-1
- pqa-3225-p334w

Move up | Move down

Add... | Remove | Properties

Learn about setting up wireless network configuration.

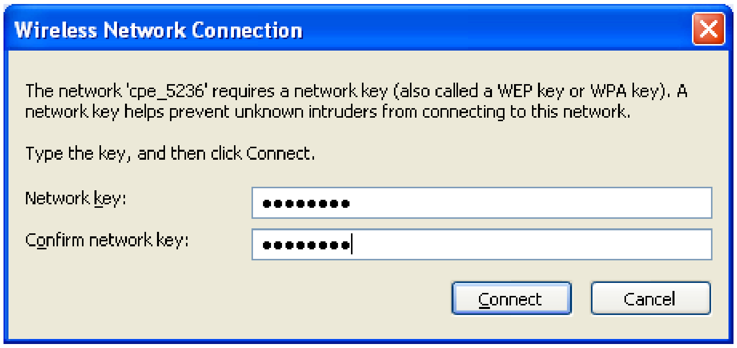
Advanced

OK | Cancel

4 4.Windows XP SP2: If the wireless security is activated for the selected wireless network, the **Wireless Network Connection** screen displays. You must set the related fields in the **Wireless Network Connection** screen to the same security settings as the associated AP and click **Connect**. Refer to the section about security settings for more information. Otherwise click **Cancel** and connect to another wireless network without data encryption.

If there is no security activated for the selected wireless network, a warning screen appears. Click **Connect Anyway** if wireless security is not your concern.

Figure 65 Windows XP SP2: Wireless Network Connection: WEP or WPA-PSK



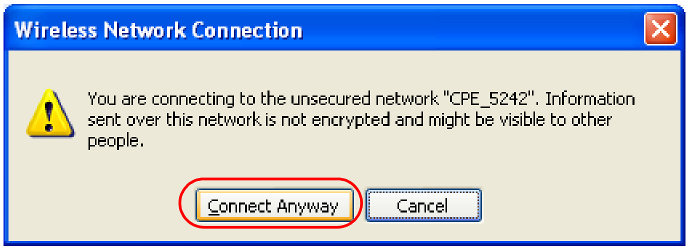
The network 'cpe_5236' requires a network key (also called a WEP key or WPA key). A network key helps prevent unknown intruders from connecting to this network.

Type the key, and then click Connect.

Network key: ●●●●●●●●●

Confirm network key: ●●●●●●●●●

Figure 66 Windows XP SP2: Wireless Network Connection: No Security



You are connecting to the unsecured network "CPE_5242". Information sent over this network is not encrypted and might be visible to other people.

5 Verify that you have successfully connected to the selected network and check the connection status in the wireless network list or the connection icon in the **Preferred networks** or **Available networks** list.

The following table describes the connection icons.

Table 27 Windows XP: Wireless Networks

ICON	DESCRIPTION
📶	This denotes the wireless network is an available wireless network.
◉	This denotes the G-220 v3 is associated to the wireless network.
✗	This denotes the wireless network is not available.

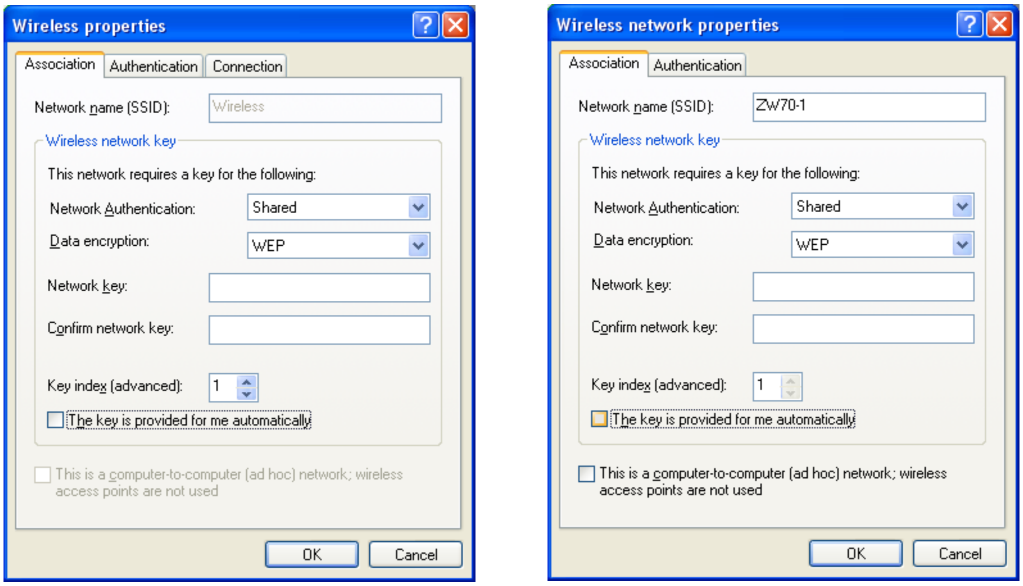
Security Settings

When you configure the G-220 v3 to connect to a secure network but the security settings are not yet enabled on the G-220 v3, you will see different screens according to the authentication and encryption methods used by the selected network.

Association

Select a network in the Preferred networks list and click Properties to view or configure security.

Figure 67 Windows XP: Wireless (network) properties: Association



Wireless properties

Association | Authentication | Connection

Network name (SSID): Wireless

Wireless network key

This network requires a key for the following:

Network Authentication: Shared

Data encryption: WEP

Network key:

Confirm network key:

Key index (advanced): 1

□ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Wireless network properties

Association | Authentication

Network name (SSID): ZW70-1

Wireless network key

This network requires a key for the following:

Network Authentication: Shared

Data encryption: WEP

Network key:

Confirm network key:

Key index (advanced): 1

□ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

The following table describes the labels in this screen.

