User Manual - AirStation WHR-HP-G54

High-Power Wireless Cable/DSL Smart Router

Work and play - further and faster! Eliminate dead spots and enjoy faster connections with vastly extended range from Buffalo Technology's amazing wireless solution, the ***AirStation High Power Wireless Broadband SmartRouter***.

System Requirements

• A high-speed (Broadband) Internet connection or existing local area connection.
• A computer with a network connection (wired or wireless) and a good web browser. The screenshots in this manual were taken with Firefox, but Netscape and Internet Explorer are also supported in versions 4.5 or later, and Safari 1.0 and later are supported with Macintosh OS X 10.2 and later.

AirStation WHR-HP-G54 Package Contents

The AirStation WHR-HP-G54 package contains the following items:
• WHR-HP-G54 Base Station
• Antenna
• AC adapter and power cable
• CAT5 LAN cable
• Utility CD with Manual
• Quick Setup Guides
• Warranty Statement

Begin by finding a good place to set up your router/access point. Some things to consider:

• You'll need to be able to plug your internet connection into it, so it should go within reach of the LAN cable from your DSL or Cable modem. You'll also want a power outlet nearby.

• Keep the access point as central in your work area as possible. Signal strength and speed fall off with distance.

• Higher is often better. For instance, set it up on the top shelf of a bookcase rather than the bottom one, if possible.

Screw the antenna into the top of your AirStation.

Make note of the AirStation's *wired MAC address*. The LAN or Wired MAC address is the default SSID (wireless network name) of the AirStation. You can find it on the bottom of the AirStation.

You may also wish to contact your ISP to ask if other information, such as global IP address, subnet mask address, default gateway address, DNS server address, or PPPoE parameters, is necessary to access your internet connection. Write down any necessary information that your ISP requires for connection.

Buffalo recommends using a wired network connection, where your computer is physically connected to the AirStation with a CAT5 straight cable plugged into one of the four LAN ports, to initially set up your router. This type of setup will eliminate possible setup problems with the wireless adapter on the computer being used to configure the AirStation.

The computer used to configure the AirStation should be set to obtain an IP address automatically using a DHCP server. The WHR-HP-G54 has a default LAN IP address of 192.168.11.1 and Subnet Mask of 255.255.255.0.

1. Power down the Cable or DSL modem and the computer which will be used to configure the AirStation router.

2. Plug the Cable or DSL's LAN Ethernet cable into the AirStation's WAN port. Initially, you may need to unplug this cable from your computer, hub or other router.

3. Plug the provided Ethernet cable into a LAN port on the AirStation and plug the other end into your computer's Ethernet adapter (NIC). If you plan to initially configure the AirStation wirelessly (not recommended), you may skip this step.

4. Power on your cable or DSL modem and wait one full minute, then power on the AirStation router and wait one full minute, and finally power on the computer which will be used to configure the AirStation. If the red DIAG light on the AirStation is lit or flashing after several minutes of being powered on, please consult Buffalo Technology Technical Support.

Launch a web browser on the computer that you're going to use to configure the AirStation.

Enter *192.168.11.1* into the URL field. Naturally, if you change your AirStation's IP address, you'll have to enter the new address instead.

A window will open, prompting you to enter a User ID and Password.

Enter *root* as the User name and leave the password field *blank*.

Your AirStation's SmartRouter technology will determine the type of internet connection you have automatically, and ask you for any needed information. If your ISP assigns IPs automatically (most cable providers do), their DHCP server will give your router an IP address. If additional login information is required to connect to the internet, the wizard will ask for it. Enter any required login information if asked. Contact your DSL provider for any missing login information.

If your DSL provider requires that PPPoE information be entered manually, see page 25.
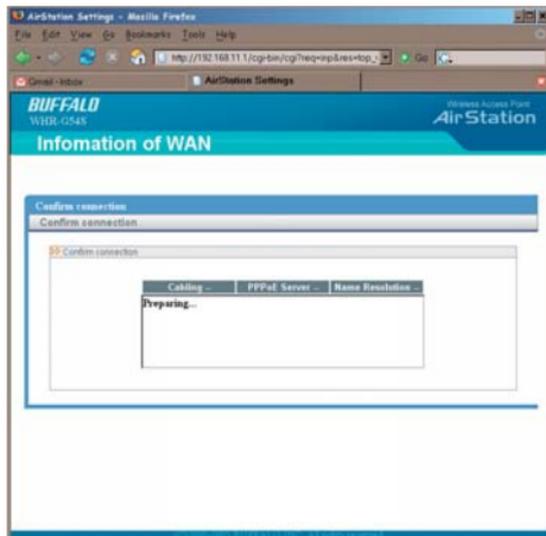
This is the opening page of your AirStation's configuration tool. You can always get to it from within the configuration screens by clicking on *Home*. From here, you can configure *port mapping* for your internet games, turn on UPnP for *Windows (MSN) Messenger*, configure your *Firewall*, setup *Encryption*, choose your *Wireless channel*, update your AirStation's firmware, and reset your Internet connection's configuration. As you explore the configuration tool, you can usually get context sensitive help by clicking on the *Help* link at the top right of the page.

To go to Advanced Settings (page 25), click on the *Advanced* tab. To get the system information you need to set up a wireless client that doesn't support AOSS, click on the *System Info* tab. See page 17 for more on *Home.*

AOSS (AirStation One-Touch Secure System) is a simple system for configuring your wireless network securely. If your router and your client device are connected and both support AOSS, then making a secure wireless connection is very easy.

Push the AOSS button on the top of your router and hold it in for a few seconds. The AOSS light will begin to flash amber. You now have two minutes to push the AOSS button on your client device and finish the connection.

If you have a *standalone client device*, it will probably have a little red button labled "AOSS" on it. Push the button! About 15 seconds later, you'll have a secure network connection.

If your client device is a PC card, CardBus, or PCI adaptor, the AOSS button will probably be in its *Client Manager Software*. Check your client device's user manual for instructions on where to push or click the AOSS button.

standalone client device	PC card	Client Manager Software

After you've pressed both buttons, it will take about 15 seconds for the connection to complete. When it's finished, the AOSS light witll glow a solid amber. You now have a secure network connection!

Some things to keep in mind

▶ Only one AOSS wireless client adapter can be configured with the AOSS router at a time. The buttons will need to be re-pressed to connect each additional AOSS wireless client adapter.

▶ It is not necessary to AOSS client devices that have already been configured via AOSS, unless significant changes have been made to the wireless network.

▶ Do not attempt to configure two separate AOSS networks at the same time, as it may cause undesired configurations.

▶ If an undesired client has connected via AOSS, it can be disconnected from within the WHR-HP-G54's advanced configuration menus.

This AirStation supports quickly changing the product from a wireless router to a conventional access point.

Put your Airstation into Access Point Mode by moving the switch on the bottom of your AirStation from AUTO to BRI. This changes the default IP address of the AirStation from 192.168.11.1 to 192.168.11.100, and DHCP, NAT, and the WAN port are disabled.

Access Point Mode might be desirable if you're adding wireless capability to an existing network with a router. It is not suitable for most home configurations. If you plan to use the AirStation as an normal wireless router, make sure that this switch is in the normal (AUTO) position!

To set up your AirStation as a bridge or repeater, turn to page 43.

If your wireless client doesn't support AOSS, you'll have to configure it manually. From the *Home* page, click on the *System Info* tab.

This page gives you all the information you might need to configure your non-AOSS wireless client. Probably you'll just need the SSID, encryption type, and password. Consult your wireless client's documentation for more information on configuring it if necessary.

You can get here from Home by clicking the *System Info* tab.

When you first open your AirStation Configuration Tool, it will take you to *Home* (see also page 11). From Home, you can configure *port mapping* for your internet games, set UPnP for *Windows (MSN) Messenger*, configure your *firewall*, setup *encryption*, choose your *wireless channel*, update your AirStation's firmware, and reset your *Internet Connection*'s configuration. Clicking the *Advanced* tab gives you access to all of the AirStation's configuration tools.

You can get back to Home from anywhere in the management tool by clicking on the *Home* button at the top left of the screen.

