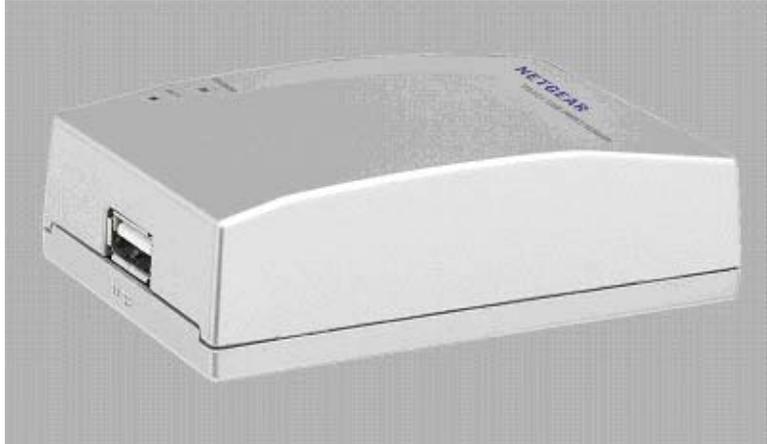


User Manual for the NETGEAR PS121 Mini Print Server



NETGEAR

NETGEAR, Inc.
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Version v1.0
February 2004

Technical Support

Please refer to the support information card that shipped with your product. By registering your product at www.netgear.com/register, we can provide you with faster expert technical support and timely notices of product and software upgrades.

NETGEAR, INC. Support Information

Phone: 1-888-NETGEAR, for US & Canada only. For other countries, see your Support information card.

E-mail: support@netgear.com

Web site: www.netgear.com

Statement of Conditions

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NETGEAR does not assume any liability that may occur due to the use or application of the product(s) or circuit layout(s) described herein.

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February 2004

Certificate of the Manufacturer/Importer

It is hereby certified that the Model PS121 Print Server has been suppressed in accordance with the conditions set out in the BMPT- AmtsblVfg 243/1991 and Vfg 46/1992. The operation of some equipment (for example, test transmitters) in accordance with the regulations may, however, be subject to certain restrictions. Please refer to the notes in the operating instructions.

Federal Office for Telecommunications Approvals has been notified of the placing of this equipment on the market and has been granted the right to test the series for compliance with the regulations.

VCCI Statement

This equipment is in the Class B category (information equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council for Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in such residential areas. When used near a radio or TV receiver, it may become the cause of radio interference. Read instructions for correct handling.

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Chapter 1

About This Manual

Thank you for purchasing the NETGEAR PS121 Mini Print Server.

Audience, Conventions, Scope

This reference manual assumes that the reader has basic-to-intermediate computer and Internet skills.

This guide uses the following typographical conventions:

Table 1. Typographical conventions

<i>italics</i>	Emphasis, books, CDs, URL names
bold times roman	User input
<code>courier font</code>	Screen text, file and server names, extensions, commands, IP addresses



Note: This format is used to highlight information of importance or special interest.

This manual is written for the PS121 Print Server according to these specifications:

Table 1-1. Manual Specifications

Product Version	NETGEAR PS121 Mini Print Server
Manual Publication Date	February 2004



Note: Product updates are available on the NETGEAR, Inc. Web site at <http://www.netgear.com/support/main.asp>.

Chapter 2

Introduction

This chapter introduces the features, package contents, and appearance of the NETGEAR PS121 Mini Print Server.

This manual describes the installation and use of the PS121 for operation with a Microsoft® Windows® XP, Windows® 2000, Windows® Me, or Windows® 98SE 2nd edition system.

For quick installation and setup, please see the Model PS121 Print Server Installation Guide. This manual describes in detail how to set up the Model PS121 single USB Mini Print Server and provides you with further reference information.

About the NETGEAR PS121 Mini Print Server

Congratulations on your purchase of the NETGEAR® PS121 Print Server. NETGEAR Print Servers are fast and easy to set up with NETGEAR Print Server configuration software. The PS121 Print Server is packed with features, including:

- **Versatility.** The Print Server supports up to three protocols: TCP/IP, SMB (Service Message Block), and NetBEUI. It features a 10/100BaseT Ethernet port for connection to your LAN and operating system support for Microsoft Windows.
- **Easy Installation.** The Print Server makes adding printers or plotters to your network simple.
- **Easy Setup.** A number of utility programs are supplied to simplify setup. For Windows 98/Me/2000/XP users, the easy to configure Print Server Setup Wizard simplifies PS121 network configuration tasks.
- **Web-based Interface.** The Web-based interface provides an easy method of configuration in TCP/IP networks regardless of your operating system.
- **Compact Size.** This allows the Print Server to be used even where space is limited.

Key Features

The key features of the PS121 Print Server are:

- Extremely compact size
- Easy configuration of the device with NETGEAR Print Server software that assures fast and easy setup for Windows 98, Windows Me, Windows 2000, and Windows XP
- 10/100 BASE-T standard Ethernet capable to connect any 10/100 Mbps hub and switch
- One USB port on the Model PS121 Print Server
- Upgradeable BIOS Flash EPROM



Note: Product updates are available on the NETGEAR, Inc. web site at <http://www.netgear.com/support/main.asp>.

For a list of USB printers that have been tested with NETGEAR print servers, see the Support section of the NETGEAR Web site.