Table 28 Windows XP: Wireless (network) properties: Association

LABEL	DESCRIPTION
Network name (SSID)	This field displays the SSID (Service Set IDentifier) of each wireless network.
Network Authentication	This field automatically shows the authentication method (**Share**, **Open**, **WPA** or **WPA-PSK**) used by the selected network.
Data Encryption	This field automatically shows the encryption type (**TKIP**, **WEP** or **Disable**) used by the selected network.
Network Key	Enter the pre-shared key or WEP key. The values for the keys must be set up exactly the same on all wireless devices in the same wireless LAN.
Confirm network key	Enter the key again for confirmation.
Key index (advanced)	Select a default WEP key to use for data encryption. This field is available only when the network use **WEP** encryption method and the **The key is provided for me automatically** check box is not selected.
The key is provided for me automatically	If this check box is selected, the wireless AP assigns the G-220 v3 a key.

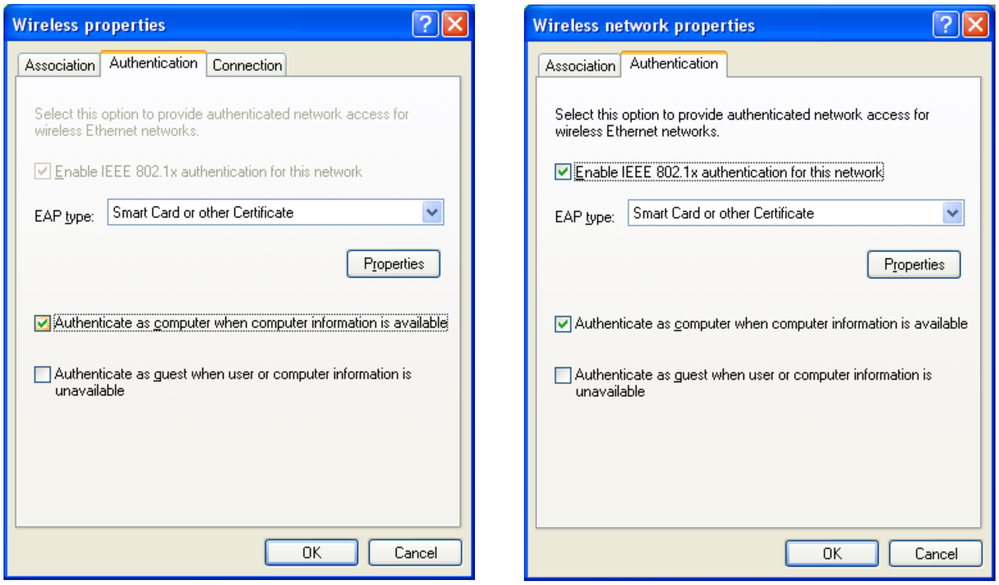
Table 28 Windows XP: Wireless (network) properties: Association (continued)

LABEL	DESCRIPTION
This is a computer-to-computer (ad hoc) network; wireless access points are not used	If this check box is selected, you are connecting to another computer directly.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Authentication

Click the **Authentication** tab in the **Wireless (network) properties** screen to display the screen shown next. The fields on this screen are grayed out when the network is in Ad-Hoc mode or data encryption is disabled.

Figure 68 Windows XP: Wireless (network) properties: Authentication


Wireless properties
Association
Authentication
Connection
Select this option to provide authenticated network access for wireless Ethernet networks.
☑ Enable IEEE 802.1x authentication for this network
EAP type: Smart Card or other Certificate
Properties
☑ Authenticate as computer when computer information is available
□ Authenticate as guest when user or computer information is unavailable
OK
Cancel
Wireless network properties
Association
Authentication
Select this option to provide authenticated network access for wireless Ethernet networks.
☑ Enable IEEE 802.1x authentication for this network
EAP type: Smart Card or other Certificate
Properties
☑ Authenticate as computer when computer information is available
□ Authenticate as guest when user or computer information is unavailable
OK
Cancel

The following table describes the labels in this screen.

Table 29 Windows XP: Wireless (network) properties: Authentication

LABEL	DESCRIPTION
Enable IEEE 802.1x authentication for this network	This field displays whether the IEEE 802.1x authentication is active. If the network authentication is set to **Open** in the previous screen, you can choose to disable or enable this feature.
EAP Type	Select the type of EAP authentication. Options are **Protected EAP (PEAP)** and **Smart Card or other Certificate**.
Properties	Click this button to open the properties screen and configure certificates. The screen varies depending on what you select in the **EAP type** field.

Table 29 Windows XP: Wireless (network) properties: Authentication (continued)

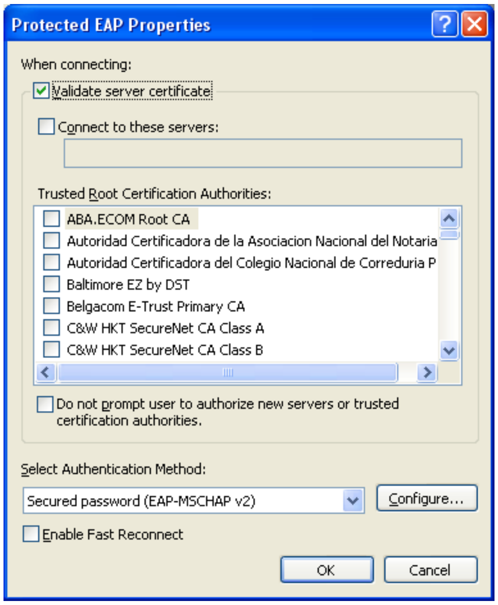
LABEL	DESCRIPTION
Authenticate as computer when computer information is available	Select this check box to have the computer send its information to the network for authentication when a user is not logged on.
Authenticate as guest when user or computer information is unavailable	Select this check box to have the computer access to the network as a guest when a user is not logged on or computer information is not available.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Authentication Properties

Select an EAP authentication type in the **Wireless (network) properties: Authentication** screen and click the **Properties** button to display the following screen.