Let's begin exploring advanced settings by clicking on *Internet Games (Port Mapping)*.
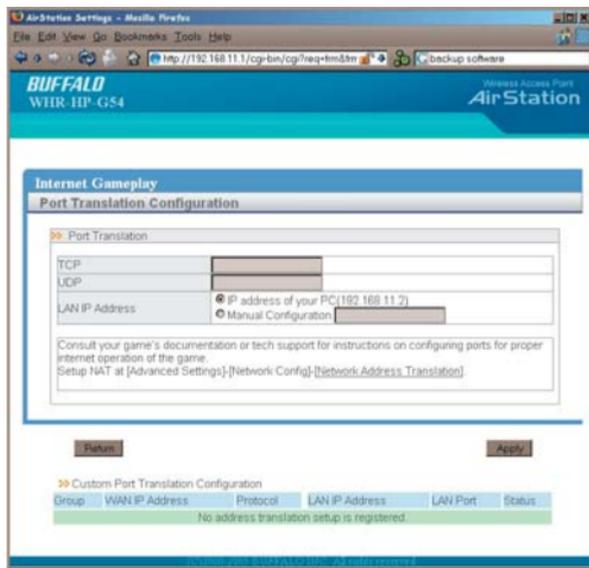
Select any ports that need to be opened for your internet games to function correctly. Consult your game's documentation for more information on what ports need to be configured.
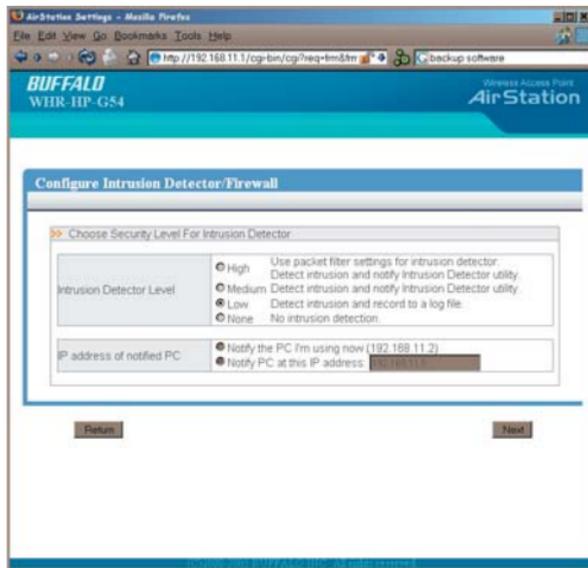
From this page, choose the level of firewall security you desire. You may also choose to have alerts sent to a different PC, if you like. Click *Next* when done to restart the router.

Get to this page from Home by clicking on *Firewall/Intrusion Detector.*
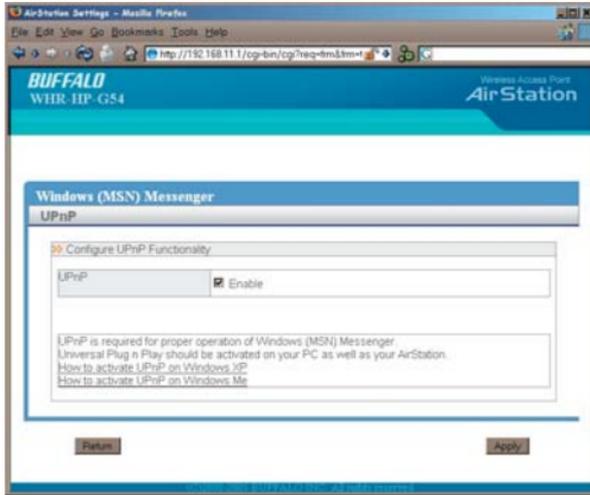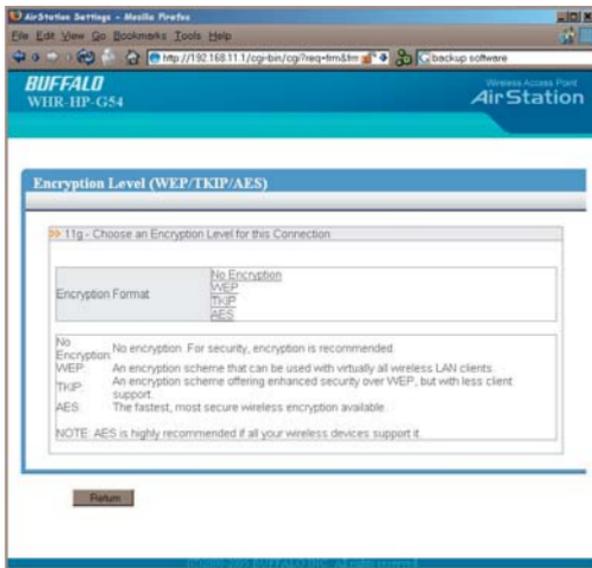
Windows (MSN) Messinger requires UPnP for proper operation. You may *Enable* UPnP here. UPnP may need to be configured on your PC as well.

If you need to configure UPnP on your PC, the links at the bottom of the page have instructions for doing so on Windows ME and XP computers.

Get to this page from Home by clicking on *Windows (MSN) Messinger*.

This page is available from *Home* by selecting *Wireless Encryption*. Here, you can manually select the type of wireless encryption you'd like to use. Your AirStation supports three different encryption schemes; choose the best one that all your clients support.

Virtually all wireless clients support **WEP**. It's a lot better than nothing.

TKIP is much more secure than WEP, but slower.

AES is even more secure than TKIP, and the fastest of all. Highly recommended if all of your wireless clients support it.
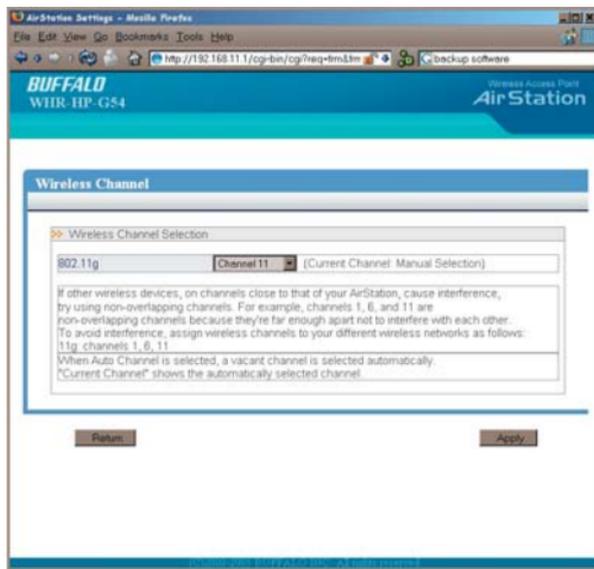
This page is available from *Home* by selecting *Wireless channel*. With *Auto Channel* selected, your AirStation will choose the best channel available. *Current channel* will show the channel that your AirStation is currently using.

You may also select any channel from 1-11 manually. Channels 1, 6, and 11 are non-overlapping. If multiple channels are in use in an area, select a different channel for your AirStation, as far away from the other channels being used as possible.
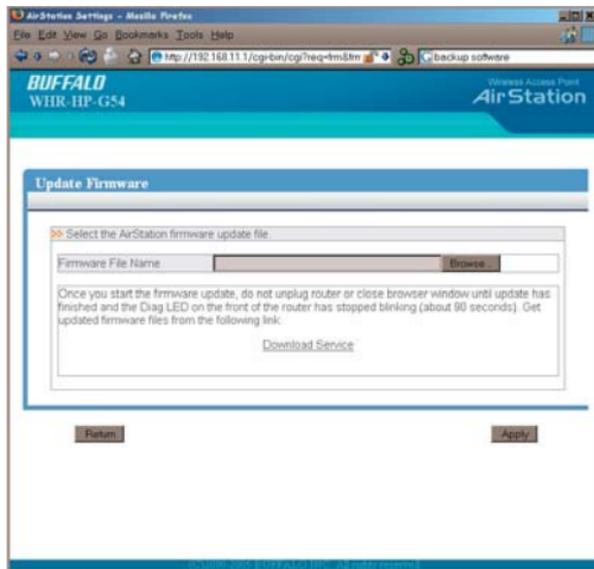
This page is available from *Home* by selecting *Firmware update*. Use *Browse* to select your firmware update file, and then click on *Apply*. Firmware update may take several minutes to complete. Don't power down your AirStation until the diag LED has gone out.