Note: Other USB printers may also be compatible, or partially compatible, but NETGEAR has not tested them.

What's in the Box?

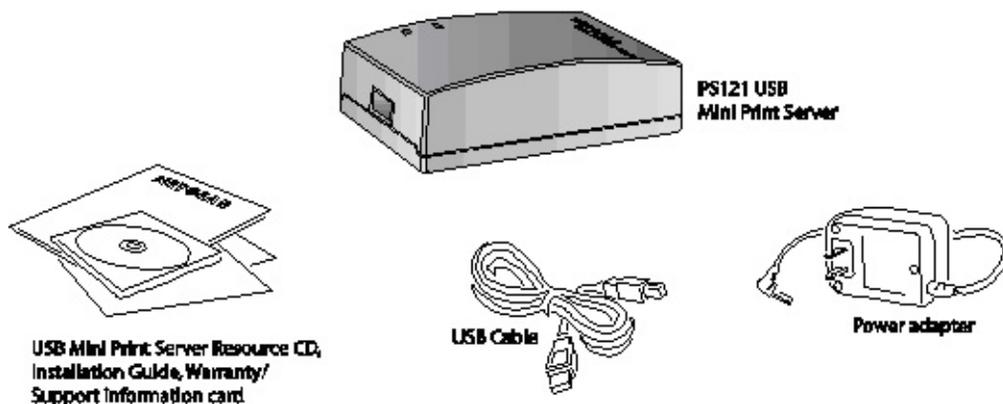


Figure 2-1: PS121 Package Contents

The product package should contain the following items:

- PS121 Print Server
- AC Power adapter
- USB cable
- Installation Guide for the NETGEAR PS121 Mini Print Server (201-10011-01)
- *NETGEAR PS121 Mini Print Server Resource CD* , including:
 - Driver and System Utility Software
 - User Manual for the NETGEAR PS121 Mini Print Server
 - Animated Network Properties Configuration Tutorial
 - PC Networking Tutorial
- Warranty & Registration card
- Support information card

If any of the parts are incorrect, missing, or damaged, contact your NETGEAR dealer. Keep the carton, including the original packing materials, in case you need to return the product for repair.

To qualify for product updates and product warranty registrations, fill out the registration information within 30 days of purchase. For priority service, register online on the NETGEAR Web page at: <http://www.NETGEAR.com>

You can also fill out and return the Warranty & Registration Card that is included in your product package.

Hardware Description

The Model PS121 Mini Print Server LEDs indicate the status of the server and the Ethernet traffic. It has one 10/100 Mbps network port. The port operates in 10/100 Mbps when connected to a 10/100Mbps Ethernet network. It has one USB port. It has a power adapter receptacle that accepts a 9V 500mA DC power adapter. It has a diagnostic/reset button.

As illustrated in the figure below, the PS121 Print Server has 2 LEDs.

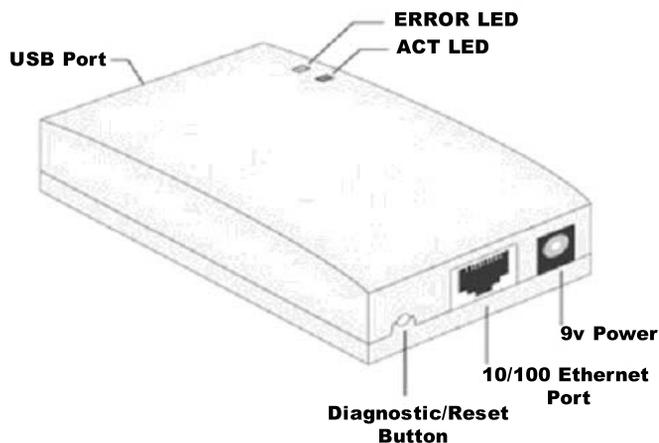


Figure 2-2: Model PS121 Mini Print Server

Status Indicators

See the table below for a description of the LED indicator lights:

Table 2-1. LED Descriptions

ACT Status LED (Green)	ERROR LED (Amber)	Description
Off	Off	No power
On	Off	Idle normal operation
Flashing	Off	Normal operation transmitting or receiving data from the network.
On	On	Hardware error
Flashing	Flashing	Firmware upgrade in progress

The USB Port

The USB port of the Model PS121 Mini Print Server is a standard USB connector.



Figure 2-3: Print Server USB Port

Note: The Model PS121 Mini Print Server does not support printers using parallel connectors. If your printer uses a parallel connector, you should use one of the other NETGEAR Print Servers such as the Model PS101 Mini Print Server.



Figure 2-4: Not Compatible with Centronics Parallel Printer Ports

Diagnostic/Reset Push Button

This button has 2 functions:

- Restore the factory default settings
- Print a test page containing all current settings



Recessed Diagnostic/Reset Button

Figure 2-5: Print Server recessed diagnostic/reset button

The button is recessed. Use a pin or paper clip to press it.

How to Restore the Factory Default Settings

1. Unplug the Print Server.
2. Press and hold the diagnostic button. While pressing the button, plug in the Print Server.
3. If you continue pressing the button for 10 seconds, a diagnostic page will be printed, showing the new (default) settings.

How to Generate a Diagnostic Printout

Note: PostScript printers are unable to print this page. If you have a PostScript printer, the test page will not be printed.

