Compliance Statement Insert

Device Name: Wireless LAN Access Point **Model Number: 6710**

The responsible party for the compliance of this device is:

Intermec Technologies Corporation
550 Second Street SE
Cedar Rapids, Iowa 52401 USA
(319) 369-3100

CAUTION: See users guide instructions for handling, charging, and replacing batteries. Failure to follow those instructions can result in personal injury, fire, or battery explosion.

This product conforms to the following approvals. The user(s) of this product are cautioned to use accessories and peripherals approved by Norand Corporation. The use of accessories other than those recommended or changes to this product that are not approved by Norand Corporation may void the compliance of this product and may result in the loss of the users authority to operate the equipment.

FCC Digital Emissions Compliance

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 radio of television receiving antenna.**
- **Increase the separation between the computer equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the radio or television receiver is connected.**
- **Consult the dealer or an experienced radio television technician for help.**

Canadian Digital Apparatus Compliance

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

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC Spread Spectrum Transmitter Compliance

This device is also certified to operate under Part 15, Subpart C, Section 15.247 of the FCC rules for Intentional Radiation Products. This certification includes Docket 87-389 covering rules effective June 1994. It may not cause interference to authorized radio communication devices, and must accept any interference caused by those devices.

Canadian RSS-210 Spread Spectrum Transmitter Compliance

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Canadian 2.4 GHz Spread Spectrum Radio Certification

This device requires a radio license, unless it is installed totally inside a building. (User's must obtain this license.)

Une license radio est requise oour ces dispositifs, sauf ouor ceux installés tout á fait á l'intérieur d'un bâtiment. (Il faut que l'utilisateur obtienne cette license.)

Antenna Requirements

FCC rules section 15.203 and Canada RSS-210 require that this device be operated using an antenna furnished by Norand Corporation. The antenna coupling on this product has been designed to accept only antennas manufactured Norand. Use of an antenna other than that furnished with the equipment is prohibited by FCC and Industry Canada rules.

European Notice

The 902-928 MHz Spread Spectrum Transmission (SST) radio referred to within the manual is not available for sale in Europe (including, but not limited to, Great Britain, Italy, Germany, France, Spain, Norway, Denmark, Sweden, Finland, Portugal, and the Benelux countries). Any references in the manual to 902-928 MHz SST, or modules containing 902-928 MHz SST radios, should be disregarded by the users of this product in Europe.

DECLARATION OF CONFORMITY

(According to ISO/IEC Guide 22 and EN 45014)
PAGE ONE OF TWO

THE PRODUCT HEREWITH COMPLIES WITH THE REQUIREMENTS OF :

THE LOW-VOLTAGE DIRECTIVE 72/32/EEC.
THE EMC DIRECTIVE 89/336/EEC.

Manufacturer's Name:
Intermec Technologies Corporation
550 2nd Street SE
Cedar Rapids, Iowa 52401

European Representative:
Intermec International Incorporated
Sovereign House, Vastern Road
Reading, Berkshire
RG1 8BT England

Declares that the product listed below:

Product Type: ITE/Residential, Commercial, and Light Industrial
Product Name: Wireless LAN Access Point
Model Number: 6710
Product Options: All
Beginning Serial Number: All
Date Issued: May 30, 1996

Conforms to the following product specifications:

Safety: IEC 950 / EN 60950

EMC: EN 55022 : 1995 / CISPR Publications 22 : 1993, Class B Limits and Methods

EN 50082-1 : 1992 Generic Immunity Standard
ETS 300 339 : Jun. 1993 Draft RES Generic EMC for radio equipments
IEC 801-2 per Draft prETS 300 339, Clause 9.2
± 8 kV Air / ± 4 kV Contact
IEC 801-3 per Draft prETS 300 339, Clause 9.1
3 V/M, 80-1000 MHz, 80% @ 400 Hz
IEC 801-4 per Draft prETS 300 339, Clause 9.3
AC Power Leads ± 2 kV; Signal and Control Leads ± 1.0 kV
IEC 801-5 (Draft) Tested per Draft prETS 300 339, Clause 9.8
IEC 801-6 Tested per Draft prETS 300-339, Clause 9.4 AC Power Leads and Signal and Control Leads 3 Vrms, 150 kHz - 80 MHz, 80% @ 400 Hz
Draft prETS 300 339, Clause 9.6, Tested per IEC 1000-4-11 30% (10 ms), 60% (100 ms), and 95% (5000ms) of 220 VAC nominal.
prETS 300 683 : EMC Standard for short range devices
IEC1000-4-2 Tested per Draft prETS 300 683, Clause 9.3
± 8 KV Air / ± 4 KV Contact
ENV 50140 Tested per Draft prETS 300 683, Clause 9.2
3 V/M, 80-1000 MHz, 80% @ 400 Hz
IEC1000-4-4 Tested per Draft prETS 300 683, Clause 9.4
AC Power Leads ± 2 kV; Signal And Control Leads ± 1.0 kV
ENV 50142 Tested per Draft prETS 300 683, Clause 9.8
ENV 50141 Tested per Draft prETS 300 683, Clause 9.5
AC Power Leads and Signal and Control Leads 3 Vrms, 150 kHz - 80 MHz, 80% @400 Hz
IEC 1000-4-11 Tested per Draft prETS 300 683, Clause 9.7
30% (10ms), 60% (100ms), and 95% (5000ms) of 230 VAC nominal.

Type Approval Certification(s): see second page of Declaration of Conformity

DECLARATION OF CONFORMITY

PAGE TWO OF TWO

I, the undersigned, hereby declare that the equipment specified above conforms the above Directive(s) and Standard(s).

Company Official: Arvin Danielson **Position: Vice President**

Signature: Signed Copy on File **Date: June 3, 1998**

European Contact: Scott Mercer, Intermec International Incorporated, Sovereign House, Vasern Road, Reading, Berkshire, RG1 8BT England; Phone INT+44 118 987 9400; Fax INT+44 118 987 9401

Product Type: ITE/Residential, Commercial, and Light Industrial
Product Name: Wireless LAN Access Point **Model Number: 6710**

Product Option: RM111
Type Approval Certifications:

BRAZIL:	FCC ID: EHARM450P	CANADA:	1008 195 234A
CHILE:	FCC ID: EHARM450P	COLOMBIA:	FCC ID: EHARM450P
COSTA RICA:	FCC ID: EHARM450P	DENMARK:	97001D Telestyrelsen
FINLAND:	Label added in Finland	GERMANY:	A129416H RM11 A132600J QE
HONG KONG:	FCC ID: EHARM450P	ICELAND:	Samþykkisnúmer IS-2454-00
ITALY:	DGPGF/SEGR/2/144/03/336451/AP/0000778	NORWAY:	Typegodkjenningsnummer NO97000460-R
PERU:	FCC ID: EHARM450P	SPAIN:	E D.G.Tel 07 97 0100
SWEDEN:	Godkand av Post&Telestyrelsen Ue970071	UNITED ARAB EMIRATES:	No special markings
UNITED KINGDOM:	W.T. License Exempt ID: 11918 I-ETS 300 220	URUGUAY:	FCC ID: EHARM450P
VENEZUELA:	FCC ID: EHARM450P		

Product Option: RM160
Type Approval Certifications:

ARGENTINA:	FCC ID: EHARM915P	AUSTRALIA:	FCC ID: EHARM915P
BRAZIL:	FCC ID: EHARM915P	CANADA:	1008 102 269
CHILE:	FCC ID: EHARM915P	COLOMBIA:	FCC ID: EHARM915P
COSTA RICA:	FCC ID: EHARM915P	MEXICO:	SCýT: RCPNORM97-319
PERU:	FCC ID: EHARM915P	PHILIPPINES:	FCC ID: EHARM915P
UNITED STATES:	FCC ID: EHARM915P	VENEZUELA:	FCC ID: EHARM915P

