

# NETWORK COMMUNICATIONS LINK 1100

**NCL1100**

## INSTALLATION AND OPERATION MANUAL

**WaveRider<sup>®</sup>**

WaveRider Communications Inc.

[www.waverider.com](http://www.waverider.com)

**NCL1100 INSTALLATION AND OPERATION MANUAL**

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**FEDERAL COMMUNICATIONS COMMISSION (USA)**

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

- This device may not cause harmful interference.
- This device must accept any interference even if it may cause undesired operation.
- The FCC ID of this device is LXX11.

**WARNING**

**You must install and use this device in strict accordance with the manufacturer's instructions, and use it only with the manufacturer's supplied antennae, cables, and other accessories.**

There is, however, no guarantee that interference from other radio communications will not occur in a particular commercial installation. In the event that these devices do cause harmful interference to an authorized radio service, the user operator must stop operating the devices until the harmful interference is eliminated.

WaveRider Communications is not responsible for any radio or television interference caused by improper use of this device, or by the substitution or attachment of connecting cables and equipment other than specified by WaveRider Communications. The correction of interference caused by such improper use is the sole responsibility of the user.

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**Table of Revisions**

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July 21, 1999	Preliminary user manual release

## 1 Introduction

This manual explains how to install an NCL1100 Network Communications Link system and operate it in an Ethernet or Token Ring environment, either under IEEE 802.3 or Ethernet II specifications. Ethernet II is not supported at this time for the Token Ring to Ethernet bridge, only Token Ring to IEEE 802.2/802.3 is supported. WaveRider Communications can only provide support for hardware and software that are sold with the NCL1100. WaveRider Communications does not provide support for any third-party equipment.

If you purchased an outdoor antenna kit, use its manual for detailed instructions about how to install a directional antenna.

### 1-1 Parts List

The parts included in the NCL1100 package are:

- one bridge
- one power cord
- this manual

If any parts are missing, please contact your vendor.

### 1-2 About the NCL1100 Network Communications Link

The NCL1100 Network Communications Link is a platform upon which a LAN transmission system is built. Its basic capabilities include MAC-layer address filtering for traffic management and security. In addition to this, it can use RF techniques to transmit to another site. The NCL1100 configuration you purchased includes the spread-spectrum interface for transmission at speeds up to 11 million bits per second (11 Mb/s).

The system consists of an indoor unit that functions as a MAC layer bridge. It contains the cards needed to interface to the LAN and to provide RF communications to the other site. The system utilizes an outdoor antenna, lightning protector, and connecting cable.

The NCL1100 is a MAC layer, self-learning bridge that supports all Ethernet 802.2/802.3 and Ethernet II Protocols, and Token Ring (Token Ring use has restraints that you must follow). These protocols include:

- Novell IPX, SPX
- Decnet
- LAT
- TN3270
- TCP/IP
- UDP/IP
- SNMP
- XNS/MS
- Appletalk
- ISO
- Banyan Vines

The NCL1100 unit determines its environment at power-up, and builds its own address tables based on the observed activity on the LAN segment to which it is attached. The system is designed this way to minimize the required set-up and user administration.

## 2 Installation

Although the NCL1100 Network Communications Link is as user-friendly as possible, keep in mind the design considerations. The NCL1100 is a complete point-to-point microwave system that uses spread-spectrum techniques. Take the same precautions as you do when you install any microwave system.

A minimum separation distance of 31.75 cm ( 12.5 inches ) is necessary to satisfy MPE ( Maximum Permissible Exposure ) requirements. This distance is measured from the front-center of the antenna to the closest point of non-service personnel access. It is recommended that the antenna be installed in a location of restricted access.

### 2-1 Preparation

Evaluate the path length and characteristics. Unless the path fits the default characteristics, have a qualified engineer perform path calculations. The default characteristics include using 50 feet (16.7 m) of coaxial cable between the antenna and the indoor system. The maximum distance between the antennae is 5 miles (8 km). You can make trade-offs with these factors, such as extending the cable length by having a higher-gain antenna or having a path shorter than 5 miles (8 km). As distance increases, you must maintain proper obstacle clearance.

Ensure that the line-of-sight exists; refer to Figure 1. You have a clear line-of-sight when you can clearly see the remote site, as well as the required Fresnel zone clearance, when you stand on the first site and look towards the second site. As well, ensure that there are no large reflective surfaces on the path, such as large buildings with metallic glass surfaces or crowded parking lots. Avoid installation on tall downtown buildings where higher-powered systems are installed, because of potential interference.