1. Ensure that both the Print Server and the attached printer are on.
2. Press the diagnostic button, and hold it in for 2 seconds.
3. The test page, containing the current settings, will print.

Chapter 3

Setup

This chapter describes how to install your NETGEAR PS121 Mini Print Server and set up basic connectivity on your Local Area Network (LAN).

Verify Printer and Network Readiness

Assure that the following are available:

- You have a working Ethernet network running TCP/IP with at least one Windows 98SE, Me, 2000, or XP PC.
- You have a printer with a USB port.

Note: As illustrated in [“Not Compatible with Centronics Parallel Printer Ports”](#) on page 2-5, the Model PS121 Mini Print Server does not support printers using parallel connectors. If your printer uses a parallel connector, you should use one of the other NETGEAR Print Servers such as the Model PS101 Mini Print Server.

- You may also need to have your printer driver software handy. For most popular printers, Windows already has the printer driver software available.

Tip: Set up the printer you will use directly on a computer and verify that it is working properly before connecting it to the PS121.

Observe these Precautions

For your own safety, and to protect your Print Server, please observe the following precautions.

- Use only the correct 9v power supply. Do not pinch, crimp or otherwise damage the power cord. If exposed to foot traffic, ensure that the cable is properly shielded and does not pose a tripping hazard.
- Unplug this device from its power source before cleaning. Use only a slightly dampened cloth for cleaning. Do not use liquid or aerosol cleaners.
- Avoid using this product near water. Exposure to water poses an electric-shock hazard.

Overview of PS121 Print Server Setup

Before you share a printer with the NETGEAR PS121 Mini Print Server, you should have at least one computer connected to an Ethernet network and have one unused port on an Ethernet hub, switch, or router.

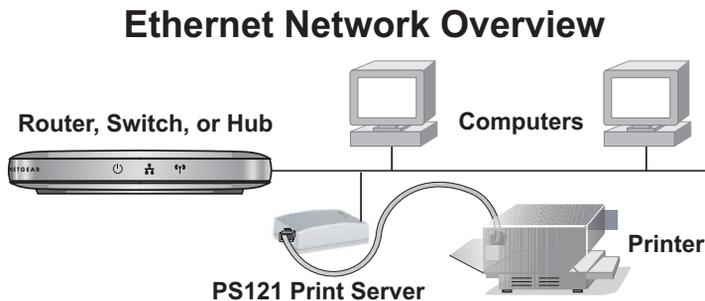


Figure 3-1: Network overview

Follow these steps to set up your NETGEAR PS121 Mini Print Server.

1. First, connect the PS121 to your printer.
2. Next, install the PS121 software from the *NETGEAR PS121 Mini Print Server Resource CD* and set up the PS121 on your network
3. Finally, configure each computer to print to the PS121 Print Server

PS121 Default Factory Settings

When you first receive your PS121, the default factory settings are shown below. You can restore these defaults with the Factory Default Restore button on the rear panel as explained in [“How to Restore the Factory Default Settings”](#) on page 2-6.

Network Setting	Default Factory Setting
IP Address	Provided Automatically via DHCP for Initial Setup but Must Be Set to Static IP for Regular Operation

Before you begin, gather your existing network settings such as the TCP/IP addresses and networking protocols in use.

First, Connect the Print Server and Printer to Your Network

1

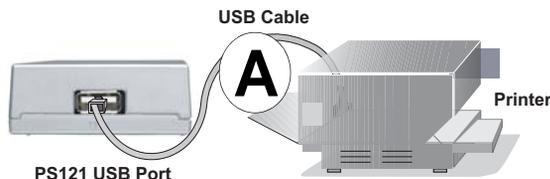
Connect the PS121 to your printer.

- a. Ensure that the PS121 power is OFF.
- b. Connect one end of the supplied USB cable (A) to the PS121, and the other end to the USB connector on your printer.
- c. Turn on your printer.
- d. Connect the 9v power cord to the PS121, and plug the the power adapter.
- e. Turn on your printer.
- f. Check the PS121 status lights and verify the following:
 - *ACT* light: When the print server is powered on, the ACT light will blink then turn solid green.
 - *ERROR* light: The ERROR light should be off.



PS121 USB Port

Connect the Print Server to the Printer



Connect the PS121 to your printer

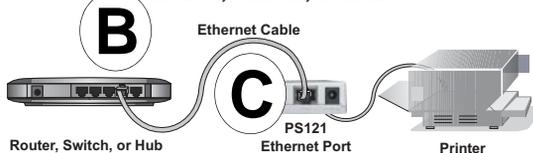
2

Connect the Ethernet cable from the PS121 to a network device like a router.

- a. Insert one end of an Ethernet cable (B) into an open Ethernet port in the network device like a hub, switch, or router.
- b. Insert the other end (C) into the Ethernet port on the PS121.

Your PS121 and printer are now connected to your network!

Connecting the Print Server to the Router, Switch, or Hub



Note: Ethernet specifications limit the cable distance to 328 ft. in length.

Now, Install and Configure the PS121 Software

Note: Any print manager software from a printer manufacturer such as Epson or HP should be uninstalled before installing the PS121 software. See [Appendix E](#) for information on Print Manager software compatibility.

Follow the steps below to install the software for PS121 and set it up on your network.