Product Option: RM180
Type Approval Certifications:

ARGENTINA:	FCC ID: EHARM24002PC	AUSTRALIA:	FCC ID: EHARM24002PC
AUSTRIA:	CEPT-RLAN A	BRAZIL:	FCC ID: EHARM24002PC
CANADA:	1008 101 760A	CHILE:	FCC ID: EHARM24002PC
COLOMBIA:	FCC ID: EHARM24002PC	COSTA RICA:	FCC ID: EHARM24002PC
DENMARK:	CEPT/RLAN/DK/9514 Telestyrelsen	FINLAND:	Label added in Finland
FRANCE:	96 0145 PP 0	GERMANY:	G128682H

GREECE:	ÁÑ×ÉÊÁ ÅËÅÃ×ÏÌÅÍÇ ÓÕÓÊÅÕÇ ×ÑÇÓÇ:ÌÅÔÁÓÏÑÁÓ ÁÅÁÏÌÁÍÙÍ 'Åãêñéóç Êõêëïöñéáò ÕÐÌÅ/ÄÔÅÅ/ÅÊ537
ICELAND;	CEPT RLAN IS-2433-01
ITALY:	CEPT-RLAN I DCSR/2/4/144-03/335321/AT/0000158
MEXICO:	SCýT: RCPNORM97-308
NORWAY:	CEPT-RLAN N
POLAND:	M£ Œ.H. № 042/98
SPAIN:	CEPT RLAN E 00 96 0431
TAIWAN:	85G0069
UNITED KINGDOM:	CEPT-RLAN GB
VENEZUELA:	FCC ID: EHARM24002PC

HONG KONG:	FCC ID: EHARM24002PC
INDIA:	FCC ID: EHARM24002PC
KOREA:	Radio Type Registration
NETHERLANDS:	ministrie van verkeer en waterstaat NL96030574 CEPT-RLAN NL
PERU:	FCC ID: EHARM24002PC
SINGAPORE:	TAC No: PMREQ-WLAN-B-1028-96
SWEDEN:	Godkaend av Post- och Telestyrelsen Ue 960004 CEPT-RLAN S Norand Corporation RM180
TURKEY:	FCC ID: EHARM24002PC
UNITED STATES:	FCC ID: EHARM24002PC

Product Option: RM188
Type Approval Certifications:

JAPAN:	MKK Approved

Intermec
Technologies Corporation

6710 Access Point

USER'S GUIDE

P/N 961-047-081
Revision C
July 1998

" NOTICE

We welcome your comments concerning this publication. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the book title and part number, as well as the paragraph or figure number and the page number.

Send your comments to:
Intermec Technologies Corporation
Publications Department
550 Second Street SE
Cedar Rapids, IA 52401

This publication printed on recycled paper.

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FCC Computer Compliance

" NOTICE

This equipment meets Class B digital device limits per Part 15 of FCC Rules. These limits protect against interference in a residential area. It emits, uses, and can radiate radio frequency energy. If you do not install and use the equipment according to its instructions, it may interfere with radio signals. 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 our 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 radio or television receiving antenna.
- Increase the separation between the computer equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the radio or television receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

FCC Spread Spectrum Radio Certification

" NOTICE

This device is certified to operate under Part 15, Subpart C, Section 15.247 of the FCC rules for Intentional Radiation Products. This certification includes Docket 87-389 covering rules effective June 1994. It may not cause interference to authorized radio communication devices, and must accept any interference caused by those devices.

Antenna Requirements

" NOTICE

FCC rules section 15.203 and Canada's RSS-210 require that this device be operated using an antenna furnished by Intermec Technologies Corporation. The antenna coupling on this product has been designed to accept only antennas manufactured by us. Use of an antenna other than that furnished with the equipment is prohibited by FCC and Industry Canada rules.

Canadian Computer Compliance

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

Cet appareil numerique de la classe B respecte toutes les exigences du Reglement sur le material boilleur du Canada.

Canadian Spread Spectrum Radio Certification

" NOTICE

This device complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Canadian 2.4 GHz Radio License

" NOTICE

This device requires a radio license, unless it is installed totally inside a building. (Users must obtain this license)

Une licence radio est requise pour ces dispositifs, sauf pour ceux installés tout à fait à l'intérieur d'un bâtiment. (Il faut que l'utilisateur obtienne cette licence.)

Telephone Installation Warning Notices

The following notices apply to equipment that may be connected to telephone lines or systems. For your personal safety, and to protect this equipment from potential electrical or physical damage, do NOT connect equipment to telephone lines or data communication equipment unless the following warnings have been read, understood, and complied with.

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using telephone (other than cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

Installation du téléphone : avertissements

Les avertissements qui suivent s'appliquent à tout équipement qui peut être branché aux lignes ou systèmes téléphoniques. Pour votre sécurité personnelle et pour protéger l'équipement de tout dommage électrique ou physique potentiel, NE PAS brancher un ordinateur tablette électronique ou ses périphériques aux lignes téléphoniques ou équipements avant que les avertissements suivants aient été lus, compris et observés :

- Ne jamais installer de câblage téléphonique pendant un orage électrique.
- Ne jamais installer de prise téléphonique dans un endroit humide à moins que la prise ait été spécifiquement conçue pour être utilisée dans les endroits humides.
- Ne jamais toucher les fils de téléphone ou de l'équipement terminal non isolés à moins que la ligne téléphonique n'ait été débranchée de l'interface réseau.
- User de prudence lors de l'installation ou de la modification de lignes téléphoniques.
- Éviter d'utiliser un téléphone (autre qu'un appareil téléphonique sans fil) pendant un orage électrique. Il pourrait y avoir un faible risque d'électrocution par la foudre.
- Ne pas utiliser le téléphone afin de signaler une fuite de gaz à proximité de la fuite.

B CAUTION: **Intermec Technologies Corporation suggests you buy cables from us to connect with other devices. Our cables are safe, meet FCC rules, and suit our products. Other cables may not be tested. They may cause problems from electrostatic discharge or induced energy. Our warranties do not cover loss, injury, or damage from other cables.**

CONTENTS

FIGURES

TABLES

Section 1
Preface

Purpose of This Guide

This user's guide describes the installation, setup, and maintenance of the 6710 Access Point. This guide covers access point FLASH version 1.27 or greater and ROM version 1.12 or greater.

Norand Corporation is now part of Intermec Technologies Corporation. As part of our continuing efforts to offer the broadest range of system solutions in the industry, the 6710 Access Point and other open wireless local area network (LAN) components have been merged into the INTERMEC® Integrated Network Communications Architecture (INCA). Where appropriate, we have continued to use the Norand name in references to the open wireless LAN to maintain continuity with existing product in the field.

Organization

This Preface describes the intended audience for this guide, lists related publications, and tells how to contact the Customer Response Center. Other sections do the following:

Section 2, "Features and Functional Overview"	Describes the access point and how it operates on the open wireless LAN. It also describes access point components.

Section 3, "Installation"	Helps you prepare your site before you install the access point, and shows how to connect the access point to 10BASE-T, 10BASE2, and 10BASE5 Ethernet.
Section 4, "Configuration"	Describes how to create a communications session with the access point, access FLASH and ROM, and set up the access point through its configuration menus.
Section 5, "Software Download"	Describes file system methodology and the functional characteristics of the software download process.
Section 6, "Indicator Lights"	Describes the access point's indicator lights and contains troubleshooting tips.