### 2-2 NCL1100 Installation

You must install the indoor unit in a temperature-controlled environment, and provide a 110/230 VAC outlet. The unit draws less than 5 amps. The indoor unit is stand-alone and can sit on a shelf or desk, or you can mount it on the wall with the optional wall-mount brackets. Do not power up the units until they are connected to the LAN and RF interfaces at both sites; refer to Figure 2. This is necessary to ensure that the start-up diagnostic tests pass, and proper terminations prevent the equipment from damage. As well as the 110/230 VAC, 50/60 Hz connection and a coaxial cable from the antenna, make a third connection to the indoor unit from the LAN itself. This connection is available in three types on the back of the unit: 10BASE-T, AUI, and BNC.

## **WARNING!**

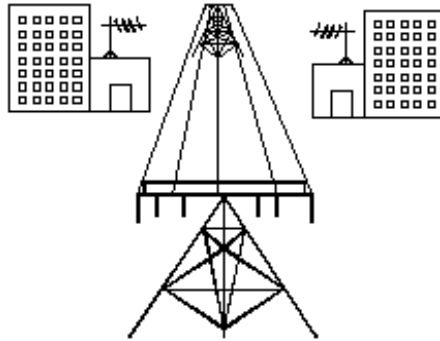
**You may cause permanent damage to the unit if any NCL1100 RF port is not terminated correctly and you power up the unit.**

Connect the indoor unit to a 110/230 VAC, 50/60 Hz power outlet.