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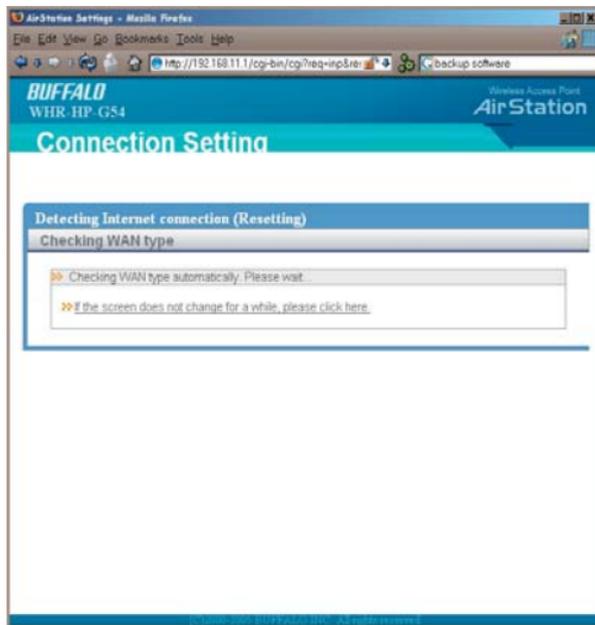
From *Home*, selecting the *Internet Connection Wizard (Multisession Reset)* tab will begin the Internet Connection Wizard.

The Internet Connection Wizard will only function correctly in simple networks, where your cable or DSL modem is plugged directly into your AirStation's WAN port. If you have a complicated existing network that you're adding the AirStation to, see page 56.
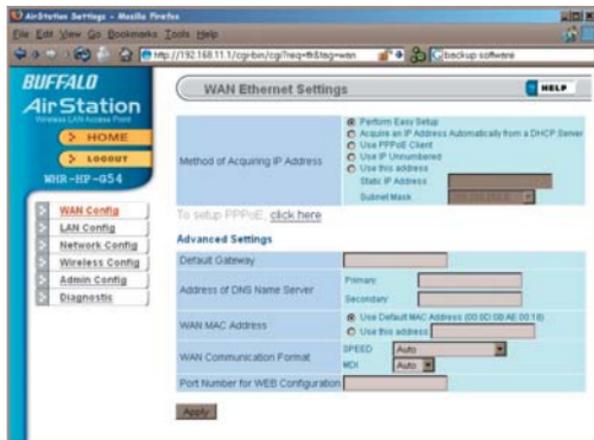
Advanced Settings lets you configure every element of your AirStation. Get to Advanced Settings from Home by clicking the *Advanced* Tab. You may return to Home by clicking on the yellow > *Home* link in the top left corner.

Click *Help* in the top right corner for more information about any of the pages in Advanced Settings.

To begin, click on *WAN Config*. The first page in WAN Config, *WAN Port*, will open.
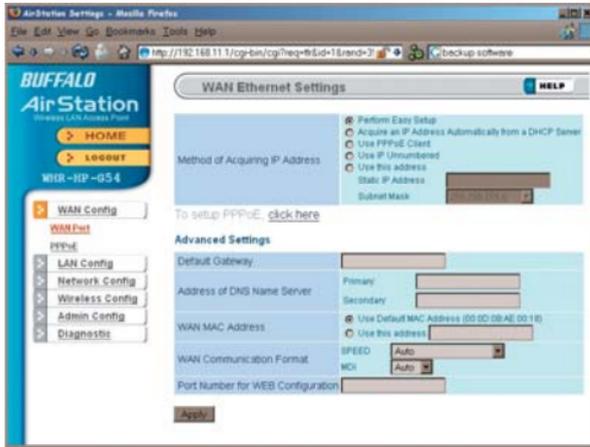
Here, you may choose how the AirStation acquires an IP address. Normally, the internet connection wizard will set this for you if you have a cablemodem or DSL. If you're not sure what to choose, perform *Easy Setup*.

To setup PPPoE manually, click on *click here* and turn to page 27.

Also on this page, under *Advanced Setup*, you may manually set the Default Gateway, DNS server, WAN MAC address, WAN format, and WEB port number.

Click *Apply* when finished.
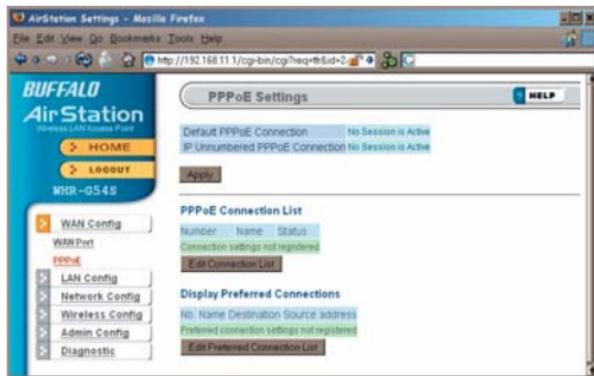
Many DSL connections require a PPPoE Connection in order to log in to an internet connection. Normally, the Easy Detection Wizard will help you configure that, but you may manually configure one here. Consult your ISP for more information on correctly configuring your PPPoE connection.

To add a new PPPoE connection, click *Edit Connection List*. To choose your preferred connection, click on *Edit Preferred Connection List*.
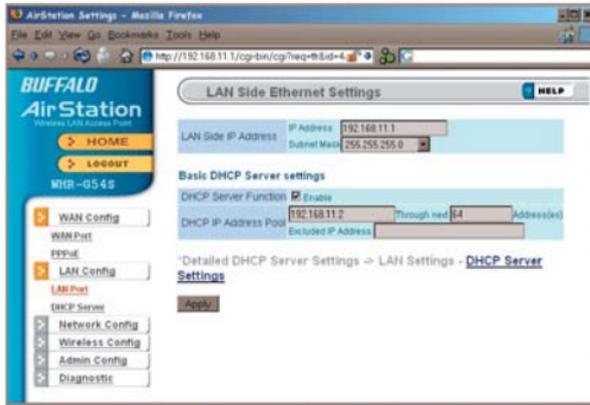
Default for the *LAN side IP address* is 192.168.11.1. To add the AirStation to an existing LAN, specify a unique IP address, not used elsewhere in the network.

The default Subnet Mask is 255.255.255.0. To connect AirStation to an existing LAN, specify the Subnet Mask that the LAN uses.

If there's more than one DHCP server on a network, disable all but one of them. To have DHCP assign addresses from a specific range, enter a begining address by *Assigned IP Address* and give the number

of addresses to assign in the *Addresses* box. To exclude specific addresses from being assigned by DHCP, specify them in the *Excluded IP Address* box. Multiple IP addresses may be specified by seperating them with a comma, e.g. 192.168.11.7,192.168.11.9. You can also specify an IP address range by start and end address connected by a dash, e.g. 192.168.11.15-192.168.11.21. The ',' and '-' can be used at the same time, e.g. 192.1 68.11.7,192.168.11.9,192.168.11.15-192.168.11.21, up to a total string length of 128 characters.

Click the *Help* link in the top right corner for more information.

Advanced DHCP Settings

This page offers the same DHCP settings as the previous one, and in addition, offers you the chance to change the *Lease Period*, *Default Gateway*, *DNS servers*, *WINS serve*r, and *Domain Name*. Click *Apply* when you have the settings the way you want them.

To manually assign an IP address, click *Manual Assignment*.

29
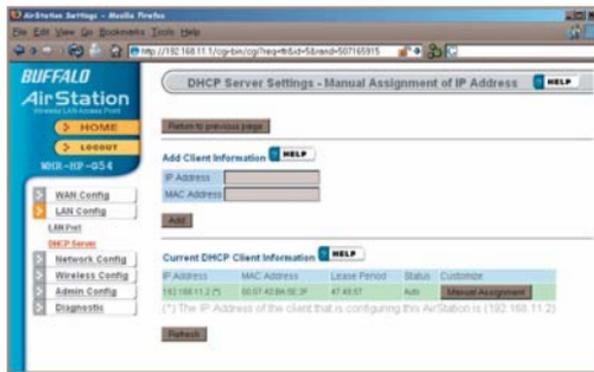
To manually link a LAN address to a MAC address, enter them under *Add Client Information* and click *Add*.