Protected EAP Properties

Figure 69 Windows XP: Protected EAP Properties



Protected EAP Properties

When connecting:

☑ Validate server certificate

□ Connect to these servers:

Trusted Root Certification Authorities:

□ ABA.ECOM Root CA
□ Autoridad Certificadora de la Asociacion Nacional del Notaria
□ Autoridad Certificadora del Colegio Nacional de Correduria P
□ Baltimore EZ by DST
□ Belgacom E-Trust Primary CA
□ C&W HKT SecureNet CA Class A
□ C&W HKT SecureNet CA Class B

□ Do not prompt user to authorize new servers or trusted certification authorities.

Select Authentication Method:

Secured password (EAP-MSCHAP v2)

□ Enable Fast Reconnect

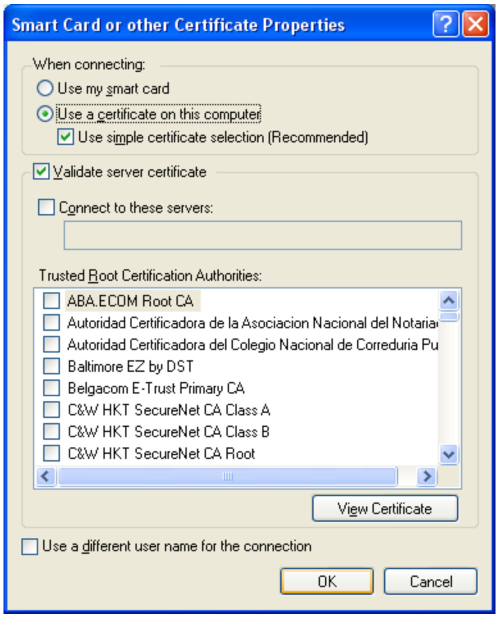
The following table describes the labels in this screen.

Table 30 Windows XP: Protected EAP Properties

LABEL	DESCRIPTION
Validate server certificate	Select the check box to verify the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
Do not prompt user to authorize new server or trusted certification authorities.	Select this check box to verify a new authentication server or trusted CA without prompting. This field is available only if you installed the Windows XP server pack 2.
Select Authentication Method:	Select an authentication method from the drop-down list box and click **Configure** to do settings.
Enable Fast Reconnect	Select the check box to automatically reconnect to the network (without re-authentication) if the wireless connection goes down.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Smart Card or other Certificate Properties

Figure 70 Windows XP: Smart Card or other Certificate Properties



Smart Card or other Certificate Properties

When connecting:

○ Use my smart card

● Use a certificate on this computer

☑ Use simple certificate selection (Recommended)

☑ Validate server certificate

□ Connect to these servers:

Trusted Root Certification Authorities:

□ ABA.ECOM Root CA
□ Autoridad Certificadora de la Asociacion Nacional del Notaria
□ Autoridad Certificadora del Colegio Nacional de Correduria Pu
□ Baltimore EZ by DST
□ Belgacom E-Trust Primary CA
□ C&W HKT SecureNet CA Class A
□ C&W HKT SecureNet CA Class B
□ C&W HKT SecureNet CA Root

□ Use a different user name for the connection

The following table describes the labels in this screen.

Table 31 Windows XP: Smart Card or other Certificate Properties

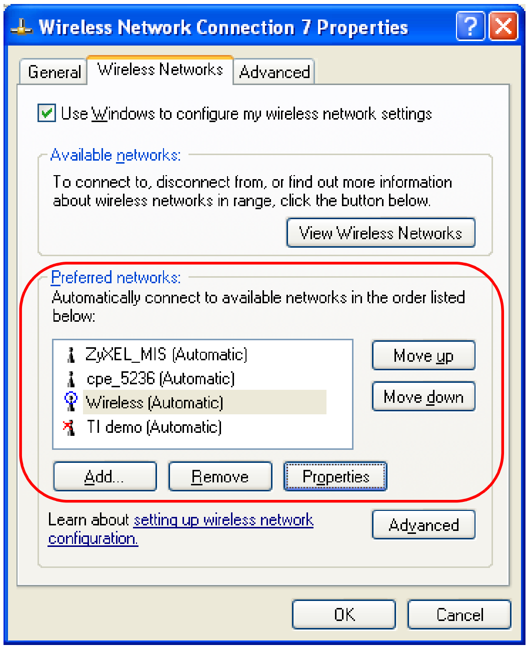
LABEL	DESCRIPTION
Use my smart card	Select this check box to use the smart card for authentication.
Use a certificate on this computer	Select this check box to use a certificate on your computer for authentication.
Validate server certificate	Select the check box to check the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
View Certificate	Click this button if you want to verify the selected certificate.
Use a different user name for the connection:	Select the check box to use a different user name when the user name in the smart card or certificate is not the same as the user name in the domain that you are logged on to.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Ordering the Preferred Networks

Follow the steps below to manage your preferred networks.

1 Windows XP SP2: Click **Change the order of preferred networks** in the **Wireless Network Connection** screen (see Figure 63 on page 95). The screen displays as shown.

Figure 71 Windows XP SP2: Wireless Networks: Preferred Networks



☑ Use Windows to configure my wireless network settings

Available networks:

To connect to, disconnect from, or find out more information about wireless networks in range, click the button below.