Appendixes contain supplemental information:

Appendix A	Lists mechanical, electrical, and environmental specifications for the access point.
Appendix B	Lists specifications and antennas for the WLIF radio.
Appendix C	Lists specifications and antennas for the 900 MHz radio.
Appendix D	Lists specifications and antennas for the synthesized UHF radio. It also discusses UHF technology.
Appendix E	Describes OWL/IP (IP tunneling).
Appendix F	Shows port and cable pin-outs.
Appendix G	Describes the 6710 Management Information Base (MIB).

The glossary at the end of this manual lists network terms.

Intended Audience

This user's guide is intended for these audiences:

- Network administrator who is familiar with various types and configurations of computer networks, how they work, and the terminology used when discussing them.
- Hardware installer who is responsible for performing the physical installation of the access point and any related hardware that might be required.

Related Publications

The following publications are available. They include information about hardware and software products related to or used with the access point and the network on which it operates.

Numbers in parentheses after the title indicate the publication's part number. Contact your Sales Representative for ordering information.

Wireless Station User's Guides

Wireless station user's guides describe how to set up, operate, and maintain radio terminals in each series of terminal. Specific manuals are:

PEN*KEY*[R] *Model 6400 User's Guide **(961-047-093)**
PEN*KEY Model 6500/6550 User's Guide **(961-047-099)**
RT1100 Radio Terminal User's Guide **(961-047-069)**
RT1700 Radio Terminal User's Guide **(961-047-068)**
RT5900 Radio Terminal User's Guide **(961-047-121)**

System Management Publications

***NORAND Open Wireless LAN with HP OpenView for Windows User's Guide* (961-051-009)**

This guide describes how to install and use the OpenView for Windows network management platform by Hewlett-Packard (HP).

***OWLView for HP OpenView for UNIX User's Guide* (961-051-011)**

This guide describes how to install and use the OWLView for HP OpenView for UNIX network management platform.

***OWLView for HP OpenView for Windows User's Guide* (961-051-010)**

This guide describes how to install and use the OWLView for HP OpenView for Windows network management platform.

Customer Support

The goal of Intermec Technologies Corporation is 100 percent customer satisfaction. If you would like more information about the access point or other open wireless LAN system components, contact us through the Customer Response Center.

In North America, call: 800-221-9236 *or* 319-369-3533

Section 2

Features and Functional Overview

This section describes the 6710 Access Point and how it operates on the open wireless LAN. This section also describes access point components.

Description

The 6710 Access Point provides transparent, wireless communications between a wired Ethernet LAN and wireless stations. Figure 2-1 shows current designs; information in this user's guide applies to both designs.

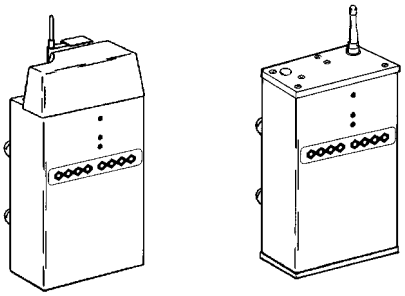


Figure 2-1
6710 Access Points

The access point functions as a 4-port translating bridge. Functionality within the access point can be partitioned into two major functional blocks: *bridging functionality* and *management functionality*. Bridging functions pertain to the forwarding of data through the access point. Management functionality involves configuration, software upgrade, and network management.

Figure 2-2 is a simplified diagram showing the functions within the access point.

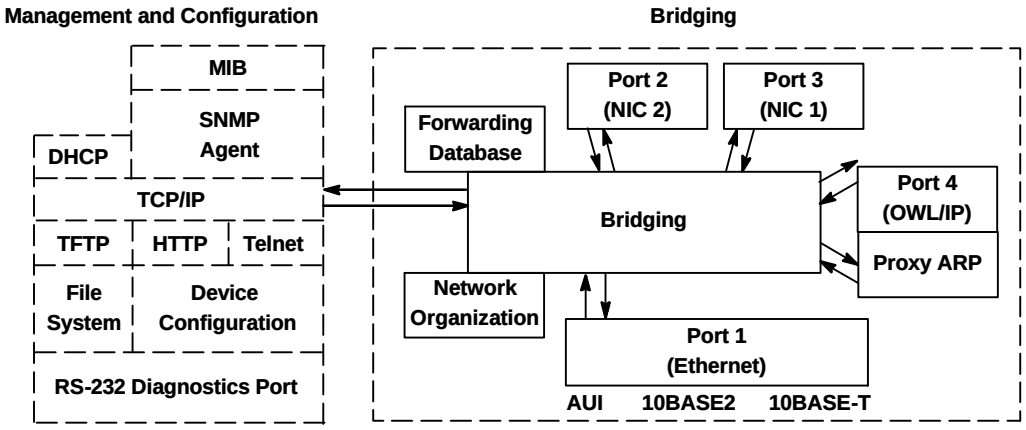


Figure 2-2
6710 Access Point Functions

Bridging Functionality

General Concepts

Bridges are common components in wired LANs. Bridges are devices that join two or more LAN segments. This provides the appearance of a single LAN segment to the protocols and applications that operate within the LAN.

Bridges operate at the Media Access Control (MAC) sublayer of the Data Link Layer (Layer 2) of the International Organization for Standardization (ISO) protocol model. Operating at the MAC layer allows bridges to operate transparently to commonly used network protocols such as TCP/IP, Novell SPX/IPX, NetBEUI, and DECnet.

In wired LANs, bridges do the following:

- Segment traffic for better efficiency and performance.
- Extend the reach of LANs when cable length or node limits have been reached.
- *Translate* between different LAN types such as IEEE 802.3 Ethernet and 802.5 Token Ring.

A LAN environment normally consists of a collection of nodes or stations, each identified by a unique 48-bit physical address (also called an IEEE address or MAC address). Data is sent on the LAN as frames or packets that contain the *source address* of the station sending the frame, and the *destination address* of the recipient station.

A bridge has at least two *ports*, each connected to a different LAN segment. Bridges *learn* which source addresses are generating traffic on each of their ports. If the bridge receives a frame with a destination address corresponding to a source address it has seen on another port, it *forwards* the frame to the port. If it receives a frame where the source and destination addresses are on the same port, it ignores *(drops)* the frame, since the destination node receives the original transmission. Generally, if a bridge receives a frame for an unknown destination address on any one port, it *floods* the frame on all other ports.

Access Point Bridging Layer

The 6710 Access Point functions as a bridge with up to four ports:

- An Ethernet port.
- One or two radio ports.
- An Open Wireless LAN/Internet Protocol (OWL/IP) port.

The access point is a *translating bridge* because it forwards frames between Ethernet and wireless media that have unique physical and MAC protocol implementations. The access point implements the basic learning and forwarding functions of a simple wired LAN bridge. It also includes additional functionality to address unique problems in wireless LANs.

Significant functions supported at the bridging layer include network organization, support for roaming and power-managed stations, and programmable flooding levels.

Network Organization

Open wireless LAN networks may be complex, supporting:

- Small or large numbers of access points on a single wired LAN backbone.
- Stations that roam between coverage areas and employ power management to improve battery life.

More complex topologies include the following:

- Range extension through *wireless access points*, which are not connected to the wired LAN backbone.
- *Secondary LANs* (connection of wired LAN segments by wireless links).
- Mixed radio frequency (RF) media.
- Operation over multiple IP subnets.
- Multiple, independent wireless LANs on one wired LAN backbone.

Access points automatically configure into a self-organized network using a spanning tree topology. They automatically reconfigure the network to maintain reliable operation as devices are added or removed, or in the event of some types of wired LAN failure. The spanning tree provides efficient, loop-free forwarding of frames through the network and rapid roaming of mobile stations within the network.

The spanning tree is initiated by the *super root*, an access point that coordinates the network and distributes common system parameters to other access points and stations. The super root is elected from a group of access points designated at the time of installation. The election process also occurs in the event of a super root failure, preventing a single point of failure.