Current DHCP Client Information shows all LAN addresses currently assigned by AirStation's DHCP. You may configure a specific client to always recieve the same IP address by clicking *Manual Assignment* to the right of its MAC Address. Clicking *Delete* returns a manually assigned client to normal DHCP operation. *Edit* allows you to manually adjust a linked IP Address and Mac Address in the Client Information window above.
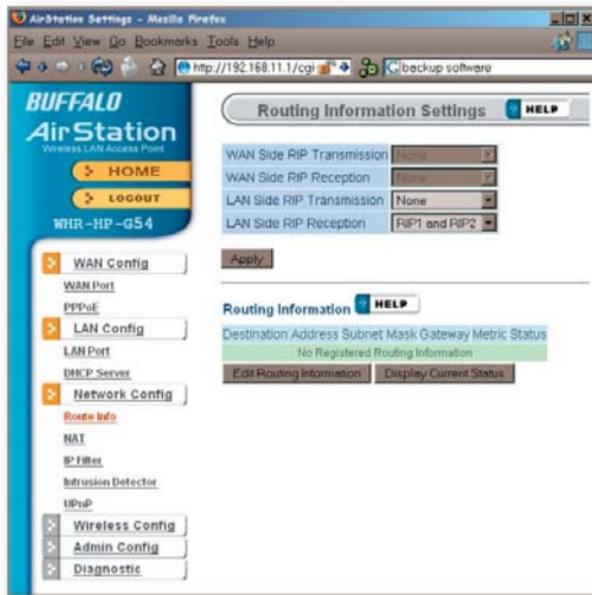
By default, the AirStation receives RIP (Route Information Protocol) information only from your local network, and doesn't broadcast RIP at all. For large, complicated network configurations, you may wish to modify this behavior. Click *Apply* when you have your desired configuration.

Lower on the page, routing information is displayed. Click *Edit Routing Information* to add a new route manually.
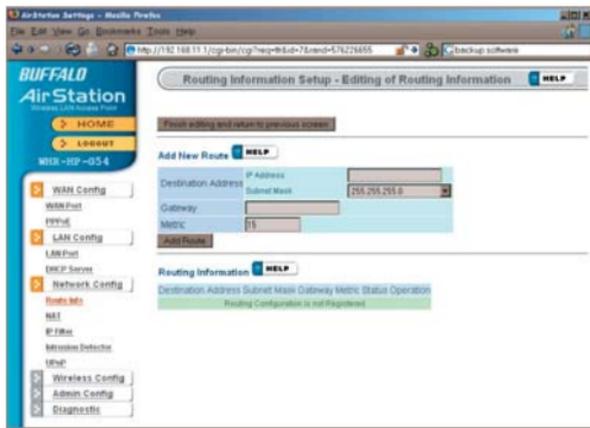
To configure a route manually, enter its *Destination Address* and *Gateway*. Enter a maximum number of hops allowable in *Metric* and click *Add*.
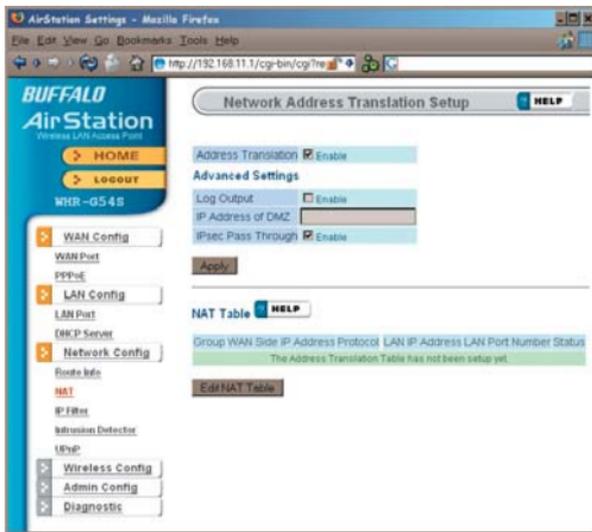
You may disable Network Address Translation and IPsec passthrough by unchecking the appropriate *Enable* boxes. If you have a DMZ, enter its IP address in the *IP Address of DMZ* box.   Incoming packets containing no recognizable destination port information will be redirected to the DMZ's IP address.

Click *Apply* when done.

To set a NAT table entry manually, click *Edit NAT Table.*
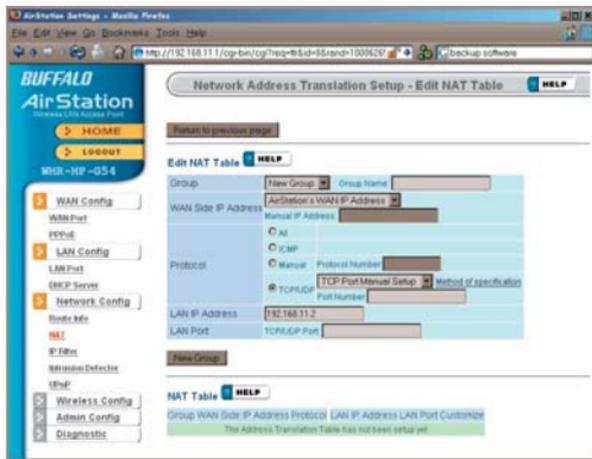
From this page you may manually add entries into the Address Translation Table. Click *Add New Group* when each is complete.

Your AirStation comes pre-configured with basic rules. You may choose which of these to use by clicking on *Add/Delete Basic Rules* and turning to page 36.

To make a custom rule, click on *Configure IP Filter* (page 37).
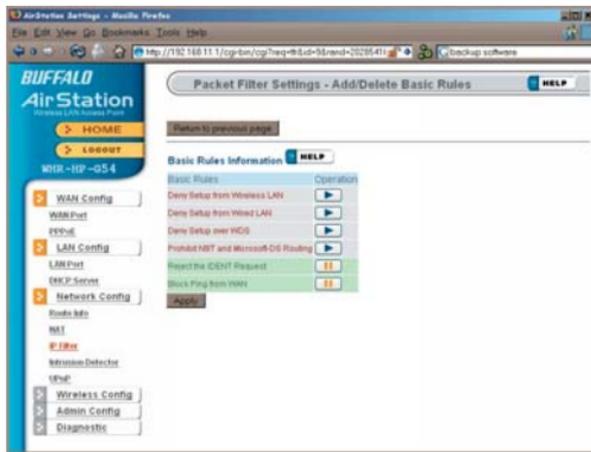
Get here by clicking on *Add/Delete Basic Rules* (see page 35). You may choose which of AirStation's preconfigured basic rules are enabled or disabled. Active rules are displayed with a green background, and disabled rules are shown in red. Choose the rules you want to use by clicking under *Operation*. When your choices are complete, click on *Initialize.*
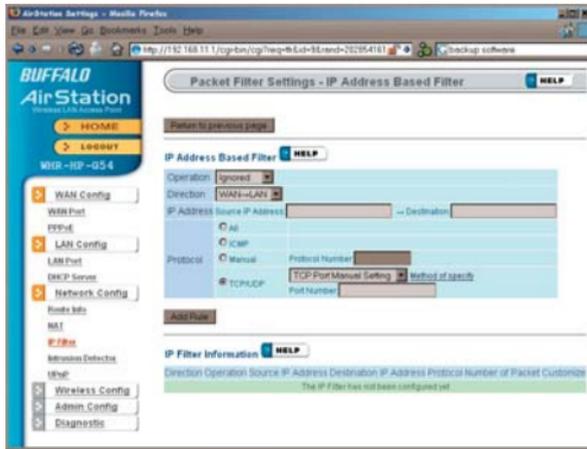
Clicking on *Configure IP Filter* from the IP filter page (page 35) will bring you to this page, where you can make your own rules. Click *Add Rule* when you have each rule configured the way you want it.

To enable intrusion detector, choose *Enable* or *Enable (Apply packet filter rules)* from the Intrusion Detector drop-down box. If packet filter rules are applied, packets will be filtered with packet filter rules before Intrusion Detector is applied.

Blocking IP spoofing blocks packets from devices using an IP address that is not their own.

In the *Threshold Value* box, enter the number of times an event has to occur before you receive notification.

To configure your email alerts, enter your email address and mail server information. You may make up a sender email address, such as "alert@router.com". Alert emails will appear to come from this address.

Intrusion detector also blocks unauthorized access attempts and suspicious traffic from WAN-side devices (the internet).

You may disable Universal Plug and Play functionality by unchecking *Enable* here. Note that Windows (MSN) Messenger will not function correctly with UPnP disabled.