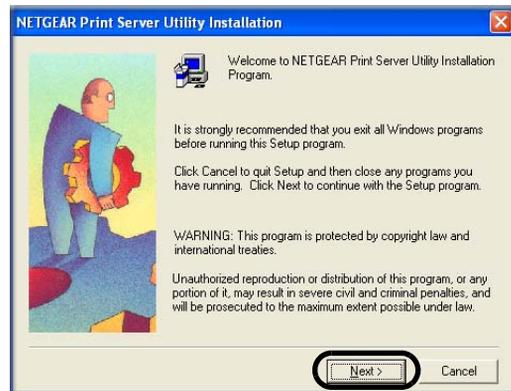
1

Install the PS121 software.

- a. Power on your computer, let the operating system boot up completely, and log in as needed.
- b. Insert the Resource CD for the PS121 into your CD-ROM drive. The CD main page shown at the right will load.
- c. Click **Install Software**.
- d. Click **Next** and follow the software installation utility prompts to complete the software installation.
- e. When prompted, restart your computer to complete the installation.
- f. When your computer restarts, click **Finish** to run the Print Server Setup Wizard.



NETGEAR PS121 Mini Print Server Resource CD



NETGEAR Print Server Installation

2

Run the Print Server Setup Wizard to Set Up a Fixed IP Address for the PS121.

- The Print Server Setup Wizard screen should be displayed.
- Click **Next** to proceed.

The Print Server Wizard will now search your network for the PS121.

If the Print Server Setup Wizard cannot find your PS121, check the network connections and status lights on the PS121.

- The “Server Name” and the “IP Address” your network assigned to the PS121 are displayed. Click **Next** to proceed to the device name screen.
- You can enter a descriptive Device Name and Domain Name or accept the defaults. Click **Next** to proceed to the IP Address configuration screen.

The Print Server Wizard displays a recommended static IP address setting for the PS121. This is usually fine.

- Click **Next** to proceed.
- Click **Finish** to exit the Print Server Setup Wizard. This completes the configuration of the PS121 for operation on your network.
- Click **Yes** to run the Add Printer Port Wizard. Follow the instructions in the next section for using the this wizard to set up each computer to use the PS121.

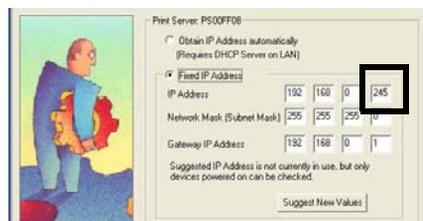


IP Address your network assigned to the PS121.

Select Print Server screen



Select Print Server Device Name screen



Set UP a Fixed IP Address for your PS121.

In this example, the address was set to 192.168.0.245. Since most home routers reserve the first 50 addresses for their DHCP pool, picking a number between 200 to 250 should work fine. Numbers above 254 will not work.

Finally, Set Up Each Computer to Use the PS121

After you have set up the PS121 in your network, you need to set up each computer to use the PS121. You do this by using the NETGEAR Add Printer Port Wizard. For each computer on your network, use the *NETGEAR PS121 Mini Print Server Resource CD* to run the Add Printer Wizard according to the steps below.

Warning: Print manager software from Epson and from some HP printers can block communications between your PC and the PS121. Uninstall such print manager software before proceeding with the Add Printer Port Wizard.

1

Use the NETGEAR Add Printer Wizard to set up each PC to use the PS121.

- a. When the Print Server Setup Wizard finishes, you are prompted to run the Add Printer Port Wizard. Click **Yes** to proceed. Alternatively, from the Windows Start menu NETGEAR Print Server program group, you can run the NETGEAR Add Printer Wizard.
- b. After a short delay while the software searches the network for your PS121, the Printer Select window opens and displays the PS121 you have set up.
- c. Click **Next** to proceed to the Port/Printer name screen. Take note of the printer model number listed.



Printer Select Window (Add Port)

Note: If no printers are displayed in this window, use the Print Server Setup Wizard to check your TCP/IP configuration and make sure that your printer is recognized on the network.

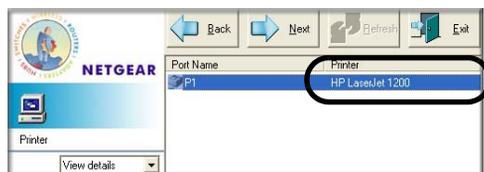
Also, be sure that both the PS121 and the connected printer are powered on, and the cable connections between the network, \ print server, and printer are secure.

2

Set up the correct printer driver for the printer port.

- Click **Next** to proceed to the Port/Printer name screen. Take note of the printer model number listed.
- Click **Next** to proceed to the Select Printer screen. If you see the exact printer model number listed as the printer model number from in the previous screen, click it to select it from the list.
- If prompted, print a test page to verify operation of the printer and the PS121. Then, close any remaining Add Printer Port Wizard or Windows Add Printer Wizard windows.

Use the *NETGEAR PS121 Mini Print Server Resource CD* to run the Add Printer Port Wizard to set up each PC on your network that you want to use with the PS121.



Select the port you added



Chapter 4

Troubleshooting

This chapter gives information about troubleshooting your NETGEAR PS121 Mini Print Server. After each problem description, instructions are provided to help you diagnose and solve the problem. For the common problems listed, go to the section indicated.