Forwarding

The bridge maintains a forwarding database of all physical station addresses known to the access point, and the correct port for each address. This database makes efficient forwarding decisions in the bridging software.

The database is updated through monitoring addresses on each port, and by messages exchanged between access points when stations roam. The database also includes the power management status of each station, supporting the pending message feature of the network.

Pending Messages

Wireless stations may use power management to maintain battery life. These stations wake up periodically to receive messages that may have arrived while their radio was powered down. The bridging software provides a pending message delivery service, allowing frames to be held until the station is ready to receive them.

Flooding Configurations

Standard LAN bridges flood frames on all ports when the destination address is unknown. Additionally, many network protocols use *multicast* addressing for connection and status communications. A multicast frame is a special type of frame destined for more than one physical address. Standard bridges always flood multicast frames.

Most wireless media supported in the access point operate at lower media speeds than Ethernet. Indiscriminate flooding from a busy Ethernet backbone to a wireless medium can consume a substantial portion of the available wireless bandwidth. This reduces system performance even though flooded frames are frequently not intended for stations on a given wireless segment.

To allow performance tuning, the access point provides separate flooding control options for both unicast (single physical address) and multicast frames. Access points serving as designated bridges connecting wired LAN segments may be configured to use different flooding settings than access points serving only wireless stations.

Two of the wireless media supported in the access point — synthesized UHF (S-UHF) and 900 MHz — provide reliable attach mechanisms, which guarantee that wireless stations are always in the access point's forwarding database. Unicast flooding is never required for these stations.

The Wireless LAN Interoperability Forum (WLIF) 2.4 GHz option also provides a reliable attach mechanism for stations using the NORAND® Network Layer (NNL) terminal emulation network protocol. Multicast flooding levels are set for individual networks based on the needs of wireless stations to receive multicast frames. For networks with IP wireless stations only, the Proxy ARP Server provides an option to enabling multicast flooding.

Proxy ARP Server

The Proxy ARP Server is an advanced flooding control capability for stations using IP. An ARP (Address Resolution Protocol) is a type of multicast message used to determine the physical (MAC) address of a station using a specific IP address. When Proxy ARP is enabled, the IP addresses of stations using IP are included in the forwarding database. If the destination IP address matches an entry in the forwarding database, the ARP is sent to the physical unicast address matching that IP address.

To allow customization of this capability to optimize performance, the server operates in one of the following modes:

- No flooding.
- Delayed flooding.
- Normal flooding.

Proxy ARP Server is discussed in more detail in Section 4, "Configuration."

Bridge Ports

The access point has the following physical ports:

- An Ethernet port.
- Two PC card slots capable of accepting a variety of wireless Network Interface Cards (NICs).

The access point also has a logical OWL/IP port.

Ethernet Port

The Ethernet port can be configured to support 10BASE-T twisted pair, 10BASE2 thinnet, or an AUI connection. The AUI connection can support 10BASE5 thicknet or 10BASEF fiber optic connections with the appropriate media adapters.

The physical connections are on the bottom panel of the access point. The desired Ethernet medium is selectable through the device configuration menus. Section 3, "Installation," has more information about connecting the access point to Ethernet media. Section 4, "Configuration," describes how to set the medium through the configuration menus.

Ethernet Port Filters

The Ethernet port can be configured to support a variety of preconfigured and custom input filters. Access points are commonly installed on LANs that carry traffic for wired and wireless devices. Setting filters prevents unnecessary traffic from the wired LAN from being forwarded onto the wireless medium. This is important because common wireless technologies operate at data rates below Ethernet speeds.

Normally, filters are set to *pass* traffic known to be (or likely to be) destined for wireless stations, and *drop* traffic not destined for stations requiring wireless connectivity. Filtering occurs in the Ethernet driver software that controls low level operation of the Ethernet ports, minimizing involvement of other functions when unnecessary frames are received. In most installations, the predefined filters are used. The default access point configuration sets no filters. Filter setup is discussed in more detail in Section 4, "Configuration."

Filtering and flooding control (described on page 2-6) are complimentary but have different functions. Filters allow frames to be eliminated based upon content of the frame, usually the network protocol header fields within the frame. For example, filters can be set to eliminate some or all IP traffic or Novell IPX traffic.

Filtering occurs regardless of whether the destination address is in the forwarding database. Using filters can improve the performance of the access point and prevent undesired frames from being forwarded to wireless stations attached to the access point.

Flooding decisions are made after frames have been received on a port and filtered. Flooding settings determine how the access point forwards frames to destination addresses not in the forwarding database.

Radio Ports

Each of the two radio ports in the access point are a connection into a LAN segment consisting of all wireless stations and access points that use the same wireless technology, are within wireless communications range of the access point, and are configured to communicate together.

The two *PC card slots* are intended for wireless NICs and are designated as NIC1 and NIC2. Internally, they are configured as Port 3 and Port 2, respectively. The following wireless options are currently supported:

- WLIF (2.4 GHz).
- 900 MHz.
- 450 MHz S-UHF.

The different media options provide alternative coverage and throughput tradeoffs. Radio media options are described in more detail in Appendixes B, C, and D.

The access point also supports combinations of two adapters for operation in mixed media systems; or, for WLIF radios, a wireless access point capability. The following dual radio configurations are supported:

- WLIF and 900 MHz.
- WLIF and S-UHF.
- WLIF and WLIF (limited to Master/Slave configuration for wireless access points).

Configuration of individual radio options and the WLIF wireless access point configuration are discussed in Section 4, "Configuration."

OWL/IP Port

The OWL/IP port is a logical port used in installations where the wireless infrastructure is required to operate across multiple IP subnets; that is, in installations where IP routers are used.

The OWL/IP port is an advanced capability that allows stations supporting IP and nonroutable protocols such as NNL (used in some terminal emulation installations) to roam without losing connectivity when a wireless LAN installation must extend over multiple IP subnets. In some cases, OWL/IP may also provide connectivity in larger, routed networks when roaming between IP subnets is not required, but where it is desirable to configure a single wireless network across router boundaries.

OWL/IP uses General Router Encapsulation (GRE), a registered protocol from the TCP/IP protocol suite. GRE allows frames destined for stations on a different IP subnet to be *encapsulated* with an IP address that passes transparently through routers. Encapsulation is also sometimes referred to as *tunneling*.

To simplify configuration, OWL/IP functionality is treated as an additional port within the access point architecture. It is a *logical* port in that there is no physical radio or wired LAN port associated with OWL/IP.

Encapsulated frames may be sent through any of the three physical ports. Access points separated by one or more routers may be thought of as originating and receiving nodes on the two sides of a tunnel that is established through the router.

The forwarding database entry for a station on the other side of the tunnel includes the physical port (NIC1, NIC2, or Ethernet) the frame should be forwarded through, and an indication that encapsulation is required. The receiving access point on the other side of the tunnel de-encapsulates the frame and then forwards it on the correct physical port.

OWL/IP is described in more detail in Section 4, "Configuration," and Appendix E, "OWL/IP."

Configuration and Management

Configuration

The access point can be configured through a local RS-232 connection, or remotely through a TCP/IP connection. The access point includes a command monitor and menu driven configuration with online help. The command monitor and file system configuration are contained in permanent read-only memory (ROM) within the access point, and can be accessed through the RS-232 diagnostics port even if software is not loaded in the access point.

Most access point functionality is provided by the software stored within the file system. Configuration parameters are stored in nonvolatile EEPROM memory, and are maintained in the event of power loss.

Diagnostics and Configuration Port

An RS-232 configuration port is provided for direct access to the access point's command monitor and configuration menus. Access through the diagnostics port is password-protected for security.