Figure 1: Potential Obstacles to Line-of-Sight



A. Building blocking line-of-sight

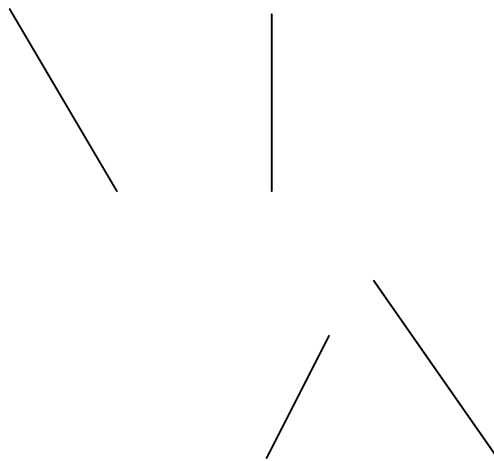


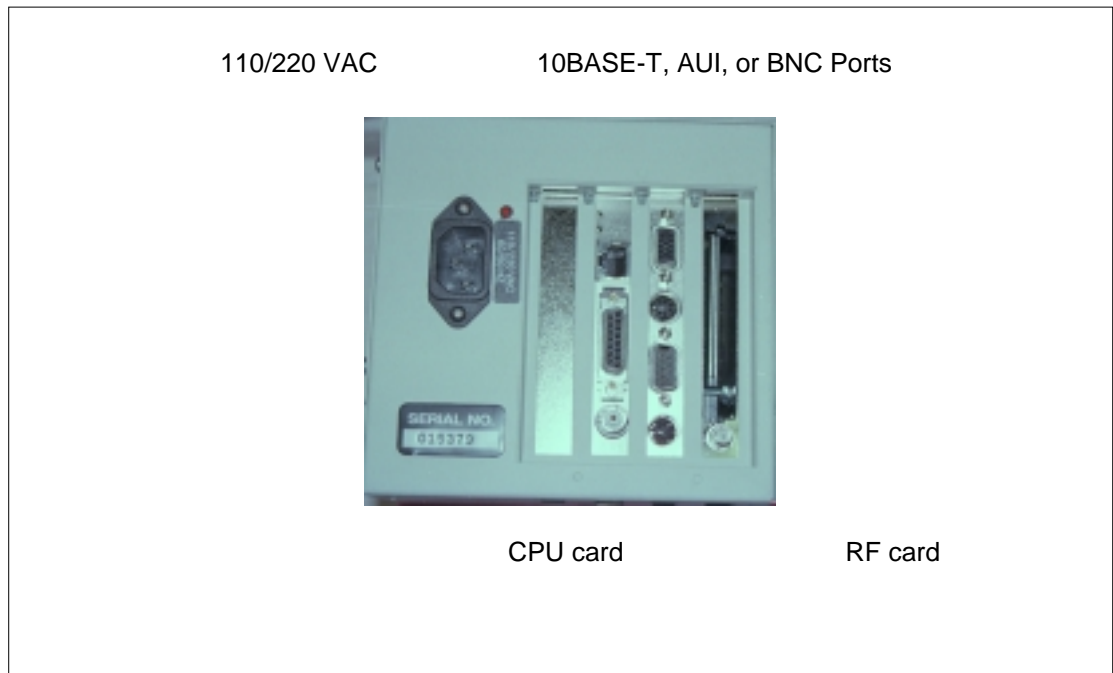
B. Power line blocking line-of-sight



C. Trees blocking line-of-sight

Figure 2: Back Panel, Indoor Unit





## 2-3 LAN Connection

The port for the network interface card includes three interfaces: an AUI connector, a 10BASE-T connector, and a BNC or 10BASE-2 connector. You can only use one port at a time and this is determined automatically during the boot or start-up process; therefore, you must connect the LAN before you power up the bridge.

Do not power up the NCL1100 system until you make all the connections. If you power it up before you make the connections, you may need to power it down, then up again after you make the connections.

Once you make the proper connections, the system immediately begins building address tables of nodes located on the local and remote LANs. It uses these tables to filter packets not destined for the remote LAN, thereby maximizing throughput capability.

**NOTE:** If you move a node from one side of the NCL1100 connection to the other, you can power both systems off, then on, so that they can re-establish the table necessary for the new node location. Alternatively, press the **b** key on the keyboard at each unit, while the NCL1100 system is running, to re-establish the table necessary for the new node location.

## 2-4 Normal Operating Messages

During normal operation, the NCL1100 system displays these messages:

- Testing RF Interface Card...
- Testing LAN interface Card...
- Cards Initialized...

## 2-5 Error Messages

When there are problems, the system displays these error messages:

- Unable to open file The InterBuilding Link.CFG  
Cause: The configuration file for IBL.EXE was not present in the current directory when you started the NCL1100, or the file does not exist.  
Cure: Type `dir` and the file name at the `C>` prompt to ensure that the IBL.EXE and Link.CFG files are present. If the files are not present, use the WaveRider Communications website at [www.waverider.com](http://www.waverider.com) for technical support.
- Network Card Error : Loopback test failed  
Cause: The NCL1100 could not perform a successful loopback test on the network card. The failure may be due to an incorrect cable connection, incorrect cable termination, or a severe network load during the loopback test.  
Cure: Ensure that the LAN cable is connected and terminated properly, then try again. If the problem persists, disconnect the network card and terminate it, then try again. If this fails, replace the card.

## 3 Diagnostics

The NCL1100 has a VGA-compatible output connector on the back of the unit. If you experience problems with the system, plug a standard VGA-compatible monitor into this connector to display the diagnostic screens. Once you connect a VGA-compatible monitor to the unit, you can monitor several things while the link is operating, without affecting the link. Also, you can add a standard PC keyboard to execute other diagnostic commands.

As the NCL1100 loads, the initial test routines display messages. A failed test points to the possible problem, such as a poor LAN or RF connection on the back of the unit.

After the Network Communications Link is loaded, it displays an inactive status screen. To activate the status screen, press the `R` key once. The system begins to display activity in real time, and updates the display screen approximately once every second. The information includes the bar graphs illustrated in Figure 5, Figure 6, and Figure 7.

RF Outgoing, Incoming:

The graph on the right-hand side of the screen shows the transmitting and receiving utilization per second of the RF section of the system.

LAN Outgoing, Incoming:

The graph on the left-hand side of the screen shows the transmitting and receiving utilization per second of the LAN section of the system.

Filtered:

The graph on the left-hand side of the screen shows the percentage of incoming LAN packets that were filtered.

Overload:

This is the percentage of incoming LAN packets that are discarded due to full internal buffers. The packets are discarded by the FIFO method, i.e., the oldest packet is discarded first.

All throughput displays are a percent of utilization, that is, the graph is from zero to one hundred percent, which is the percentage of total throughput available. On an 11 Mb/s link, one hundred percent throughput equals 11 Mb/s.

Figure 3 is the display screen in the normal mode, with no packet activity to generate bar graphs on the screen.



Figure 4 is a diagnostic screen that shows RF packets outgoing. Note that since only one bridge is transmitting, the outgoing utilization is 100%. On the 11 Mb/s, however, the maximum utilization is 84%, with the packet size set at 1514 (T 1514 then <Enter>).