- Is the mini print server on and is the Status light lit?
Go to [“Basic Functioning” on page 4-1.](#)
- Have I connected the mini print server correctly?
Go to [“Printing Errors” on page 4-2.](#)
- I can’t access the mini print server from my computer.
Go to [“Troubleshooting the TCP/IP Settings Using Ping” on page 4-3](#)
- I can’t remember the mini print server’s configuration password, or I want to clear the configuration and start over again.
Go to [“Restoring the Default Configuration” on page 4-4.](#)
- How can I check the printer’s current status remotely?
Go to [“Checking the Current Status of the Printer” on page 4-4](#)

Basic Functioning



Note: For the most up-to-date PS121 installation details and troubleshooting guidance visit www.netgear.com.

If you have trouble setting up your PS121, check the tips below.

The mini print server has no power

- Make sure the power cord is connected to the mini print server.

- Make sure the power adapter is connected to a functioning power outlet. If it is in a power strip, make sure the power strip is turned on. If it is plugged directly into the wall, verify that it is not a switched outlet.
- Make sure you are using the correct NETGEAR power adapter supplied with your mini print server.

No lights are lit on the mini print server

It takes a few seconds for the status light to be lit. Wait a minute and check the status light on the mini print server.

Printing Errors

The printer is printing "garbage" characters

If the printer does not match the printer driver in the operating system, then run the Add Printer Wizard.

Windows error message appears when printing

Consult Windows help.

The print server is not found

Make sure you can access other places from your computer. If you cannot, then troubleshoot your computer or Internet connectivity.

If you are running a software firewall, disable it. This includes the Windows XP firewall — which may have been turned on during Windows upgrade or installation without you being aware of it.

Nothing is printing

- Try printing from another computer. If this is successful, then there is a problem with your computer configuration, not the print server. Consult the computer and operating system documentation.

- Turn off the print server, then turn it on. Test whether the print server works.
- If the printer does not match the printer driver in the operating system, then run the Add Printer Wizard. See [“Setting Up Each PC to Recognize the Print Server”](#) on page 5-1
- Disable the printer's bidirectional feature, if it is turned on.

I am using a DHCP server, and the Mini Print Server gets an IP Address conflict

If the mini print server is left on when the DHCP server is turned off, the mini print server will retain its IP Address without informing the DHCP server. Reset the mini print server so it will obtain a new IP Address. This problem also arises if you assigned a static IP Address within the range used by the DHCP server. If so, use another address NOT within the range used by the DHCP server.

Troubleshooting the TCP/IP Settings Using Ping

The Windows ping utility sends an echo request packet to the designated device. The device then responds with an echo reply. You can ping the mini print server from your computer to verify that the LAN path to your mini print server is set up correctly.

To ping the mini print server from a PC running Windows 95 or later:

1. From the Windows toolbar, click the Start button and select Run.
2. In the field provided, type Ping followed by the IP address of the mini print server, as in this example:

```
ping 192.168.0.1
```

3. Click OK.

You should see a message like this one:

```
Pinging <IP address> with 32 bytes of data
```

If the path is working, you see this message:

```
Reply from < IP address >: bytes=32 time=NN ms TTL=xxx
```

If the path is not working, you see this message:

```
Request timed out
```

If the path is not functioning correctly, you could have one of the following problems:

- Wrong physical connections
 - Make sure the Status LED is on.
- Wrong network configuration
 - Verify that the IP address for your mini print server and your workstation are correct and that the addresses are on the same subnet.

Restoring the Default Configuration

This section explains how to restore the factory default configuration settings to the PS121.

Use the Default Reset button on the rear panel of the mini print server. Use this method for cases when the administration password or IP address is not known. See [“Diagnostic/Reset Push Button” on page 2-6](#) for a description of this button.

Checking the Current Status of the Printer

You can check the current status of the printer remotely from the Web configuration screen. The following conditions are displayed.

- Current status — on-line, off-line, out of paper
- Print State — either Idle or Printing, depending on the state of the printer

You can click the Print Test Page button to print the print server status page. See [“Printer Port Screen” on page 4-6](#) for more information.

Appendix A

Technical Specifications

This appendix provides technical specifications for the NETGEAR PS121 Mini Print Server.

Standards Compatibility	IEEE 802.3u, 100BASE-TX, Fast Ethernet IEEE 802.3i 10BASE-T CSMA/CD NetBEUI, and TCP/IP protocols
Data Rate	10/100 Mbps differential Manchester encoded
Interface	10BASE-T/100BASE-TX network port (RJ-45) USB printer port
Power Specifications for the Power Adapter	Input voltage: 100 to 240 V AC, 50 to 60 Hz, according to the power adapter Localized plug: For North America, Japan, UK, Europe, and Australia Output voltage: 9 V DC at 500 mA
Power Specifications for the Print Server	Power consumption: 5 W maximum Input voltage: 9 V DC at 0.5 Amps, maximum
Width	1.3 in. (6.2 cm)
Height	0.8 in. (2.0 cm)
Depth	2.3 in. (6.0 cm)
Weight	0.4 lb. (0.1 kg)
Operating Temperature	0 to 40 C (32 to 104 F)
Operating Humidity	90% maximum relative humidity, noncondensing
Electromagnetic Emissions Compliance	CE mark, commercial FCC Part 15, Class A EN 55 022 (CISPR 22), Class A VCCI Class A ITE C-Tick N10947
Safety Agency Approvals, Power Adapter	CE mark, commercial UL listed (UL 1950) CSA certified (CSA 22.2 #950) TUV licensed (EN 60 950) T-Mark

Appendix B

Understanding IP Addresses

This appendix provides information about understanding IP addresses, which you must assign to the NETGEAR PS121 Print Server when operating in a TCP/IP environment.