The port uses a standard PC AT style cable, and operates at speeds up to 57.6 Kbps. Configuration using this port is described in Section 4, “Configuration.”

Remote Access

Remote access is available over TCP/IP connections using Telnet or Hypertext Transfer Protocol (HTTP) for configuration management, and Simple Network Management Protocol (SNMP) for network management.

TCP/IP

The access point supports remote access through a Request for Comments (RFC) compliant TCP/IP stack. Before initial usage, the stack must be initially configured with an IP address and an optional default router through the RS-232 diagnostics port. Alternatively, the access point may be configured with a Dynamic Host Configuration Protocol (DHCP) server name. The access point then obtains its IP address, default router, and subnet mask from a DHCP server.

DHCP Client

The access point contains a DHCP client, allowing it to receive an IP address over the network. The DHCP client supports temporary and permanent leases. It also accepts permanent leases from a Bootstrap Protocol (Bootp) server. See Section 4, “Configuration,” for further detail on DHCP operation.

Telnet

Telnet may be used to access the access point’s configuration menus. The command interface is identical to the command interface through the diagnostics port. See Section 4, “Configuration,” for more information about access through Telnet.

HTTP

The access point supports configuration using HTTP from a workstation equipped with a Web browser. Internet Explorer or Netscape Navigator is recommended. See Section 4, "Configuration," for more information about access through a Web browser.

Electronic Software Distribution

The access point supports electronic software distribution, which allows software upgrades after installation. The access point provides a dual bank file system with one active bank and one inactive bank. It operates from the active bank, allowing software upgrades to be stored in the inactive bank. This enables upgrades to be loaded while the access point is operating.

The upgrade can be started immediately after downloading by swapping the active and inactive banks and rebooting. The access point can also be programmed to load the new software at a later time, such as after all access points have been upgraded or during a time of little system activity.

TFTP Client and Server

Software downloads are accomplished using the Trivial File Transfer Protocol (TFTP), another member of the IP suite. Each access point contains a TFTP client and server. The TFTP client allows the access point to obtain software updates from a TFTP server. The server can be an access point configured with the TFTP server enabled, or another network workstation with TFTP server capability.

Scripting

The access point supports a scripting capability that automates most of the software download process. Scripts can be uploaded to the access point through Telnet or SNMP.

Network Management

The access point is instrumented for network management, with variables defined in the Management Information Base (MIB). The MIB is SNMP V1 compliant.

Management information can be accessed through the SNMP agent. The MIB may be ordered separately and compiled for any SNMP network management platform. Additional capabilities are supported in the OWLView network management application for HP OpenView.

Appendix G, "MIB," contains the 6710 Access Point MIB. Consult the following documentation for more information on network management:

- *NORAND Open Wireless LAN with HP OpenView for Windows User's Guide* (961-051-009)
- *OWLView for HP OpenView for UNIX User's Guide* (961-051-011)
- *OWLView for HP OpenView for Windows User's Guide* (961-051-010)

Sample Configuration

Figure 2-3 shows a sample network configuration. It also shows access points providing additional coverage and wireless links to secondary Ethernet LANs.

" **NOTE:** *Consult Appendix D, "S-UHF Specifications and Antennas," for network configuration limitations for S-UHF systems.*

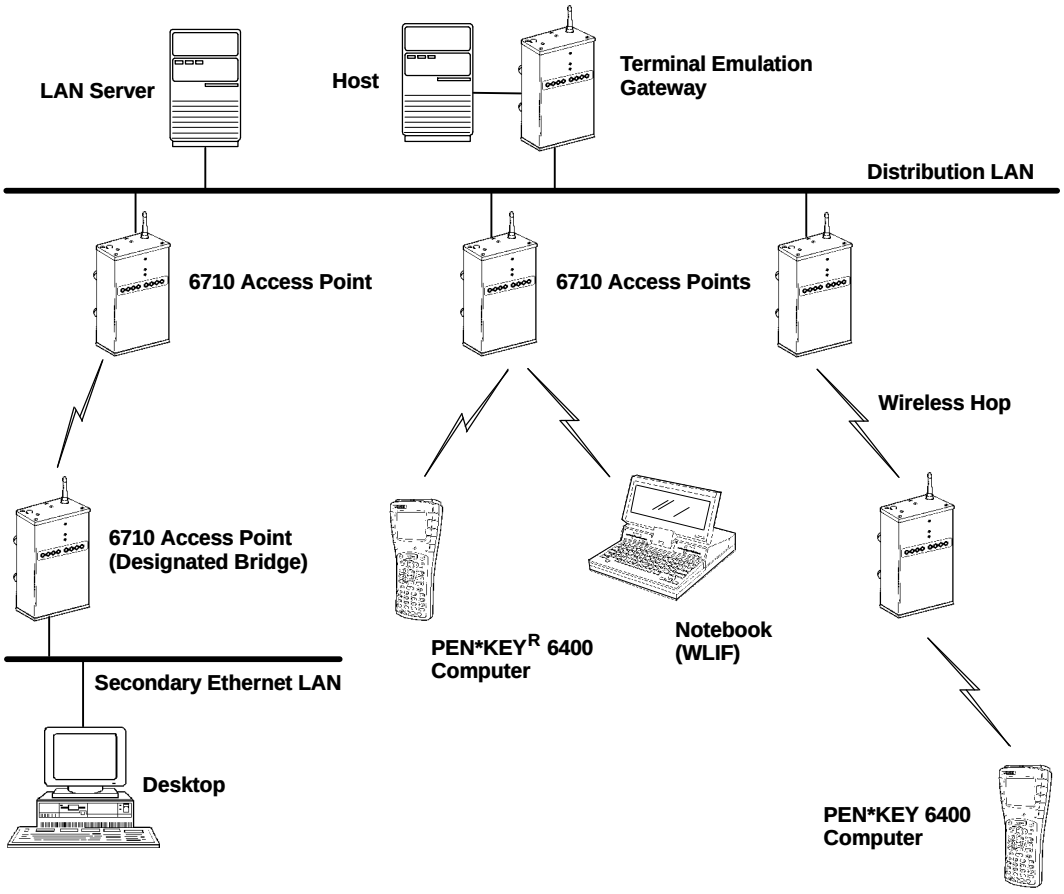


Figure 2-3
Sample Network Configuration

Components

Figure 2-4 shows access point components, described on the following pages. Not shown is the mounting bracket, which attaches the access point to a wall or ceiling.