Preferred networks:

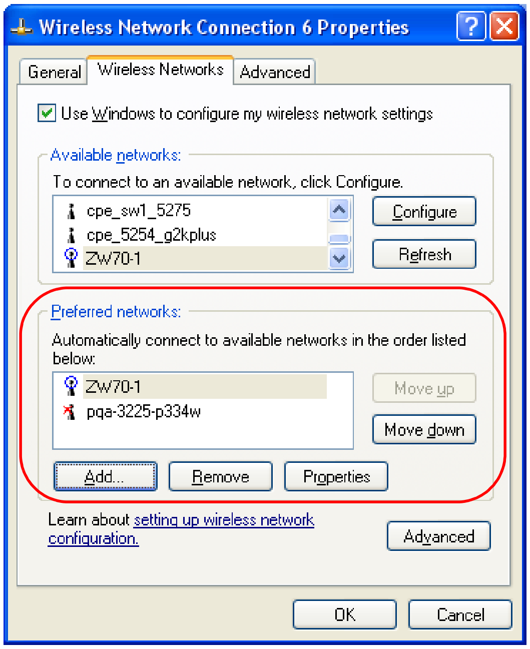
Automatically connect to available networks in the order listed below:

- ZyXEL_MIS (Automatic)
- cpe_5236 (Automatic)
- Wireless (Automatic)
- TI demo (Automatic)

Learn about setting up wireless network configuration.

Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the screen as shown.

Figure 72 Windows XP SP1: Wireless Networks: Preferred Networks



☑ Use Windows to configure my wireless network settings

Available networks:

To connect to an available network, click Configure.

- cpe_sw1_5275
- cpe_5254_g2kplus
- ZW70-1

Preferred networks:

Automatically connect to available networks in the order listed below:

- ZW70-1
- pqa-3225-p334w

Learn about setting up wireless network configuration.

2 Whenever the G-220 v3 tries to connect to a new network, the new network is added in the **Preferred networks** table automatically. Select a network and click **Move up** or **Move down** to change it's order, click **Remove** to delete it or click **Properties** to view the security, authentication or connection information of the selected network. Click **Add** to add a preferred network into the list manually.

APPENDIX D
Wireless Security

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. .

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless station. The wireless station 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless stations for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender’s identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the Wireless screen. You may still configure and store keys here, but they will not be used while Dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 32 Comparison of EAP Authentication Types

		EAP-TLS	**EAP-TTLS**	**PEAP**	**LEAP**
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless stations. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless stations using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a sucessful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

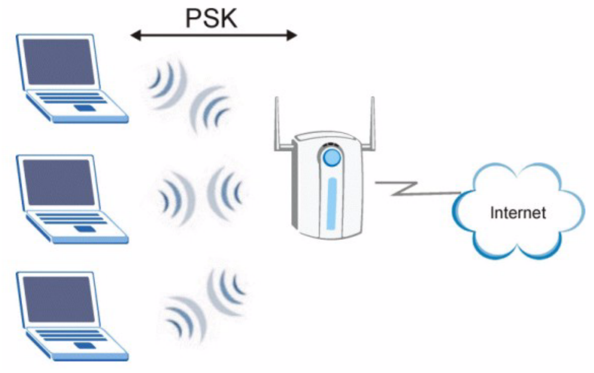
Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

WPA(2)-PSK Application Example

A WPA(2)s-PSK application looks as follows.

1. First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
2. The AP checks each client's password and (only) allows it to join the network if it matches its password.
3. The AP and wireless clients use the pre-shared key to generate a common PMK.
4. The AP and wireless clients use the TKIP or AES encryption process to encrypt data exchanged between them.

Figure 73 WPA-PSK Authentication

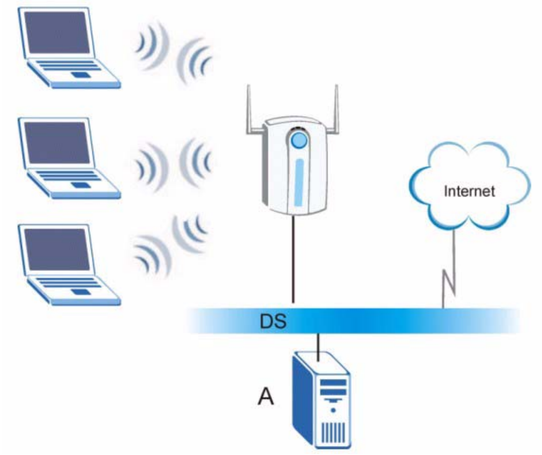


WPA(2) with RADIUS Application Example

You need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

1. The AP passes the wireless client's authentication request to the RADIUS server.
2. The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
3. The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the pair-wise key to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 74 WPA(2) with RADIUS Application Example



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each Authentication Method/ key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 33 Wireless Security Relational Matrix

	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

APPENDIX E

Setting up Your Computer’s IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

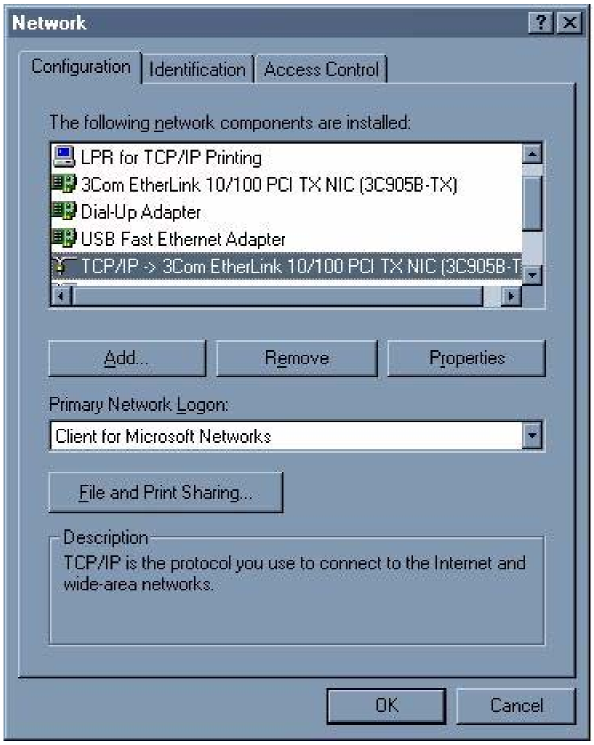
TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window

Figure 75 WIndows 95/98/Me: Network: Configuration



The following network components are installed:

- LPR for TCP/IP Printing
- 3Com EtherLink 10/100 PCI TX NIC (3C905B-TX)
- Dial-Up Adapter
- USB Fast Ethernet Adapter
- TCP/IP -> 3Com EtherLink 10/100 PCI TX NIC (3C905B-T

Primary Network Logon: Client for Microsoft Networks

Description
TCP/IP is the protocol you use to connect to the Internet and wide-area networks.

Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1 In the **Network** window, click **Add**.

2 Select **Adapter** and then click **Add**.

3 Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1 In the **Network** window, click **Add**.

2 Select **Protocol** and then click **Add**.

3 Select **Microsoft** from the list of **manufacturers**.

4 Select **TCP/IP** from the list of network protocols and then click **OK**.

If you need Client for Microsoft Networks:

1 Click **Add**.

2 Select **Client** and then click **Add**.

3 Select **Microsoft** from the list of manufacturers.

4 Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.

5 Restart your computer so the changes you made take effect.

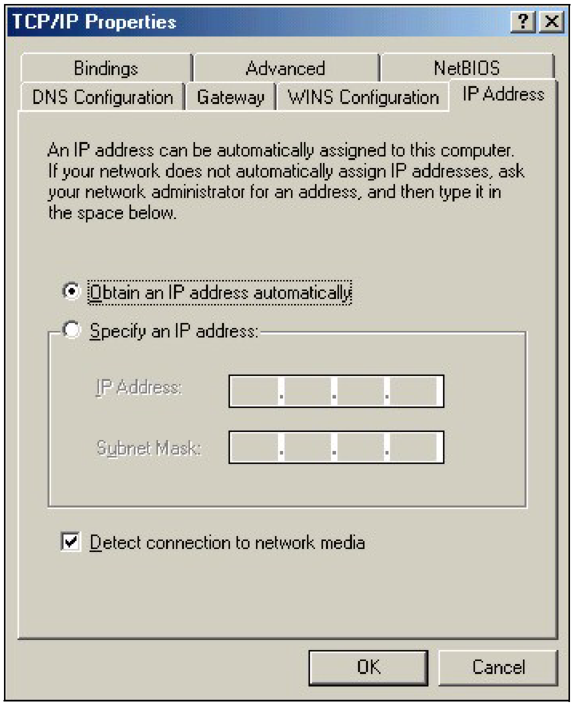
Configuring

1 In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**

2 Click the **IP Address** tab.

- If your IP address is dynamic, select **Obtain an IP address automatically**.
- If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

Figure 76 Windows 95/98/Me: TCP/IP Properties: IP Address



TCP/IP Properties

An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.

● Obtain an IP address automatically

○ Specify an IP address:

IP Address:

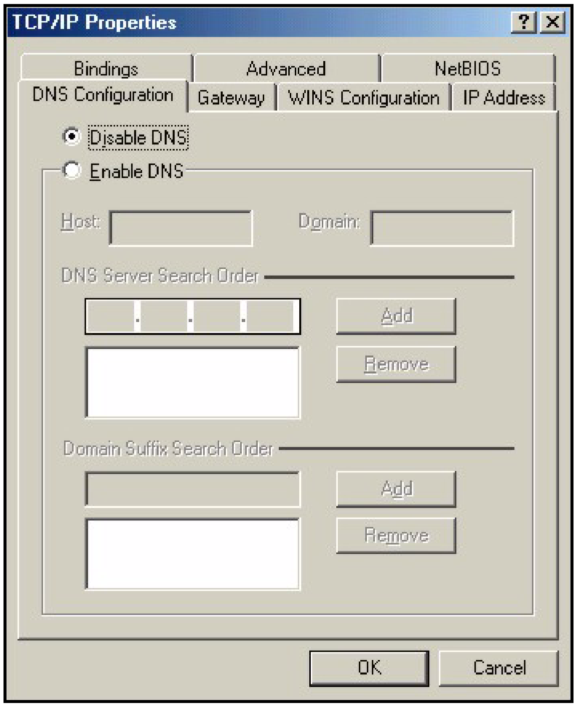
Subnet Mask:

☑ Detect connection to network media

3 Click the **DNS** Configuration tab.

- If you do not know your DNS information, select **Disable DNS**.
- If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 77 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.

- If you do not know your gateway’s IP address, remove previously installed gateways.
- If you have a gateway IP address, type it in the **New gateway field** and click **Add**.

5 Click **OK** to save and close the **TCP/IP Properties** window.

6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.

7 Restart your computer when prompted.

Verifying Settings

1 Click **Start** and then **Run**.

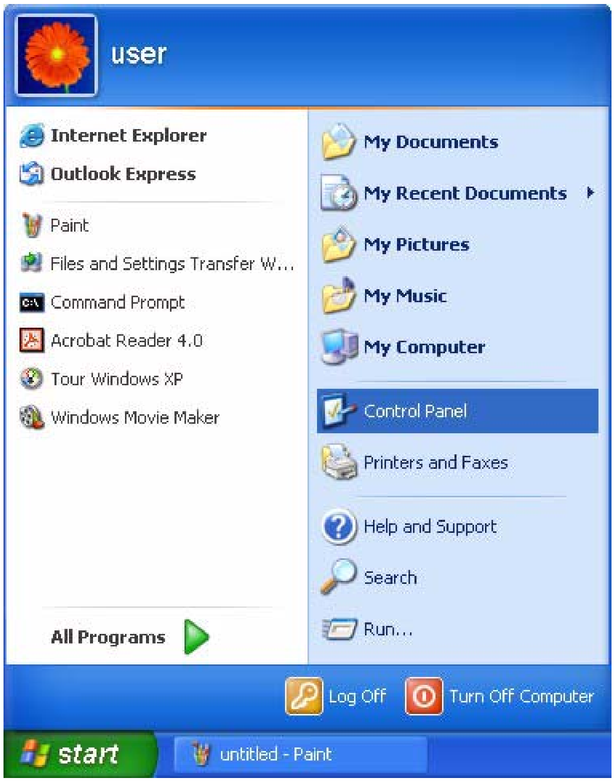
2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.