IP Addresses and the Internet

Because TCP/IP networks are interconnected across the world, every machine on the Internet must have a unique address to make sure that transmitted data reaches the correct destination. Blocks of addresses are assigned to organizations by the Internet Assigned Numbers Authority (IANA). Individual users and small organizations may obtain their addresses either from the IANA or from an Internet service provider (ISP). You can contact IANA at www.iana.org.

The Internet Protocol (IP) uses a 32-bit address structure. The address is usually written in dot notation (also called dotted-decimal notation), in which each group of eight bits is written in decimal form, separated by decimal points.

For example, the following binary address:

```
11000011 00100010 00001100 00000111
```

is normally written as:

```
195.34.12.7
```

The latter version is easier to remember and easier to enter into your computer.

In addition, the 32 bits of the address are subdivided into two parts. The first part of the address identifies the network, and the second part identifies the host node or station on the network. The dividing point may vary depending on the address range and the application.

There are five standard classes of IP addresses. These address classes have different ways of determining the network and host sections of the address, allowing for different numbers of hosts on a network. Each address type begins with a unique bit pattern, which is used by the TCP/IP software to identify the address class. After the address class has been determined, the software can correctly identify the host section of the address. The follow figure shows the three main address classes, including network and host sections of the address for each address type.

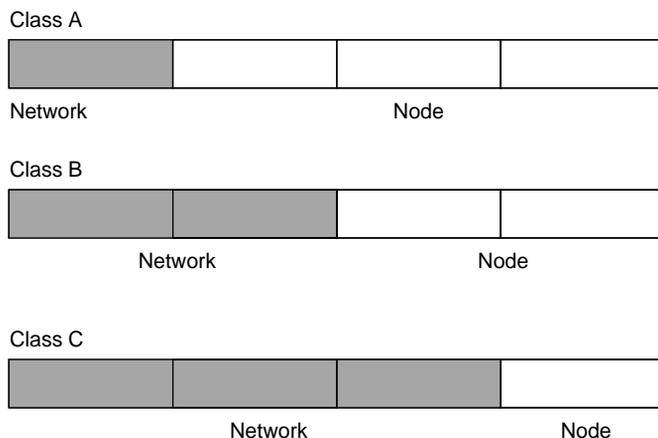


Figure 4-1: Three Main Address Classes

The five address classes are:

- **Class A**
Class A addresses can have up to 16,777,214 hosts on a single network. They use an eight-bit network number and a 24-bit node number. Class A addresses are in this range:
1.x.x.x to 126.x.x.x.
- **Class B**
Class B addresses can have up to 65,354 hosts on a network. A Class B address uses a 16-bit network number and a 16-bit node number. Class B addresses are in this range:
128.1.x.x to 191.254.x.x.
- **Class C**
Class C addresses can have 254 hosts on a network. Class C addresses use 24 bits for the network address and eight bits for the node. They are in this range:
192.0.1.x to 223.255.254.x.
- **Class D**
Class D addresses are used for multicasts (messages sent to many hosts). Class D addresses are in this range:
224.0.0.0 to 239.255.255.255.

- Class E
Class E addresses are for experimental use.

This addressing structure allows IP addresses to uniquely identify each physical network and each node on each physical network.

For each unique value of the network portion of the address, the base address of the range (host address of all zeros) is known as the network address and is not usually assigned to a host. Also, the top address of the range (host address of all ones) is not assigned, but is used as the broadcast address for simultaneously sending a packet to all hosts with the same network address.

Netmask

In each of the address classes previously described, the size of the two parts (network address and host address) is implied by the class. This partitioning scheme can also be expressed by a netmask associated with the IP address. A netmask is a 32-bit quantity that, when logically combined (using an AND operator) with an IP address, yields the network address. For instance, the netmasks for Class A, B, and C addresses are 255.0.0.0, 255.255.0.0, and 255.255.255.0, respectively.

For example, the address 192.168.170.237 is a Class C IP address whose network portion is the upper 24 bits. When combined (using an AND operator) with the Class C netmask, as shown here, only the network portion of the address remains:

```
11000000 10101000 10101010 11101101 (192.168.170.237)
```

combined with:

```
11111111 11111111 11111111 00000000 (255.255.255.0)
```

Equals:

```
11000000 10101000 10101010 00000000 (192.168.170.0)
```

As a shorter alternative to dotted-decimal notation, the netmask may also be expressed in terms of the number of ones from the left. This number is appended to the IP address, following a backward slash (/), as “/n.” In the example, the address could be written as 192.168.170.237/24, indicating that the netmask is 24 ones followed by 8 zeros.

Subnet Addressing

By looking at the addressing structures, you can see that even with a Class C address, there are a large number of hosts per network. Such a structure is an inefficient use of addresses if each end of a routed link requires a different network number. It is unlikely that the smaller office LANs would have that many devices. You can resolve this problem by using a technique known as subnet addressing.