Figure 3: Screen, Normal Mode



Figure 4: Screen, RF Packets Outgoing



As well as the normal display screen, the NCL1100 has a diagnostic utility included. This utility diagnoses the RF link; use it only if the NCL1100 display shows that the RF link failed (no incoming and/or outgoing packets).

After you run the `tt` and `yy` RF tests, connect the LAN and attempt communication across the link. By leaving the LAN disconnected until you run all RF tests, you can determine which side of the link has the problem, LAN or RF.

*Press these keys:*                      *to have this happen:*

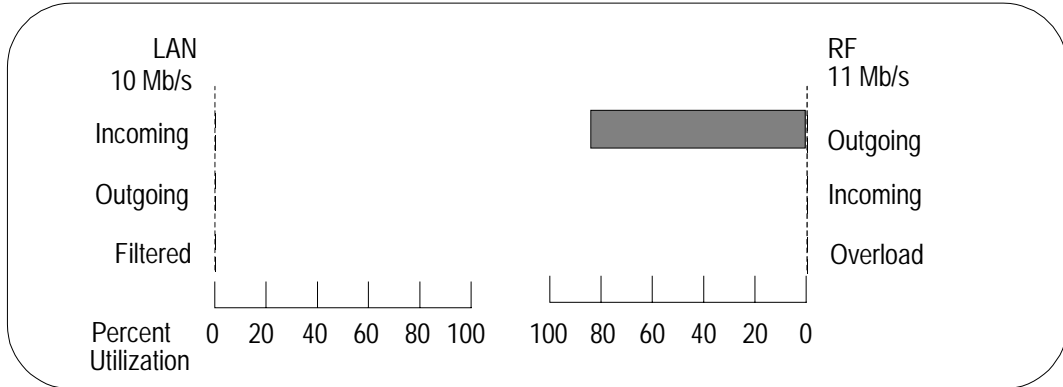
T T <Enter>                              1496-byte packets are sent in one direction

Y Y <Enter>                              1496 byte packets go in both directions and activate the remote unit

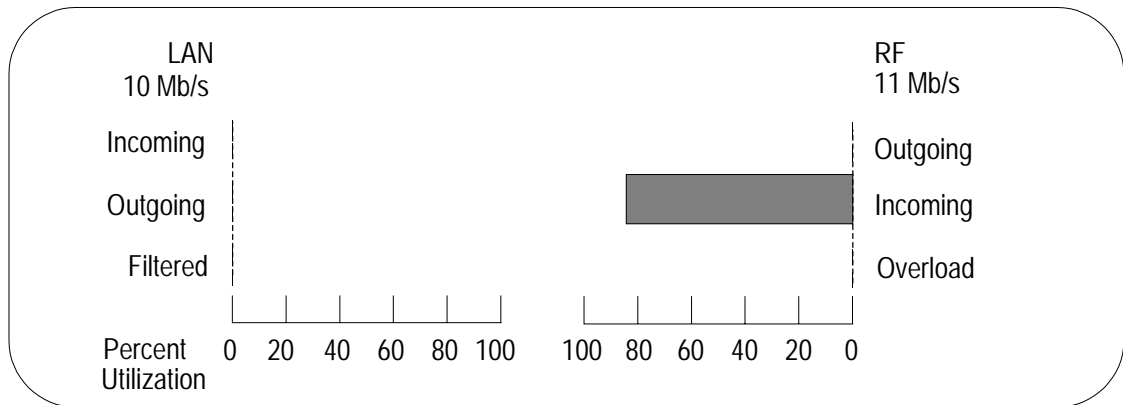
The screen displays the packets sent and received by the system. These packets are test packets of approximately 1496 bytes in length. The bar graphs on the lower half of the screen

show the packets received and sent since the last screen update. The system updates the screen approximately once/second. Outgoing packets are shown even if the RF link, between the local and remote RF sites, is not working. If the RF link is not working, however, no incoming RF packets are shown at the remote RF site even if the local RF site is placed in a test mode so that the local site generates outgoing RF packets. If only one end is transmitting and the other end is receiving, then the RF utilization shows 84% incoming at the remote site and 84% outgoing at the local site, unless interference or another system decreases performance. Refer to Figure 5 and Figure 6. To terminate this test, power off and then on both indoor units, or press T or Y once.