3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

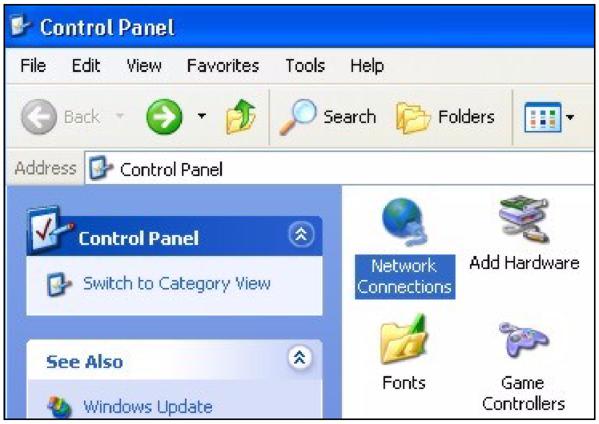
1 For Windows XP, click **start**, **Control Panel**. In Windows 2000/NT, click **Start**, **Settings**, **Control Panel**.

Figure 78 Windows XP: Start Menu



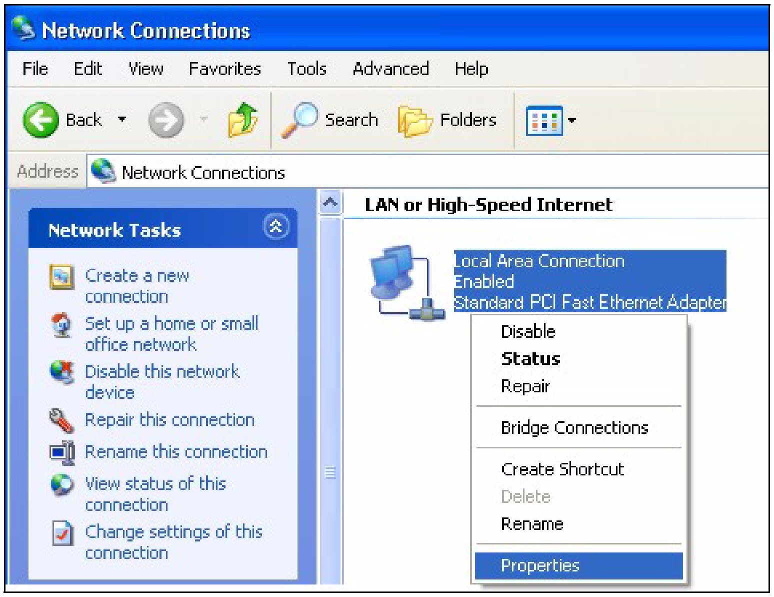
2 For Windows XP, click **Network Connections**. For Windows 2000/NT, click **Network and Dial-up Connections**.

Figure 79 Windows XP: Control Panel



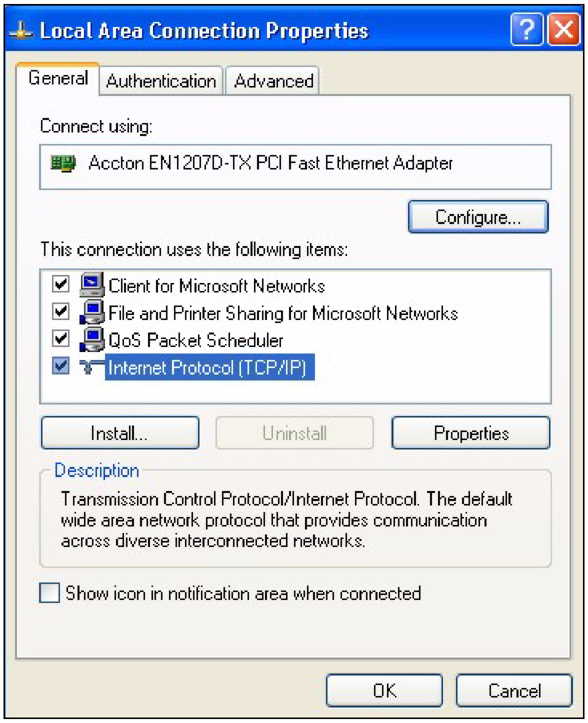
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 80 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and click **Properties**.

Figure 81 Windows XP: Local Area Connection Properties



Connect using:

Accton EN1207D-TX PCI Fast Ethernet Adapter

This connection uses the following items:

☑ Client for Microsoft Networks

☑ File and Printer Sharing for Microsoft Networks

☑ QoS Packet Scheduler

☑ Internet Protocol (TCP/IP)