Clicking *Start AOSS Sequence* has the same function as pushing the AOSS button on the router: it initiates the AOSS process.

If all your clients support AOSS, it's very simple to set them up. Press the AOSS button on the router, or the one on this page, and then push the AOSS button on the client device.

Each client device will have to be set up seperately. Wait for each AOSS process to finish before starting the next one.

Consult your client device's documentation for the location of its AOSS button.

If you have a mixed mode network, with both 802.11b and 802.11g clients, it's recommended that you check *11g protection* to ensure that slower 11b clients don't hog all available bandwidth.

Choosing *Auto* for *Wireless mode* lets both 802.11b and 802.11g clients connect to the network. If you would prefer to allow only one or the other, you have those options as well.

Two different framebursting modes are available. These can double throughput in your network if all clients are configured to use them. *125* High Speed Mode* is an improved version of *Framebursting* and is highly recommended if your clients support it. If a framebursting mode is enabled and some of your clients don't support it, it simply won't be used.

Reducing the *Output Power* below 100% will reduce the range of your router.

Buffalo recommends that you choose the strongest form of encryption that's supported by all your client devices.

- *WEP* is a lot better than nothing, and almost every wireless device ever made supports it.

- *TKIP* is slower than WEP but much more secure.

- *AES* is the most secure of all, and the quickest as well. Use it if you can.

Setting the key renewal period too short can decrease network performance.
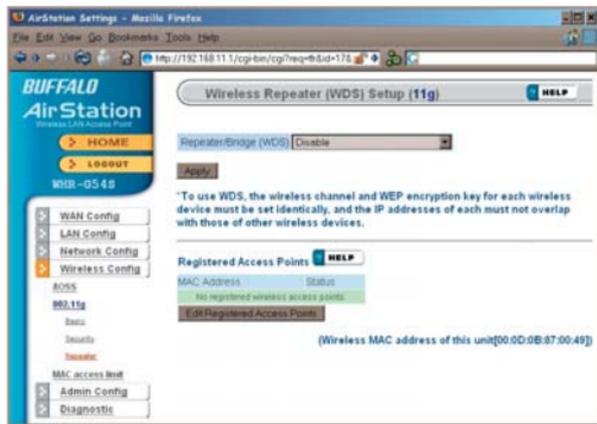
To setup a bridge between two or more wireless access points, select *Enable* and click on *Apply*.

For more on setting up WDS, see page 67, or click on *Help* at the top right corner of the screen.

You may limit access to your wireless network to specific computers. Computers not listed on your MAC Registration List will not be able to connect to the network. If you enable this, click *Edit Registration List* to add MAC addresses to your registration list.
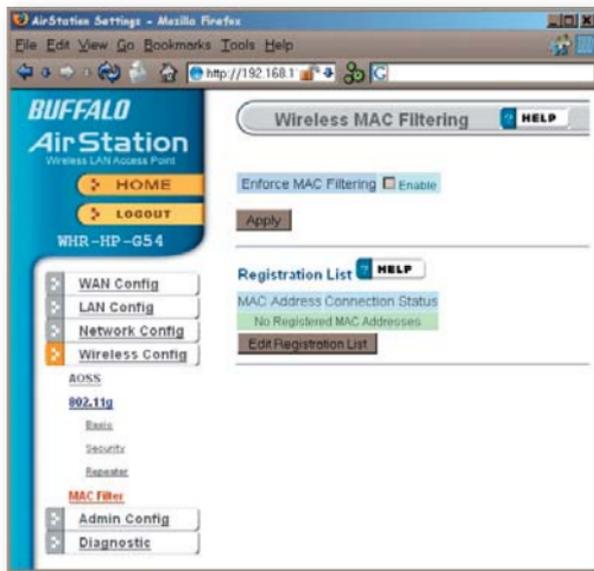
Enter a MAC address and click *Apply* for each client that's going to be accessing the network.

Here, you can change your AirStation's name on your network and the administrator password. The name of the administrator account is fixed as "root". If you have many AirStations on your network, having clear, descriptive names for each can make them much easier to administrate.
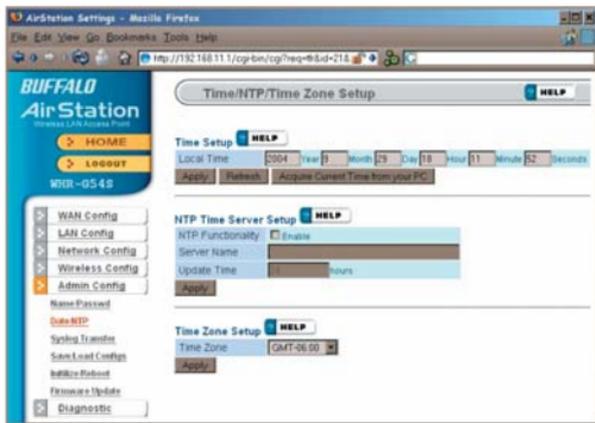
You may set the time and date on your AirStation by entering it manually, and then clicking *Apply*.

You may also click *Acquire Current Time from your PC* to set time and date automatically to match the PC you're using to set it up.

If you have an NTP time server on your network, *Enable* NTP functionality and enter your NTP *Server Name*. Choose how often you want time updated and click *Apply*.

If you're setting time manually, you'll need to select your Time Zone and click *Apply*.
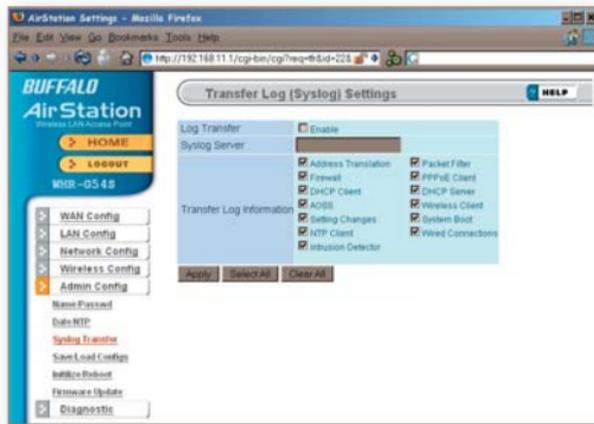
If you have a syslog server on your network, you may send logs to it. Check *Enable* to have logs transferred. Enter the address of your Syslog Server, check the logs you want transferred, and click *Apply*.
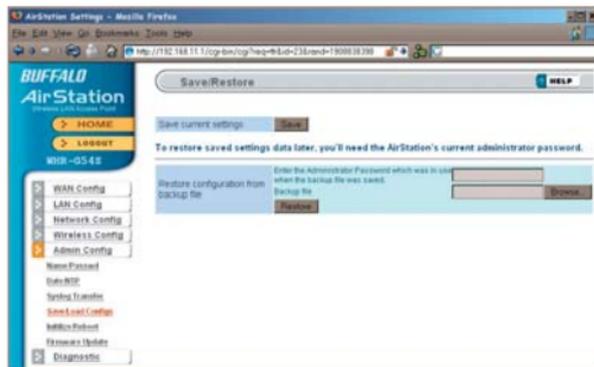
Once your AirStation's configured the way you want it, you can save the configuration here. You'll need the current administrator password to restore the configuration from the backup file later.