**Figure 5: Display for Local RF Site during Testing**



**Figure 6: Display for Remote RF Site during Testing**

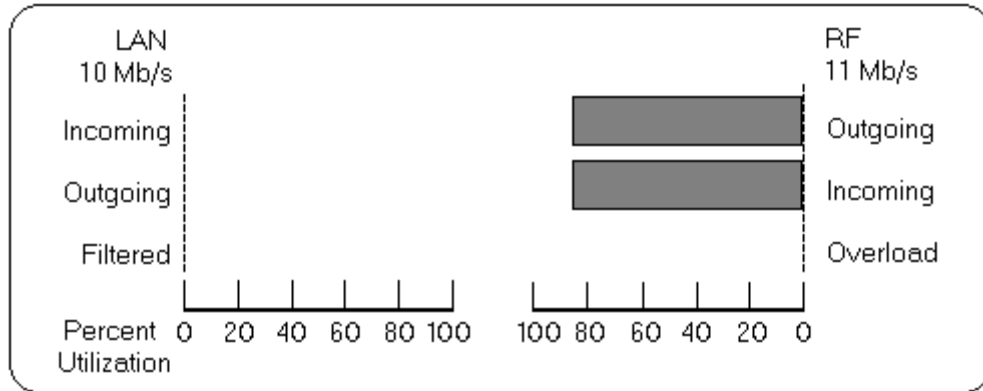


You can use a second diagnostic method to test the RF link, but it does not test the hardware. To perform this test, follow these instructions:

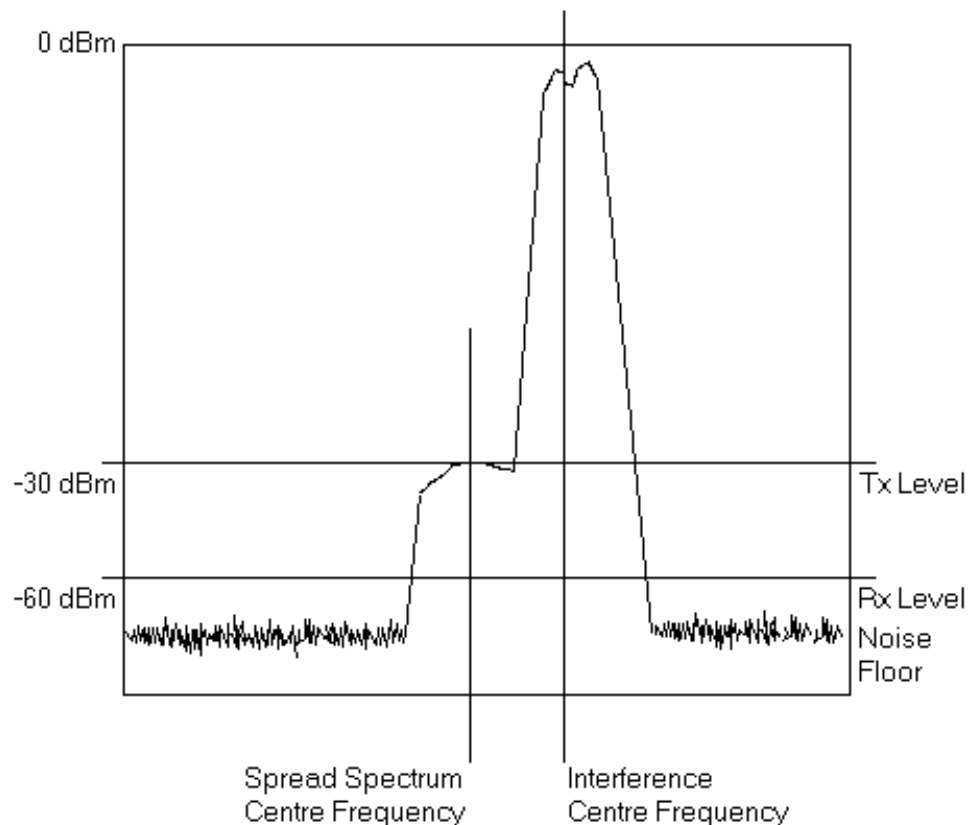
1. Power both indoor units off, then on, to ensure that you use the proper command line during the test procedure.
2. After the NCL1100 system is running and the display screen appears at both sites, at the local site press the R key to activate the display, then press YY. This action places both RF sites in the test mode, sending and receiving the opposite site's packets.
3. When both sites are transmitting and receiving test packets, check that the RF utilization shows approximately 44% incoming and outgoing at both the local and remote sites. Figure 7 illustrates the monitors for both the remote and local RF sites, when both sites are transmitting and receiving. This is the YY test.