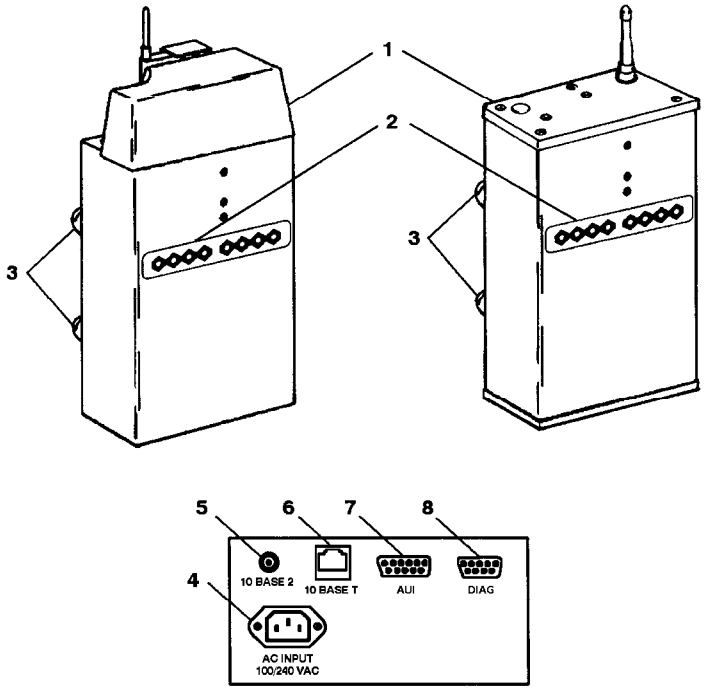
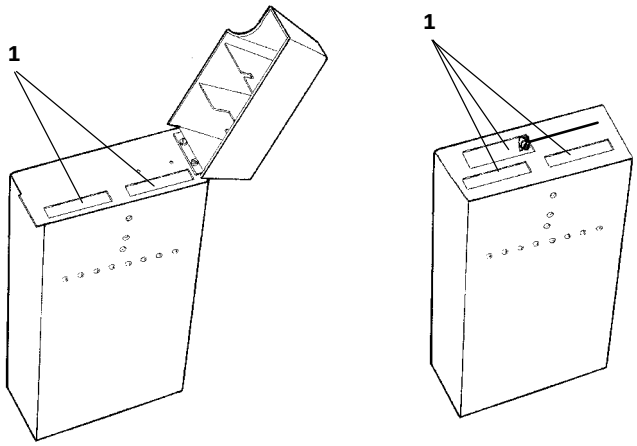


Figure 2-4
Access Point Components

1. **Protective cover.** The cover protects two Type II or Type III PC card slots. Figure 2-5 shows where the slots are located.



1. PC card slots

Figure 2-5
PC Card Slots

2. **Indicator lights.** Four pairs of indicator lights (LEDs) on the front panel show the status of the access point. During the power-up sequence, the lights show the results of the power-up self diagnostics and provide information about the operating status.

   After the power-up sequence, the lights show the current operating status and indicate if a problem exists. Section 6, "Indicator Lights," describes the lights in detail.

3. **Rubber feet.** Four nonskid rubber feet provide a stable base for the access point when you place it on a desktop or other horizontal surface.

   When the mounting bracket is installed for an access point mounted vertically or on the ceiling, the rubber feet provide a small amount of tension to the bracket to help hold it in place.

4. **AC INPUT.** The AC INPUT connector is a standard IEC type, three-prong AC input connector. The power cord attaches to this connector. The internal power supply is an autosensing international power supply. It accepts a source voltage between 85 and 264 V ac, with a frequency between 47 and 63 Hz.

5. **10 BASE 2.** The 10 BASE 2 port is a standard BNC port through which the access point connects to 10BASE2 Ethernet (thinnet).

6. **10 BASE T.** The 10 BASE T port is a standard RJ45 port through which the access point connects to 10BASE-T (UTP) Ethernet.

7. **AUI.** The AUI port is a 15-pin, D-subminiature (D-sub) port. The access point connects to an AUI network adaptor through this port, for connection to 10BASE5 Ethernet (thicknet). Appendix F, "Port and Cable Pin-Outs," contains pin definitions.

" **NOTE:** *Section 3, "Installation," shows how to connect the access point to 10BASE2, 10BASE5, and 10BASE-T.*

8. **DIAG.** The DIAG port is a 9-pin D-sub communication port that communicates at RS-232 levels. Use this port to configure the access point, download new software, and retrieve statistics. Appendix F contains pin definitions.

Accessories

Power Cord

The power cord connects the access point to the wall outlet. The following chart lists power cord part numbers.

Country	Part Number
Australia	321-472-001
Denmark	321-501-001
Europe	321-473-001
Italy	321-471-001
Germany	321-515-001
United Kingdom	321-474-001
United States	321-054-001

Industrial Locking Mounting Bracket

The Industrial Locking Mounting Bracket "locks" the access point into the bracket. This bracket is recommended for installations where vibration, shaking, or other movement can dislodge the access point from its mount.

Item	Part Number
Mounting kit	203-386-001

Section 3

Installation

This section describes how to:

- Check the access point's default configuration.
- Prepare for the installation.
- Collect the networking equipment you need.
- Find the best location.
- Connect to the Ethernet medium.
- Install PC cards.
- Apply power.

Checking the Default Configuration

The access point is shipped with default settings for system software parameters, which are listed in Section 4, "Configuration." You may need to change some default settings to achieve a more efficient configuration for your site. See Section 4 for information about reconfiguring the access point. The access point should be properly configured before it is connected to the network.

Preparing for the Installation

" **NOTE:** *Someone who knows and understands all applicable local building codes and is proficient with the tools and equipment used to install FCC Class B electromechanical devices should physically install the access point.*

Before you install the access point, unpack it and inspect it for damage or missing parts. Save all the paperwork you received. If the access point appears to be damaged, contact the Customer Response Center for instructions on returning the unit for replacement.

The shipment contains the access point with FLASH and the following items:

- Mounting bracket
- AC power cord
- Warranty card

Collecting the Equipment

Before you install the access point onto the network, collect the equipment you will need.

Ethernet LAN Components

The access point directly connects to 10BASE2, 10BASE-T, or 10BASE5 Ethernet medium. Consult a cabling reference for maximum run lengths and node limits for Ethernet wiring.

10BASE2 Components

10BASE2 components include a T-connector, a cable terminator, and the proper lengths of 10BASE2 coax cable. The **10BASE2 T-connector** (Figure 3-1) attaches to the access point's 10BASE2 port, and connects the access point to the middle or end of 10BASE2 cable.

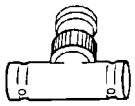


Figure 3-1
T-Connector

A **cable terminator** (Figure 3-2) attaches to the T-connector. It is required for a device connected to the end of 10BASE2 cable. The terminator properly terminates the network cable to maintain proper impedance. Proper termination is necessary for reliable Ethernet operation.

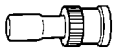


Figure 3-2
Cable Terminator

10BASE-T Component

10BASE-T **coax cable** is normally used to connect the access point to an Ethernet hub. The cable has an RJ45 plug on each end (Figure 3-3).

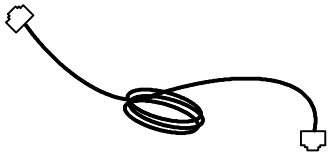


Figure 3-3
Cable With RJ45 Plugs

10BASE5 Components

10BASE2 components include the proper lengths of 10BASE5 coax cable, an AUI drop cable (less than or equal to 50 feet/15 meters long), and a transceiver. Two types of transceivers are the intrusive N-Series transceiver and the nonintrusive vampire tap.

The N-Series transceiver (Figure 3-4) is a T-shaped connector with a 15-pin AUI port and two type N connectors. This transceiver is intrusive because network service is disrupted while the coaxial cable is cut and a threaded N-series connector placed on each end of the cable.

A 10BASEF (fiber optic) adapter may be attached directly to the AUI connector.

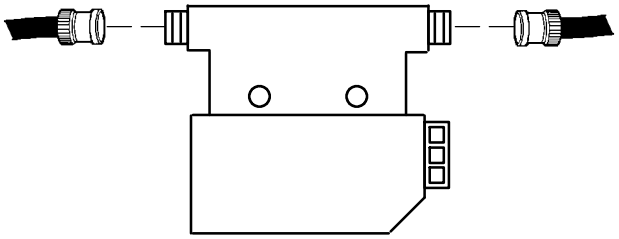


Figure 3-4
N-Series Transceiver

The vampire tap is an insulation-piercing clamp device that clamps onto the coaxial cable (Figure 3-5). The vampire tap pierces the coaxial cable's insulation and makes contact with the shield and inner conductor without cutting the cable.