Click *Help* at the top right corner of the page for more information on backing up and recovering system configuration files.
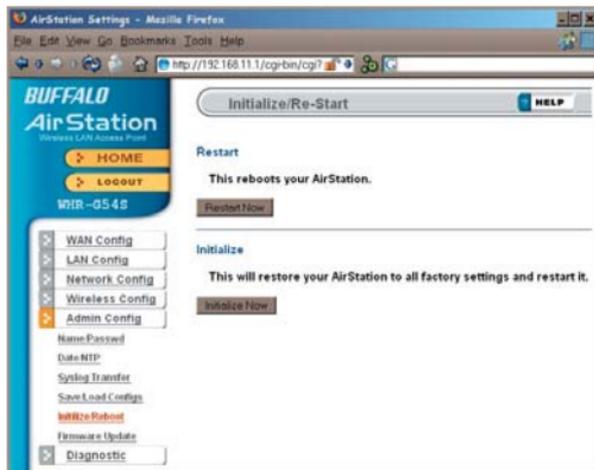
Click *Restart Now* to restart your AirStation. Click *Initialize Now* to restore your AirStation to factory defaults and restart it.
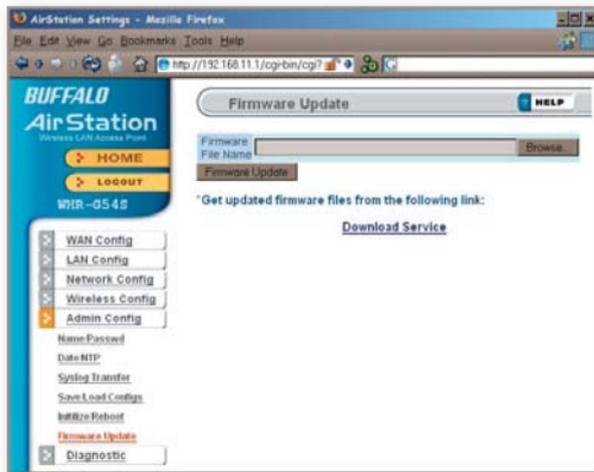
Click *Browse* to select your firmware update file. Then, click the *Firmware Update* button to update firmware.

Firmware Update may take several minutes to complete. Do not power down the router until Firmware Update is finished and the diag light on the front of the router has stopped blinking.

When available, updated firmware may be downloaded from *www.buffalotech.com*.

The System Information page lists all the setup information for your AirStation. It can be very handy for setting up clients that don't support AOSS.

Here you can choose what information gets logged and see recent log entries.

Here, you can see the packets and errors for each of your networks.

Client Monitor shows you a list of all clients currently connected to the wireless network.
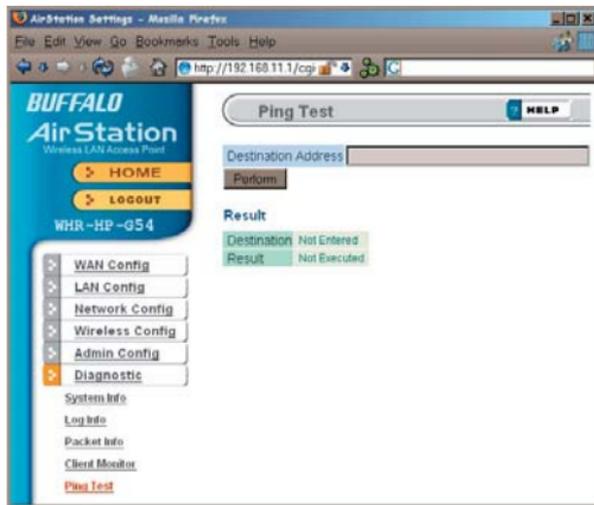
To perform a *Ping* test, enter a target (such as *192.168.11.2* or *www. buffalotech.com*) and click *Execute*.

Successful pings return "64 bytes from . . ." messages. If the ping returns "Connection failed" or other errors, something is preventing you from communicating successfully with your target.

Add an AirStation without changing your existing LAN configuration

1. Set the AirStation into Access Point Mode by moving the switch on the bottom from *AUTO* to *BRI*.

2. Connect one of the AirStation's LAN ports to an existing router or switch on your network. Nothing should be plugged into the WAN port.

3. Open LAN Settings - LAN Port Settings and configure the following settings:

   IP Address =[192.168.11.1] (Specify an unused network address from the existing LAN.)

   Subnet Mask=[255.255.255.0] (Use the same Subnet Mask as the existing LAN.)

   DHCP Server Function=[Disable]

4. Restart PC.

The WHR-HP-G54's external antenna will usually give the best performance if oriented to point straight up. If your AirStation is resting on its side, use the antenna's swivel and twist function to orient it pointed upward.

In some environments it's desirable to further increase range by installing an external, higher-gain antenna. External antennas come in all shapes and sizes. Antennas also come with different connectors. The WHR-HP-G54 has an *RP-SMA* connector on it. If your antenna has a different kind of connector, you'll need an adaptor.

To install a different antenna, unscrew the stock antenna from the RP-SMA connector on top of the AirStation, and screw on the connector or adaptor from your new antenna.

For more information, FAQ's, and updates, consult the AirStation website at
http://www.buffalotech.com.

WHR-HP-G54 AirStation Specifications

Physical Specifications

Dimensions 1.1 x 5.1 x 5.7 in. (28 x 130 x 144mm)
Weight 9.8 oz. lb. (277g)

Temperature & Humidity

Operation 0˚ to 40˚ C
Maximum humidity 80%
Transit/Storage 0˚ to 40˚ C maximum humidity 80% (no condensation)

Power Characteristics

Transmit Mode 1.1A (Nominal),
Power Supply 5 V output; 100-240V AC Universal, 50/60 Hz
Power Consumption about 6.5 Watts (Max)

Regulatory Information

Wireless communication is often subject to local radio regulations. Although AirStation wireless networking products have been designed for operation in the license-free 2.4 GHz band, local radio regulations may impose limitations on the use of wireless communication equipment.

Network Compatability

IEEE802.11g/b Standard for Wireless LANs (125* High Speed Mode also Available.)
Wi-Fi (Wireless Fidelity) certified by the Wi-Fi Alliance.

Host Operating System

Microsoft Windows® 98SE/ME/NT4.0/2000/XP, Unix, Linux and MacOS
Media Access Protocol
Wired - CSMD/CD (Collision Detection)
Wireless - CSMD/CA (Collision Avoidance) with Acknowledgment (ACK)

Radio Characteristics

RF Frequency Band 2.4 GHz (2400-2483 MHz)

11 selectable channels (3 non-overlapping)

Modulation Technique Direct Sequence Spread Spectrum

• ODFM for High Transmit Rate
• DQPSK for Standard Transmit Rate
• DBPSK for Low Transmit Rate

Spreading 11-chip Barker Sequence

Nominal Output Power: 19dBm (802.11b), 16dBm (802.11g)

Transmit Rate:

• High Speed 54 Mbps (125 Mbps in 125* High Speed Mode)
• Medium Speed 36 Mbps (96 Mbps in 125* High Speed Mode)
• Standard Speed 2 Mbps
• Low Speed 1 Mbps

Open Office Environment
160 m (525 ft.)
270 m (885 ft.)
400 m (1300 ft.)
550 m (1750 ft.)

Semi-Open Office Environment
50 m (165 ft.)
70 m (230 ft.)
90 m (300 ft.)
115 m (375 ft.)

Closed Office
25 m (80 ft.)
35 m (115 ft.)
40 m (130 ft.)
50 m (165 ft.)

Receiver Sensitivity -83 dBm -87 dBm -91 dBm -94 dBm (depends on data rate)

Delay Spread (at FER of <1%) 65 ns 225 ns 400 ns 500 ns (depends on data rate)

• The range of wireless devices can be affected by metal surfaces, solid high-density materials and obstacles in the signal path.

Table "Radio Characteristics" lists the typical ranges when used indoors:

• In Open Office environments, clients can "see" each other, i.e. there are no physical obstructions between them.

• In Semi-open Office environments, work space is separated by room dividers; client cards are at desktop level.

• In Closed Office environments, workspace is separated by floor-to-ceiling brick walls.

Note: The range values listed in Table "Radio Characteristics" are typical distances as measured at Buffalo Technology AirStation laboratories. These values are provided for your guidance but may vary according to the actual radio conditions at the location where the AirStation product is installed.

AirStation IEEE 802.11 Channel Sets

The range of the wireless signal is related to the Transmit Rate of the wireless communication. Communications at a lower Transmit range may travel longer distances.

Center Channel ID FCC

1 2412 2 2417 3 2422 4 2427 5 2432 6 2437 7 2442 8 2447 9 2452 10 2457 11 2462 11 default channel

Common Problems

- Out of range, client cannot connect to the AirStation.
- Configuration mismatch, client cannot connect to the AirStation.
- Absence or conflict with the Client Driver.
- Conflict of another device with the AirStation hardware.

LED Activity

Monitoring LED activity helps identify problems.

- Power LED should be Green,
- Wireless LED should be Green if the line is active. If is it blinking Green, wireless communication is active.
- Ethernet LED should be Green (100Mbps) or Amber (10Mbps) while the communication is active.
- The Red Diag LED will flash during boot and firmware updates.

DIAG LED Activity

Unplug the power for three seconds. Plug the power back in to monitor the Diag LEDs during start-up.