Subnet addressing allows us to split one IP network address into smaller multiple physical networks known as subnetworks. Some of the node numbers are used as a subnet number instead. A Class B address gives us 16 bits of node numbers translating to 64,000 nodes. Most organizations do not use 64,000 nodes, so there are free bits that can be reassigned. Subnet addressing makes use of those bits that are free, as shown below.



Figure 4-2: Example of Subnetting a Class B Address

A Class B address can be effectively translated into multiple Class C addresses. For example, the IP address of 172.16.0.0 is assigned, but node addresses are limited to 255 maximum, allowing eight extra bits to use as a subnet address. The IP address of 172.16.97.235 would be interpreted as IP network address 172.16, subnet number 97, and node number 235. In addition to extending the number of addresses available, subnet addressing provides other benefits. Subnet addressing allows a network manager to construct an address scheme for the network by using different subnets for other geographical locations in the network or for other departments in the organization.

Although the preceding example uses the entire third octet for a subnet address, note that you are not restricted to octet boundaries in subnetting. To create more network numbers, you need only shift some bits from the host address to the network address. For instance, to partition a Class C network number (192.68.135.0) into two, you shift one bit from the host address to the network address. The new netmask (or subnet mask) is 255.255.255.128. The first subnet has network number 192.68.135.0 with hosts 192.68.135.1 to 129.68.135.126, and the second subnet has network number 192.68.135.128 with hosts 192.68.135.129 to 192.68.135.254.



Note: The number 192.68.135.127 is not assigned because it is the broadcast address of the first subnet. The number 192.68.135.128 is not assigned because it is the network address of the second subnet.

The following table lists the additional subnet mask bits in dotted-decimal notation. To use the table, write down the original class netmask and replace the 0 value octets with the dotted-decimal value of the additional subnet bits. For example, to partition your Class C network with subnet mask 255.255.255.0 into 16 subnets (4 bits), the new subnet mask becomes 255.255.255.240.

Table 4-1. Netmask Notation Translation Table for One Octet

Number of Bits	Dotted-Decimal Value
1	128
2	192
3	224
4	240
5	248
6	252
7	254
8	255

The following table displays several common netmask values in both the dotted-decimal and the masklength formats.

Table 4-2. Netmask Formats

Dotted-Decimal	Masklength
255.0.0.0	/8
255.255.0.0	/16
255.255.255.0	/24
255.255.255.128	/25
255.255.255.192	/26
255.255.255.224	/27
255.255.255.240	/28
255.255.255.248	/29

Table 4-2. Netmask Formats

255.255.255.252	/30
255.255.255.254	/31
255.255.255.255	/32

NETGEAR strongly recommends that you configure all hosts on a LAN segment to use the same netmask for the following reasons:

- So that hosts recognize local IP broadcast packets.
When a device broadcasts to its segment neighbors, it uses a destination address of the local network address with all ones for the host address. In order for this scheme to work, all devices on the segment must agree on which bits comprise the host address.
- So that a local router or bridge recognizes which addresses are local and which are remote.

Private IP Addresses

If your networks are isolated from the Internet (for example, only between your two branch offices), you can assign any IP addresses to the hosts without problems. However, the IANA has reserved the following three blocks of IP addresses specifically for private networks:

10.0.0.0 - 10.255.255.255
172.16.0.0 - 172.31.255.255
192.168.0.0 - 192.168.255.255

NETGEAR recommends that you choose your private network number from this range. NETGEAR products default to 192.168.0.xxx.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines explained here. For more information about address assignment, refer to RFC 1597, *Address Allocation for Private Internets*, and RFC 1466, *Guidelines for Management of IP Address Space*. The Internet Engineering Task Force (IETF) publishes RFCs on its Web site at www.ietf.org.

Address Resolution Protocol

An IP address alone cannot be used to deliver data from one device to another on a LAN. In order for data to be sent from one device on the LAN to another, you must convert the IP address of the destination device to its media access control (MAC) address. Each device on an Ethernet network has a unique Ethernet MAC address, which is a 48-bit number assigned to each device by the manufacturer. The technique that associates the IP address with a MAC address is known as address resolution, and IP uses the Address Resolution Protocol (ARP) to do this.

If a device needs to send data to another station on the network and it does not already have the destination MAC address recorded, ARP is used. An ARP request is broadcast onto the network, and all stations receive and read the request. The destination IP address is included as part of the message so that only the station with the correct IP address responds to the ARP request and all other nodes discard it.

The node with the right IP address responds with its own MAC address directly to the sender, providing the transmitting station with the destination MAC address needed for it to send the data. The IP address data and MAC address data for each node are held in an ARP table, so that the next time data needs to be sent, the address can be obtained from the address information in the table.

IP Configuration by DHCP

When an IP-based local area network is installed, each workstation must be configured with an IP address. If the workstations need to access the Internet, they should also be configured with a gateway address and one or more DNS server addresses. As an alternative to manual configuration, there is a method by which each device on the network can obtain this configuration information automatically. A device on the network may act as a Dynamic Host Configuration Protocol (DHCP) server. The DHCP server stores a list or pool of IP addresses, along with other information (such as gateway and DNS addresses) that it may assign to the other devices on the network. The most of NETGEAR routers have the capacity to act as a DHCP server.