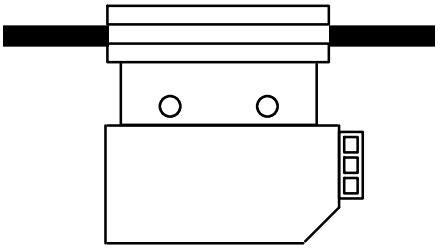


Figure 3-5
Vampire Tap

Communication Equipment

You can access the access point's system software configuration menus locally through the unit's DIAG port, or remotely through a Telnet session or Web browser.

Local DIAG Port Access

For local access, you need the following:

- Third-party communications software terminal emulation package with Y-modem capability (such as PROCOMM PLUS by DataStorm Technologies, Inc.). Install the program according to its user guide.
- PC (personal computer) station, which should meet the requirements outlined in the user guide for the terminal emulation program.
- Cable to connect the PC to the access point's DIAG port. The following chart lists cables.

For this PC Port	Use Cable Part Number
9-pin	226-106-001 (null modem cable)
25-pin	321-355-001

Telnet

You need the following to access the configuration menus through a Telnet session:

- PC or workstation with an installed and configured network interface card and a Telnet application. You can also use a host capable of acting as a Telnet client.
- Telnet VT emulator (TNVT) installed on the PC.
- IP address for the access point. See Section 4 for more information about IP addresses.

Web Browser

The access point's configuration menus are designed for HTML Level 2.0 or higher. You need the following to access the configuration menus through a Web browser:

- Graphical browser application.
- Internet or local network connection.
- IP address for the access point. See Section 4 for more information about IP addresses.

Network Management Platform

To manage the system through a network management platform, you need the platform (such as OpenView for Windows by Hewlett-Packard) installed on a network management station using SNMP. The station must meet the requirements outlined in the platform's user guide.

Finding the Best Location

Site Survey

Intermec strongly recommends that Intermec or certified providers conduct a site survey to determine the ideal locations for all of your network components. A proper site survey requires special equipment and training. A site survey provides an installation recommendation that addresses various factors, which can affect the performance of your wireless LAN system.

General Installation Guidelines

Coverage in most sites requires a network of access points to be installed. Radio coverage varies greatly with factors such as building construction, number and type of obstructions in the signal path, and the RF media in use. Additional factors related to the intended use of the system also dictate installation practices. The following general practices should be followed in any installation:

- Locate access points centrally within areas requiring coverage.
- Try to position the access point so its indicator lights are visible. The lights are useful for troubleshooting the installation.
- Position antennas below roof trusses and away from I-beams, racks, or other structures and obstructions.
- Overlap access point coverage areas to avoid coverage holes.
- Install wired LAN cabling within node limit and cable length limitations.

- Ensure that a power outlet is within 6 feet of the access point. An uninterruptable power supply is recommended when the ac power system is not reliable.
- Ensure that LAN and ac cables can reach the access point after you install it. Leave sufficient room around the access point so you can easily attach and remove cables.
- Do not locate an access point with the S-UHF radio option in a computer room. RF emissions from the higher speed processors in current-generation computers may reduce system range.

Mounting the Access Point

You can mount the access point horizontally on a tabletop, vertically on a wall or post, or on the ceiling.

Horizontal (Tabletop) Mount

1. Remove the mounting bracket from the bottom of the access point. The bracket is not needed for a tabletop installation.
2. Set the access point in position. The unit rests securely on four rubber feet that keep it from slipping out of place.
3. Make all Ethernet connections. See "Connecting to Ethernet" on page 3-10.
4. Make all power connections. See "Applying Power" on page 3-20.
5. Watch the indicator lights to verify that the access point is working properly. See Section 6, "Indicator Lights," for help.

Vertical and Ceiling Mounts

See Figure 3-6 and the procedure following it.

" **NOTE:** *If mounting the access point on a hollow wall, secure the mounting plate to a 3/4" (thick) plywood base by four 1" X 1/4" nuts, bolts, and washers. Anchor the plywood base to two separate wall studs by four 2" X 1/4" diameter lag screws (two lag screws in each stud).*

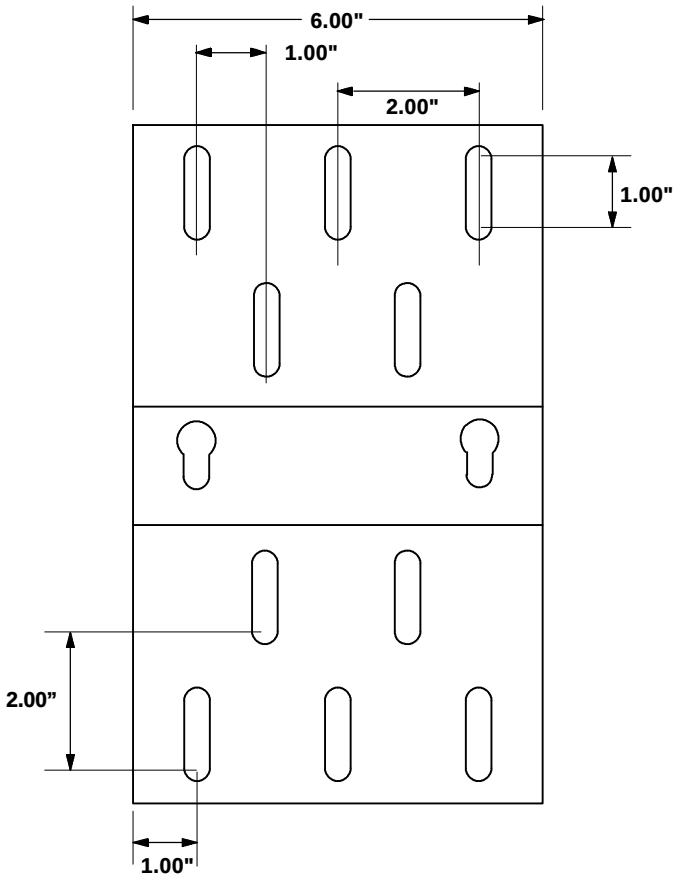


Figure 3-6
Mounting Bracket

1. Inspect where the access point will be mounted and determine what hardware is needed. Different surfaces such as drywall, wood, and concrete block require different mounting hardware. For this reason, a universal mounting bracket is included with the access point.
2. Remove the mounting plate from the bottom of the access point.
3. Using the mounting plate as a template, mark where the anchors that secure the mounting plate to the surface should be located.
4. Attach the access point mounting plate to the wall or ceiling with 2" x 1/4" diameter lag screws or bolts, depending upon the surface. The mounting plate must be secured to the surface by at least four anchors, one on each corner.
5. Reattach the access point to the mounting plate.
6. Make all Ethernet connections. See "Connecting to Ethernet."
7. Make all power connections. See "Applying Power" on page 3-20.
8. Watch the indicator lights to verify that the access point is working properly. See Section 6, "Indicator Lights," for help.

" **NOTE:** *An optional locking kit is available. See Section 2, "Features and Functional Overview," for more information.*

Connecting to Ethernet

The following pages show how to connect the access point to 10BASE2, 10BASE5, and 10BASE-T Ethernet.

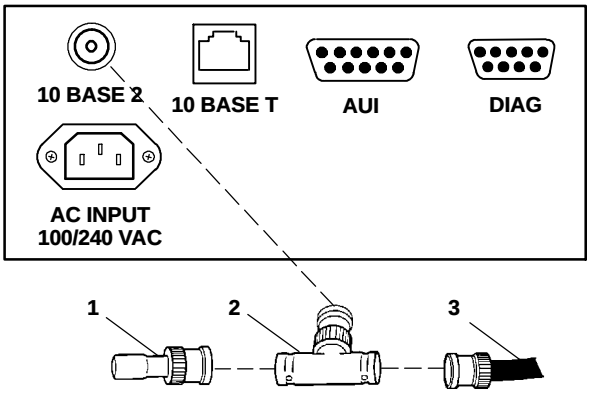
10BASE2 Ethernet

The access point connects to the end or middle of the 10BASE2 cable segment.