DIAG LED Activity Table

DIAG LED Display	Time	Description/Action
Continuous Red	Starting	RAM Error Red flash, 2 times Starting Flash ROM Error
Red flash, 3 times	Starting	A problem on the wired LAN side
Red flash, 4 times	Starting	A problem on the wireless LAN side

LEDs Work But Client PC Cannot Connect to Network

If the LEDs indicate that the network is working properly (Power LED is on, Transmit/ Receive LED blinks), check the TCP/IP settings of the network.

Changing Client TCP/IP Settings in Windows

Consult the LAN Administrator for correct TCP/IP settings.

To add or change TCP/IP Settings:

1. On the Windows task bar, click Start.
2. Select Settings, then Control Panel.
3. Double-click on the Network icon to view Network Properties.
4. From the list of installed components, verify the TCP/IP => wireless LAN adapter protocol is installed.

- If the wireless adapter protocol is not yet installed, click the *Add* button and select the TCP/IP protocol from the list. Refer to Windows Help for more information.
- If the wireless adapter protocol is installed, select the protocol and click the *Properties* button. Verify that the parameters match the settings provided by your LAN Administrator. Make changes if necessary, and click OK.

5. If prompted, restart your computer.

Other Problems

Please refer to **www.buffalotech.com** for further reference materials.

Troubleshooting WDS

The most common issue with WDS installations is using the wrong MAC address. The proper MAC Address for the access points is the *Wireless MAC Address*. The best place to get this from *System Information* in the configuration tool.

Restrictions:

1. All wireless access points in the wireless bridge need to support WDS. At time of publication, only Buffalo G54 and Apple Airport Extreme access points support WDS.

2. No single access point can communicate with more then six other access points in the wireless bridge.

Good Practices:

1. Start the wireless bridge system with only two access points and then add more, one at a time.

2. Setup all access points in the wireless bridge in close proximity before deploying them to their final location.

3. Only one access point in the wireless bridge should be serving DHCP and routing services unless a routed wired network exists.

Setting up WDS; the long version:

1. It is recommended that all access points in the bridge are reset to their factory default settings. This is done by holding the INIT button on the rear of the access point down for 5-10 seconds.

2. Login to the first access point in the wireless bridge (this should be the DHCP server enabled access point if there is not already a routed wired network).

3. Click on the *Advanced* button.

4. The wireless settings page will appear. Select the proper settings for the wireless network. Record all settings on a piece of paper. All settings except for the SSID need to be identical amongst all access points in the bridge. If roaming is desired, then set the SSID settings identically as well. Press the *Set* button if any changes are made.

(NOTE: If the IP address was changed, then reconnecting to the access point for configuration will require accessing it via its new IP address in a web browser (e.g. http://NEW_IP_ADDRESS). Write down the new IP address carefully if you changed it, and put it in a safe place!

5. Click on the *LAN port* link on the left.

6. Check that the *LAN side IP address* values are correct for your network, or leave them at their defaults. Record the *LAN side IP address*. Press the *Set* button if any settings on this page have been set.

7. Click on the *Management* link on the left.

8. The System Information page will appear. In the Wireless section of the table record the MAC address (including the colons). Please make sure the MAC address is recorded from the Wireless section and not the other sections.

9. Logout of the access point by clicking on the *Logout* link on the left. Close the browser window.

10. Login to the second access point in the wireless bridge.

11. Click on the *Advanced Settings* tab.

12. The wireless settings page will appear. Select the proper settings for the wireless network. Refer to the settings recorded from the first access point. All settings except for the SSID need to be identical amongst all access points in the bridge. If roaming is desired, then set the SSID settings identically as well.

13. Click on the *LAN port* link on the left.

14. Make sure that the *LAN side IP address* setting is different than that of the first access point. The IP addresses cannot be the same, but they should be on the same network. It is recommended that the IP address of the second access point is one higher then that of the first access point. Thus, if access point one's address is 1.1.1.1, then access point two's address should be 1.1.1.2. If there is a *DHCP server function* setting on this page, then make sure to set it to *Disabled*. Press the *Apply* button when finished. If the IP address was changed, then reconnecting to the access point for configuration will require accessing it via its new IP address in a web browser (e.g. http://NEW_IP_ADDRESS).

15. Click on the *Wireless bridge (WDS)* link on the left.

16. Enable WDS and press the *Apply* button. If desired, move the switch on the bottom of the WHR-HP-G54 from AUTO to BRI to disable normal router functionality (optional).

17. Enter the Wireless MAC Address of the first access point (which was recorded on Step 8) into the field *MAC Address of AirStation (Wireless)* (include the colons). Press the *Add* button.

18. The Wireless MAC address inputted on the step above will appear in the *Connected AirStation* table. Confirm that enable is checked, and then press the *Apply* button.

19. At the top of the page, press the *Apply* button.

20. Once the router has rebooted, click on the *Management* tab on the left.

21. The System Information page will appear. In the Wireless section of the table record the MAC address (including the :'s). Please make sure the *Wireless* MAC address, and not the wired MAC address, is recorded.

22. Logout of the access point by clicking on *Logout* at the top of the page. Close the browser window.

23. Login to access point one again.

24. Click on the *Advanced Settings* tab.

25. Click on the *Wireless bridge (WDS)* link on the left.

26. Enable the WDS function and press the *Apply* button.

27. Enter the Wireless MAC Address of the first access point (recorded in Step 21) into the field that says *MAC Address of AirStation(Wireless)* (include the :'s). Press the *Add* button.

28. The Wireless MAC address inputted on the step above will appear in the *Connected AirStation* table. Please check that the checkbox by *enable* is checked, and then press the *Apply* button.

29. At the top of the page, press the *Apply* button.

30. Once the router has rebooted, click on the *Management* tab on the left.

31. Click on the *Ping Test* link on the left.

32. In the *Destination* field enter the IP address of the second access point and press the *OK* button.

   a. If the *Result* section of the table reports information like "1st: 64 bytes from IP_ADDRESS" then the WDS bridge is effectively working.

   b. If the *Result* section of the table reports "Destination Host Unreachable", then an error has occurred during the setup.

WDS is a complicated bridging system with a lot of variables. If there are still problems with WDS configuration on the network, please contact Buffalo Tech Support (see pages 82 and 83).

10BaseT: 802.3 based Ethernet network that uses UTP (Unshielded twisted pair) cable and a star topology. 10 Mbps data tansmission speed.

100BaseT: 802.3 based Ethernet network that uses UTP (Unshielded twisted pair) cable and a star topology. 100 Mbps data tansmission speed.

1000BaseT: 802.3 based Ethernet network that uses UTP (Unshielded twisted pair) cable and a star topology. 1000 Mbps data tansmission speed.

802.1x: The standard for wireless LAN authentication used between an AP and a client. 802.1x with EAP will initiate key handling.

Access Point: A hardware device that acts as a communication hub for *Clients* (users of wireless devices) to connect to a wired LAN.

Ad-Hoc Network: A network based on peer-to-peer communication rather than a router, switch, or hub.

Bandwidth: The transmission capacity of a computer or a communication channel, usually stated in Megabits per second (Mbps).

Bridge: A device which forwards traffic between network segments with a common network layer address, based on data link layer information.

Client: A PC, workstation, or other device that connects to a network wirelessly through an *Access Point*.

Cross-Over Cable: A UTP cable that has its transmit and receive pair crossed to allow communications between two devices.

Default Gateway: The IP Address of either the nearest router or server for the LAN.

Destination Address: The address portion of a packet that identifies the intended recipient station.

DHCP (Dynamic Host Configuration Protocol): Based on BOOTP, it uses a pool of IP addresses, which it assigns to each device connected to it, and retrieves the address when the device becomes dormant for a period of time.

DNS (Domain Name System): System used to map readable machine names into IP addresses.

Driver: Software that interfaces a computer with a specific hardware device.

Dynamic IP Address: An IP address that is automatically assigned to a client station in a TCP/IP network, typically by a DHCP server.

Ethernet: The most widely used architecture for Local Area Networks (LANs). It is a shared-media network architecture. The IEEE 802.3 standard details its functionality.

Ethernet cable: A wire similar to telephone cable that carries signals between Ethernet devices. It is designed to connect a single device's NIC to a router, switch, or hub. See also *Crossover cable*.