List of Glossary Terms

Use the list below to find definitions for technical terms used in this manual.

10BASE-T

IEEE 802.3 specification for 10 Mbps Ethernet over Category 3, 4, or 5 twisted pair wiring.

100BASE-Tx

IEEE 802.3 specification for 100 Mbps Fast Ethernet over Category 5 twisted pair wiring.

1000BASE-T

IEEE 802.3 specification for 1000 Mbps Gigabit Ethernet over Category 5 twisted pair wiring.

802.1Q

IEEE specification for the operation of Virtual LAN (VLAN) Bridges that permit the definition, operation and administration of Virtual LAN topologies within a Bridged LAN infrastructure.

802.3

The IEEE standard defining the hardware layer and transport layer of (a variant of) Ethernet. The maximum segment length is 500m and the maximum total length is 2.5km. The maximum number of hosts is 1024. The maximum packet size is 1518 bytes.

802.3ab

Gigabit ethernet over Copper (also known as 1000BaseT) is an extension of the existing Fast Ethernet standard. It specifies Gigabit Ethernet operation over the Category 5e/6 cabling systems already installed, making it a highly cost effective solution.

802.3u

The IEEE committee working on standards for Fast Ethernet.

ADSL

Short for asymmetric digital subscriber line, a technology that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

DHCP

An Ethernet protocol specifying how a centralized DHCP server can assign network configuration information to multiple DHCP clients. The assigned information includes IP addresses, DNS addresses, and gateway (router) addresses.

DNS

Short for Domain Name System (or Service), an Internet service that translates domain names into IP addresses.

Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address. For example, the domain name `www.example.com` might translate to `198.105.232.4`. The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

Domain Name

A descriptive name for an address or group of addresses on the Internet. Domain names are of the form of a registered entity name plus one of a number of predefined top level suffixes such as `.com`, `.edu`, `.uk`, etc. For example, in the address `mail.NETGEAR.com`, `mail` is a server name and `NETGEAR.com` is the domain.

DSL

Short for digital subscriber line, but is commonly used in reference to the asymmetric version of this technology (ADSL) that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

Dynamic Host Configuration Protocol

DHCP. An Ethernet protocol specifying how a centralized DHCP server can assign network configuration information to multiple DHCP clients. The assigned information includes IP addresses, DNS addresses, and gateway (router) addresses.

Gateway

A local device, usually a router, that connects hosts on a local network to other networks.

IETF

Internet Engineering Task Force. Working groups of the IETF propose standard protocols and procedures for the Internet, which are published as RFCs (Request for Comment) at www.ietf.org.

An open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.

IP

Internet Protocol is the main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.

IP Address

A four-byte number uniquely defining each host on the Internet, usually written in dotted-decimal notation with periods separating the bytes (for example, 134.177.244.57).

Ranges of addresses are assigned by Internic, an organization formed for this purpose.

IPX

Short for Internetwork Packet Exchange, a networking protocol used by the Novell NetWare operating systems.

Like UDP/IP, IPX is a datagram protocol used for connectionless communications. Higher-level protocols, such as SPX and NCP, are used for additional error recovery services.

ISP

Internet service provider.

Internet Protocol

The main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.

LAN

A communications network serving users within a limited area, such as one floor of a building.

local area network

LAN. A communications network serving users within a limited area, such as one floor of a building.

A LAN typically connects multiple personal computers and shared network devices such as storage and printers. Although many technologies exist to implement a LAN, Ethernet is the most common for connecting personal computers.

MAC address

The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Usually written in the form 01:23:45:67:89:ab.

Mbps

Megabits per second.

NetBIOS

The Network Basic Input Output System is an application programming interface (API) for sharing services and information on local-area networks (LANs).

Provides for communication between stations of a network where each station is given a name. These names are alphanumeric names, up to 16 characters in length.

Network Address Translation

NAT. A technique by which several hosts share a single IP address for access to the Internet.

NIC

Network Interface Card. An adapter in a computer which provides connectivity to a network.

packet

A block of information sent over a network. A packet typically contains a source and destination network address, some protocol and length information, a block of data, and a checksum.

router

A device that forwards data between networks. An IP router forwards data based on IP source and destination addresses.

Routing Information Protocol

RIP. A protocol in which routers periodically exchange information with one another so that they can determine minimum distance paths between sources and destinations.

Subnet Mask

A mask used to determine what subnet an IP address belongs to. Subnetting enables a network administrator to further divide an IP address into two or more subnets.

TCP/IP

The main internetworking protocols used in the Internet. The Internet Protocol (IP) used in conjunction with the Transfer Control Protocol (TCP) form TCP/IP.

WAN

A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.

WEB Proxy Server

A Web proxy server is a specialized HTTP server that allows clients access to the Internet from behind a firewall.

The proxy server listens for requests from clients within the firewall and forwards these requests to remote Internet servers outside the firewall. The proxy server reads responses from the external servers and then sends them to internal client clients.

wide area network

WAN. A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.

Windows Internet Naming Service

WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses.

If a remote network contains a WINS server, your Windows PCs can gather information from that WINS server about its local hosts. This allows your PCs to browse that remote network using the Windows Network Neighborhood feature.

WINS

WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses.

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