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

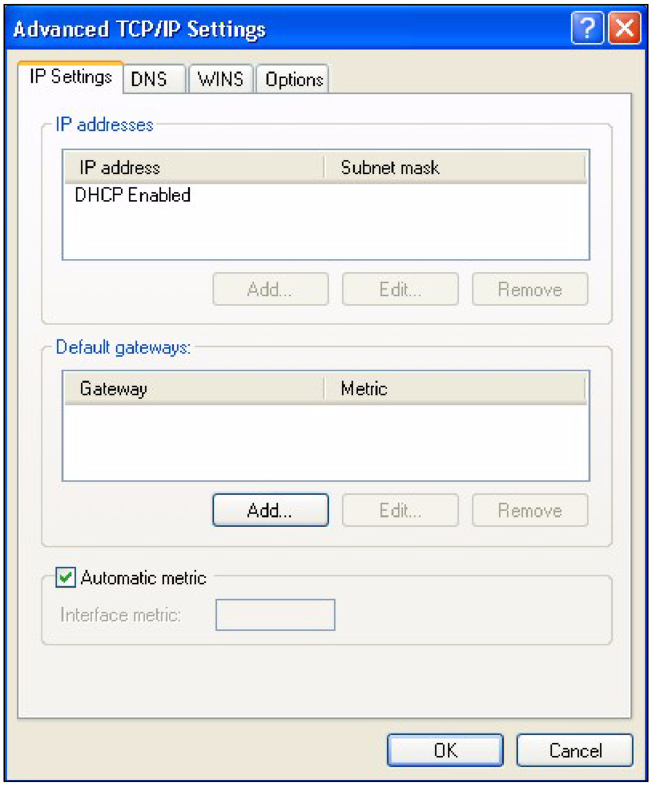
□ Show icon in notification area when connected

5 The **Internet Protocol TCP/IP Properties** window opens (the **General** tab in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.

- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields. Click **Advanced**.

Figure 82 Windows XP: Advanced TCP/IP Settings



6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

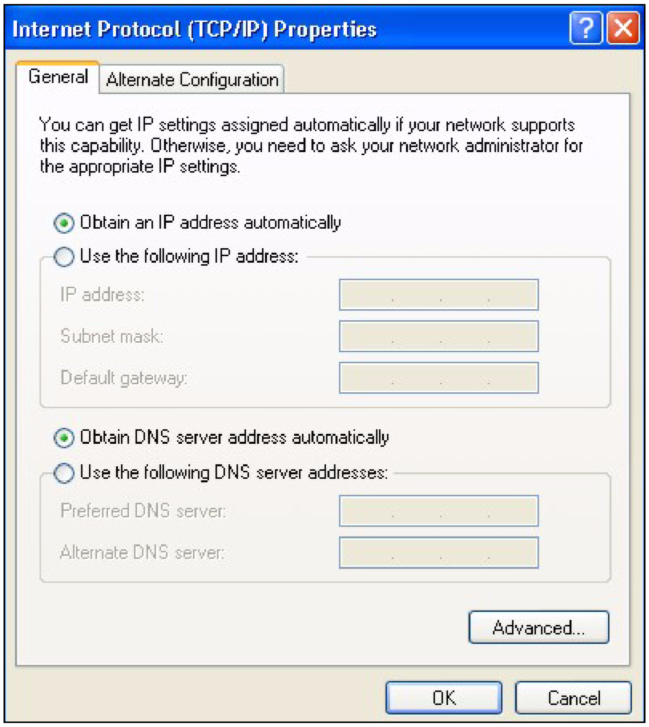
- In the **IP Settings** tab, in **IP addresses**, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 83 Windows XP: Internet Protocol (TCP/IP) Properties



Internet Protocol (TCP/IP) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

Advanced...

OK | Cancel

8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **OK** to close the **Local Area Connection Properties** window.

10Restart your computer (if prompted).

Verifying Settings

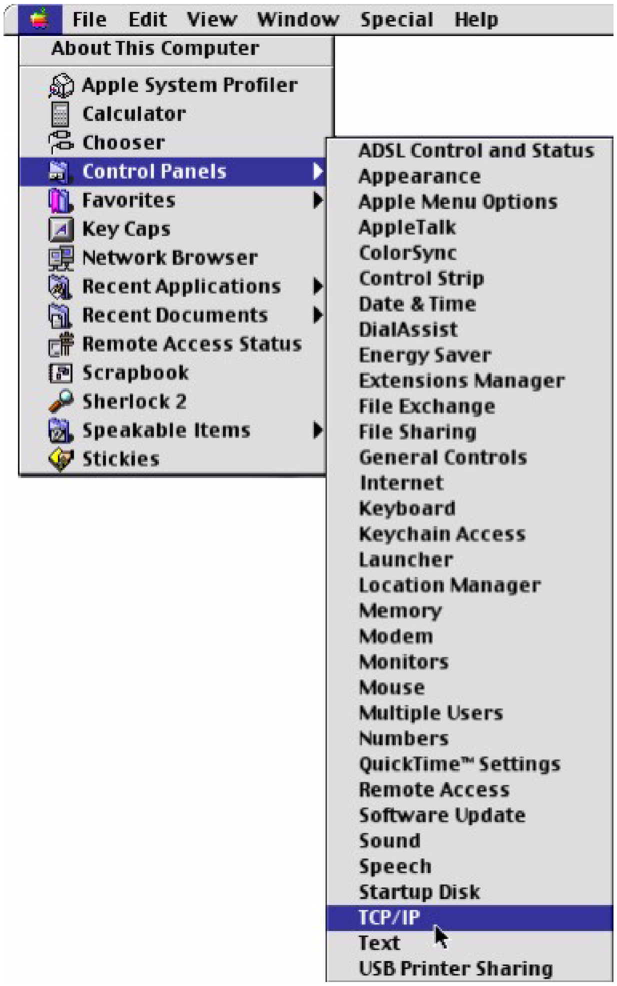
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Macintosh OS 8/9

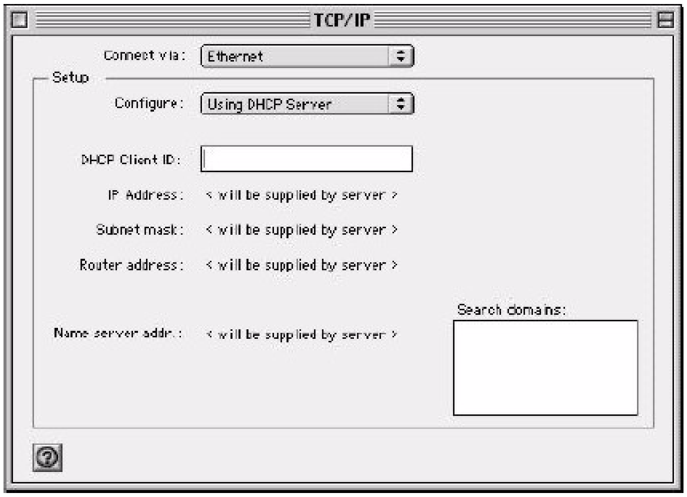
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 84 Macintosh OS 8/9: Apple Menu