4. If the incoming RF utilization is less than 44%, then the RF link portion of the system is suspect. Focus your trouble-shooting on the coaxial cable, antenna, or interference.
5. If the RF link is not working, the coaxial cable is connected properly, and the antennae are in unobstructed alignment with each other, then you may need a spectrum analyzer (refer to Figure 8) to pinpoint interfering frequencies and take corrective action. You can, however, move the antenna slightly in an alignment-type pattern, while it is on its mast, to correct the problem; or use nearby objects to shield the antenna from the offending frequency.

**Figure 7: Display for Local and Remote Sites During Testing**



**Figure 8: Spectrum Analyzer Display of Interference**



## 4 SNMP Installation

This section describes how to configure and use SNMP (simple network management protocol) on the wireless link. The wireless bridge includes an SNMP agent that collects valuable statistical and configuration information about the network interface card inside your wireless link. Network administrators analyze this information to keep their networks operating at peak efficiency.

The SNMP agent maintains a database of statistical and configuration information in RAM. It obtains this information directly from the wireless bridge during operation. With this true SNMP agent, any SNMP manager (e.g., Hewlett Packard's Openview, Sun Microsystems's SunNet Manager) can directly monitor the LAN side of the wireless bridge.

If you purchased the SNMP upgrade package, you can use the SNMP agent with IPX and TCP/IP networks. Although the SNMP agent does not require you to load a particular operating system or protocol stack, an IP address must be available if it is to communicate with SNMP stations using TCP/IP protocol. You can configure the SNMP at any time.

You need a monitor and keyboard to configure the SNMP agent in the wireless bridge. An editor is included with the bridge to allow you to edit a file called *pcagent.cfg*. The agent is configured when you use the editor to edit this file. The procedure for using this editor is:

1. From the main service monitoring screen that shows the bar graphs, press the `x` key. The system exits the bridge's normal operating mode and displays a DOS-like prompt.
2. At this prompt, type `CLS` and then press `<Enter>` to clear the screen.
3. Type `E pcagent.cfg` and press `<Enter>`.
4. Edit the displayed fields or accept the defaults. Refer to Table 1 for the fields and their default values.
5. Hold down the `<ALT>` key and press the `x` key to exit and save the file.
6. Hold down the `<CTRL>` and `<ALT>` keys, and press the `<DELETE>` key to reboot the system and return it to the normal operating mode, or power off and on the system again.

**Table 1: pcagent.cfg Fields and Default Values**

Field	Default Value
ComStr	TTI
sysContact	TTI
sysName	TTI
sysLocation	TTI
smcDosWslpAdr *	123.123.001.001
smcDosWsTrapDstAdr.1 †	123.123.002.002
smcDosWsTrapDstPro.1 ‡	2
smcDosWsTrapDstAdr.2 †	123.123.003.003
smcDosWsTrapDstPro.2 ‡	2
smcDosWsTrapDstAdr.3 †	123.123.004.004
smcDosWsTrapDstPro.3 ‡	2

- \* *smcDosWslpAdr* is the IP address string in the configuration file. It is assigned a value in the form X.X.X.X, where each X is a value from 0 to 255. The alphabetic object name is upper- and lower-case sensitive. You need an IP address if agent/SNMP communicates with SNMP management stations using the TCP/IP protocol.

- † In a TCP/IP network, these are IP addresses of network management stations to which to send traps (alerts) if an alarm occurs.  
In an IPX network, these are IPX network addresses (e.g., *smcDosWsTrapDstAdr.1*) of the network management stations where traps are sent. Traps can be sent to a maximum of three management stations (Adr.1, Adr.2, and Adr.3).
- ‡ In an IPX network, if the network management station is on another network, the protocol specified here must be acceptable to the router on the local network.  
An example is *smcDosWsTrapDstPro.1 = 2*. The protocols include:
  - 1 = not used
  - 2 = TCP/IP (Ethernet and Token Ring)
  - 3 = IPX with Ethernet II frame type (Ethernet only)
  - 4 = IPX with 802.2 (LLC) frame type (Ethernet and Token Ring)
  - 5 = IPX with SNAP frame type (Ethernet and Token Ring)
  - 6 = IPX with 802.3 frame type (Ethernet only)