File and Print Sharing: A Microsoft application that allows computers on a network to share files and printers.

Firmware: Computer programming instructions that are stored in a read-only memory unit rather than being implemented through software.

Frame: A fixed block of data, transmitted as a single entity. Also referred to as a packet.

Full-Duplex: To transmit on the same channel in both directions simultaneously.

Half-duplex: To transmit on the same channel in both directions, one direction at a time.

Hub: A device which allows connection of computers and other devices to form a LAN.

IEEE (Institute of Electrical and Electronics Engineers): The professional organization which promotes development of electronics technology.

IP (Internet Protocol) Address: A unique 32-binary-digit number that identifies each sender or receiver of information sent in packets.

Infrastructure: A wireless network or other small network in which the wireless network devices are made a part of the network through the Access Point.

ISP (Internet Service Provider): A company that provides access to the Internet and other related services.

IV (Initialization Vector): The header section of an encrypted message packet.

LAN (Local Area Network): A group of computers and peripheral devices connected to share resources.

LED (Light Emitting Diode): The lights on a hardware device representing the activity through the ports.

MAC (Medium Access Control) Address: The unique number that distinguishes every network interface card.

Mbps (Mega Bits Per Second): A measurement of millions of bits per second.

MDI/X (Media Dependent Interface/Cross-over): Port on a network hub or switch that crosses the incoming transmit lines with the outgoing receive lines.

MHz (MegaHertz): One million cycles per second.

NAT (Network Address Translation): An internet standard that enables a LAN to use one set of IP addresses for internal traffic and a second set for external traffic.

NIC (Network Interface Card): An expansion card connected to a computer so the computer can be connected to a network.

Packet: A block of data that is transferred as a single unit, also called a frame or a block.

Packet Filtering: Discarding unwanted network traffic based on its originating address or its type.

PCI (Peripheral Component Interconnect): A bus that is connected directly to the CPU.

PCMCIA (Personal Computer Memory Card International Association) Card: Removable module that adds features to a portable computer.

Peer-to-peer: This simple network is formed by connecting computers directly, without use of routers or hubs. A *crossover cable* is plugged into an Ethernet port in each computer, connecting them directly.

Ping (Packet Internet Groper): An Internet utility used to determine whether a particular IP address is accessable.

Plug and Play: Hardware that, once physically installed, finishes its installation automatically and may immediately be used, as opposed to hardware that requires further manual configuration.

PoE (Power over Ethernet): A mechanism to send DC power to a device using a CAT5 Ethernet cable.

PPPoE (Point-to-Point Protocol over Ethernet): A specification for connecting users on an Ethernet line to the Internet through a common broadband medium.

Protocol: A standard way of exchanging information between computers.

RADIUS (Remote Authentication Dial In User Service): A server that issues authentication keys to clients.

RAM (Random Access Memory): Non-permanent memory.

Repeater Hub: A device that collects, strengthens and transmits information to all connected devices, allowing the network to be extended to accommodate additional workstations. See also *Bridge*.

RC4: The encryption algorithm used by WEP.

RJ-45 connector: An 8-pin connector used between a twisted pair cable and a data transmission device.

ROM (Read Only Memory): Memory hardware that allows fast access to permanently stored data but prevents addition to or modification of the data.

Router: A device in a network that handles message transfer between computers. Similar to a *hub*, but with added functionality and efficiency.

Roaming: The ability to use a wireless device while moving from one access point to another without losing the connection.

Server: Any computer that makes files or peripheral devices available to users of the network and has a resident Network OS.

SMTP (Simple Mail Transfer Protocol): The protocol used to define and deliver electronic mail (E-mail) from one location to another.

SNMP (Simple Network Management Protocol): An application layer protocol that outlines the formal structure for communication among network devices.

Static IP Address: A permanent IP address is assigned to a node in a TCP/IP network. Also known as global IP.

STP (Shielded Twisted Pair): Twisted Pair cable wrapped in a metal sheath to provide extra protection from external interfering signals.

Subnet Mask: An eight-byte address divided into 4 parts separated by periods.

TCP/IP (Transmission Control Protocol/ Internet Protocol): Protocol used by computers when communicating across the Internet or Intranet.

TKIP (Temporal Key Integrity Protocol): An encryption method replacing WEP. TKIP uses random IV and frequent key exchanges.

Topology: The shape of a LAN (Local Area Network) or other communications system.

Twisted Pair: Cable that comprises 2 or more pair of insulated wires twisted together.

UDP (User Datagram Protocol): A communication method (protocol) that offers a limited amount of service when messages are exchanged between computers in a network. UDP is used as an alternative to TCP/IP.

Uplink: Link to the next level up in a communication hierarchy.

UTP (Unshielded Twisted Pair) cable: Two or more unshielded wires twisted together to form a cable.

WAN (Wide Area Network): A networking system covering a wide geographical area.

WEP (Wired Equivalent Privacy): A security protocol for wireless local area networks defined in the 802.11b standard, using a 64 bit or 128 bit key. WEP was designed to provide the same level of security as that of a wired LAN. However, it has been found that WEP is not as secure as once believed.

Web Browser: A software program that allows viewing of web pages.

Wi-Fi (Wireless Fidelity): An organization that tests and assures interoperability among WLAN devices.

Wire Speed: The maximum speed at which a given packet can be transferred using Ethernet and Fast Ethernet standard specifications.

WLAN (Wireless LAN): A LAN topology using wireless devices.

VPN (Virtual Private Network): A security method to connect remote LAN users to a corporate LAN system.

Notice

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

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. In accordance with FCC regulation, BUFFALO has limited the WHR-HP-G54 to operation on channels 1-11 by USA specific firmware.

FCC Warning

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

FCC RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for uncontrolled

equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment should be installed and operated with at least 20cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and legs). This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Safety

This equipment is designed with the utmost care for the safety of those who install and use it. However, special attention must be paid to the dangers of electric shock and static electricity when working with electrical equipment. All guidelines of this manual and of the computer manufacturer must therefore be allowed at all times to ensure the safe use of the equipment.

EU Countries intended for use

The ETSI version of this device is intended for home and office use in Austria, Belgium, Denmark, Finland, France (with Frequency channel restrictions), Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Norway, The Netherlands, Portugal, Spain, Sweden, Switzerland and United Kingdom. The ETSI version of this device is also authorized for use in EFTA member states Iceland, Liechtenstein, Norway and Switzerland.

EU Countries not intended for use

None.

Potential restrictive use

France: Only channels 10,11,12, and 13.

Buffalo Technology (Melco Inc.) products come with a two-year limited warranty from the date of purchase. Buffalo Technology (Melco Inc.) warrants to the original purchaser the product; good operating condition for the warranty period. This warranty does not include non-Buffalo Technology (Melco Inc.) installed components. If the Buffalo product malfunctions during the warranty period, Buffalo Technology/(Melco Inc.) will, replace the unit, provided the unit has not been subjected to misuse, abuse, or non-Buffalo Technology/(Melco Inc.) authorized alteration, modifications or repair.

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Buffalo Technology (USA), Inc.
4030 West Braker Lane, Suite 120
Austin, TX 78759-5319

GENERAL INQUIRIES

Monday through Friday
8:30am-5:30pm CST
Direct: 512-794-8533 | **Toll-free:** 800-456-9799 | **Fax:** 512-794-8520 | **Email:** *sales@buffalotech.com*

TECHNICAL SUPPORT

North American Technical Support by phone is available 24 hours a day, 7 days a week. (USA and Canada).
Toll-free: (866) 752-6210 | **Email:** *info@buffalotech.com*

Buffalo Technology (Europe), Inc.
176 Buckingham Avenue,
Slough, Berkshire, SL1 4RD
United Kingdom

GENERAL INQUIRIES

Email: *sales@buffalo-technology.com*

TECHNICAL SUPPORT

Technical Support in Europe is available between the hours of 9am-6pm (GMT) Monday to Thursday and 9am-4:30pm (GMT) Friday for this product. Customers in Europe can obtain Technical Support using the following information:

E-mail: *helpdesk@buffalo-technology.ie* | Web: *www.buffalo-technology.com*

* When operating in High-Speed Mode, this Wi-Fi device achieves an actual throughput of up to 34.1 Mbps, which is equivalent to the throughput of a system following 802.11g protocol and operating at a signaling rate of 125 Mbps.