2 Select **Ethernet built-in** from the **Connect via** list.

Figure 85 Macintosh OS 8/9: TCP/IP



TCP/IP

Connect via: Ethernet

Setup

Configure: Using DHCP Server

DHCP Client ID:

IP Address: < will be supplied by server >

Subnet mask: < will be supplied by server >

Router address: < will be supplied by server >

Search domains:

Name server addr.: < will be supplied by server >

3 For dynamically assigned settings, select **Using DHCP Server** from the **Configure:** list.

4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.
- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your gateway in the **Router address** box if you have one.

5 Close the **TCP/IP Control Panel**.

6 Click **Save** if prompted, to save changes to your configuration.

7 Restart your computer (if prompted).

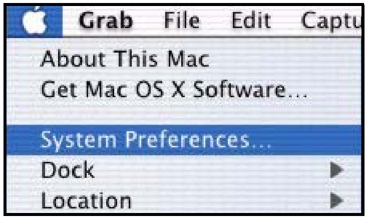
Verifying Settings

Check your TCP/IP properties in the **TCP/IP Control Panel** window.

Macintosh OS X

1 Click the **Apple** menu, and click **System Preferences** to open the **System Preferences** window.

Figure 86 Macintosh OS X: Apple Menu

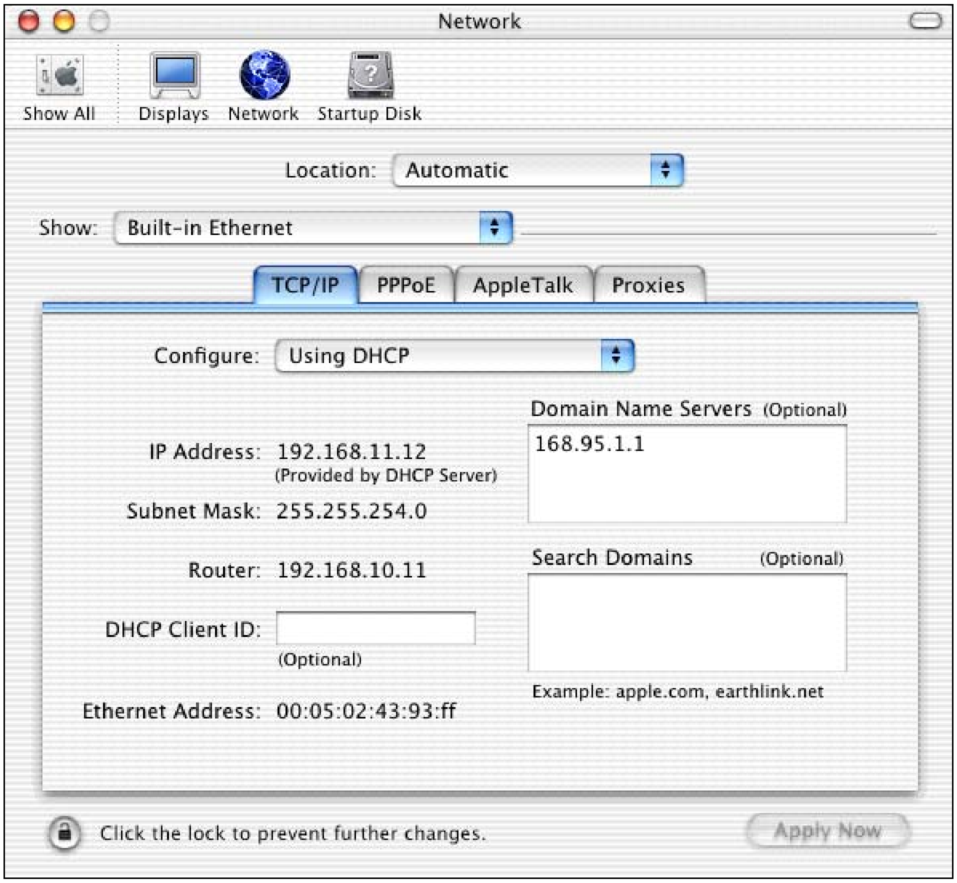


2 Click **Network** in the icon bar.

- Select **Automatic** from the **Location** list.
- Select **Built-in Ethernet** from the **Show** list.
- Click the **TCP/IP** tab.

3 For dynamically assigned settings, select **Using DHCP** from the **Configure** list.

Figure 87 Macintosh OS X: Network



Location: Automatic

Show: Built-in Ethernet

Configure: Using DHCP

IP Address: 192.168.11.12
(Provided by DHCP Server)

Subnet Mask: 255.255.254.0

Router: 192.168.10.11

DHCP Client ID:
(Optional)

Ethernet Address: 00:05:02:43:93:ff

Domain Name Servers (Optional)
168.95.1.1

Search Domains (Optional)

Example: apple.com, earthlink.net

Click the lock to prevent further changes.

4 For statically assigned settings, do the following:

- From the **Configure** box, select **Manually**.
- Type your IP address in the **IP Address** box.
- Type your subnet mask in the **Subnet mask** box.
- Type the IP address of your gateway in the **Router address** box if you have one.

5 Click **Apply Now** and close the window.

6 Restart your computer (if prompted).

Verifying Settings

Check your TCP/IP properties in the **Network** window.

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