" **NOTE:** *Cable lengths between network devices on the 10BASE2 Ethernet LAN must meet ANSI/IEEE standards.*

End of Segment

See Figure 3-7 and the procedure following it.



1. **Cable terminator (50 ohm)**
2. **T-connector**
3. **10BASE2 cable**

Figure 3-7
End of 10BASE2 Segment

1. Plug the T-connector (2) into the 10 BASE 2 port.
2. Plug one end of the Ethernet cable (3) into an open end of the T-connector. Align the notches in the cable end with the posts on the T-connector, push the cable in, and twist one-quarter turn.
3. Plug the cable terminator (1) into the other end of the T-connector.

Middle of Segment

See Figure 3-8 and the procedure following it.

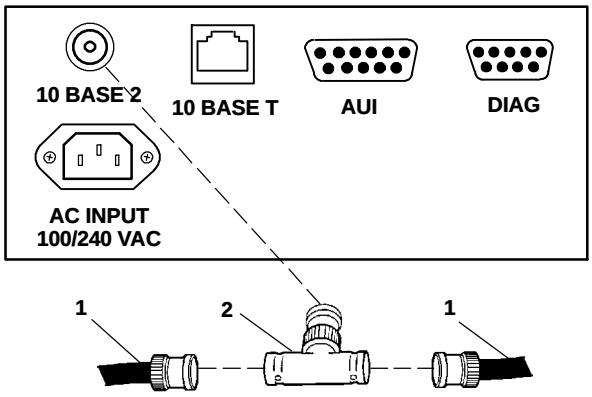


Figure 3-8
Middle of 10BASE2 Segment

1. Plug the T-connector (2) into the 10 BASE 2 port.
2. Plug one end of the Ethernet coaxial cable (1) into an open end of the T-connector. Align the notches in the cable end with the posts on the T-connector, push the cable in, and twist about one-quarter turn.
3. Plug the end of another Ethernet coaxial cable segment into the other open end of the T-connector.

10BASE5 Ethernet

The access point connects to 10BASE5 through an N-Series transceiver or vampire tap.

" **NOTE:** *Cable lengths between network devices on the 10BASE5 Ethernet LAN must meet ANSI/IEEE standards.*

N-Series Transceiver

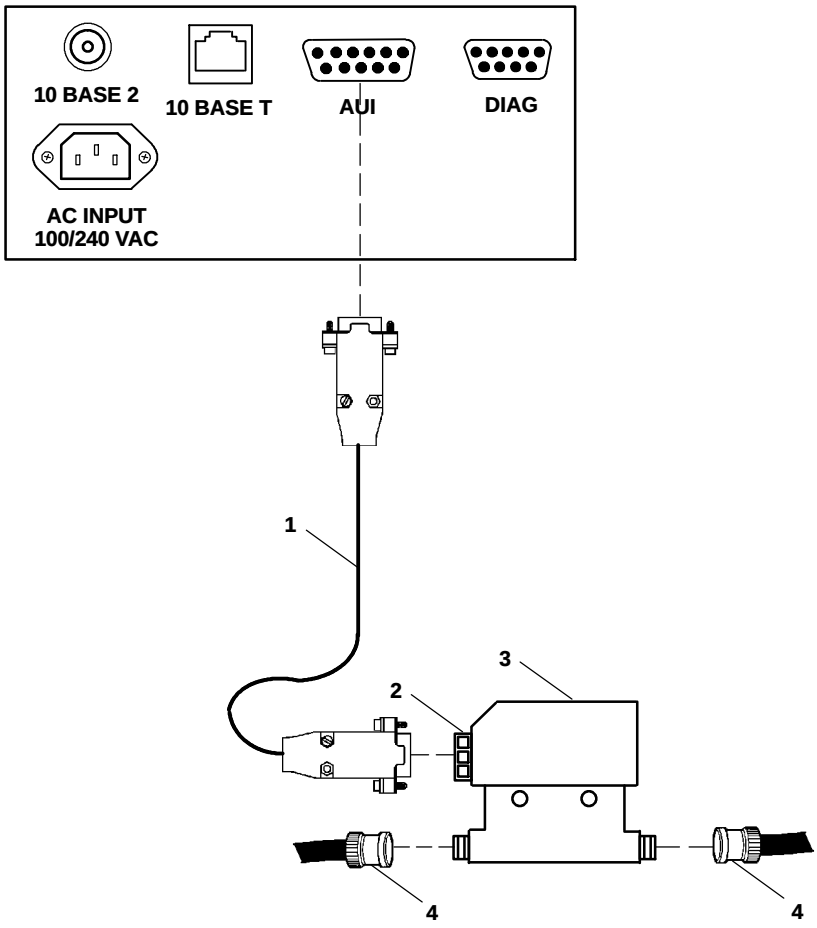
See Figure 3-9 and the following procedure.

1. Attach one end of the drop cable (1) to the AUI port.
2. Route the drop cable to the 10BASE5 cable (4) and determine a suitable spot to cut the cable and attach the transceiver (3).
3. Attach the transceiver to the 10BASE5 cable, then connect the other end of the drop cable to the AUI port (2) on the transceiver.

Vampire Tap

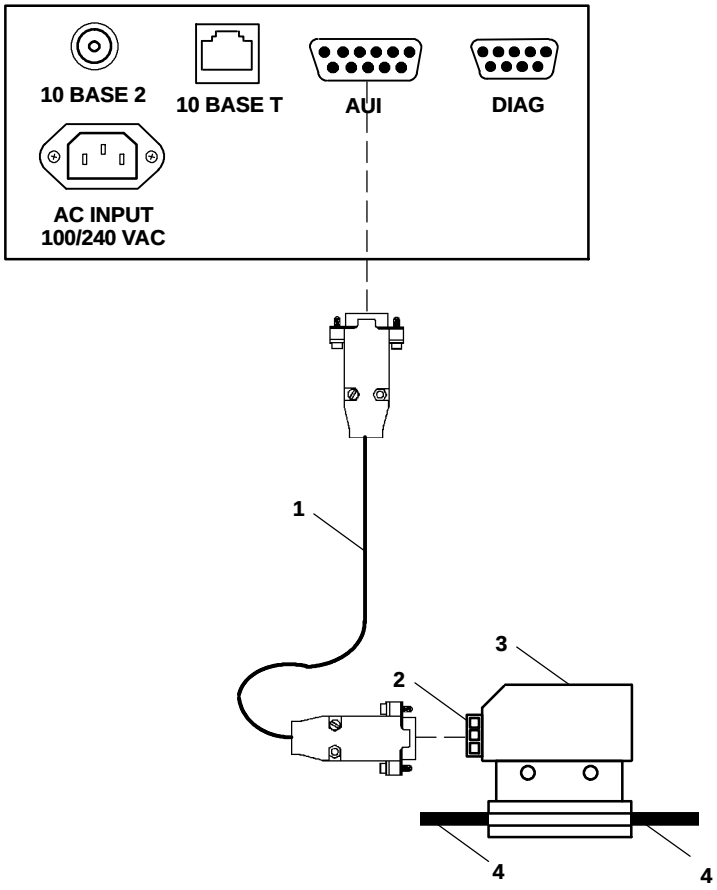
See Figure 3-10 and the following procedure.

1. Attach one end of the drop cable (1) to the AUI port.
2. Route the drop cable to the 10BASE5 cable and determine a suitable spot on the cable to attach the vampire tap (3).
3. Attach the vampire tap to the 10BASE5 cable, then connect the other end of the drop cable to the AUI port (2) on the tap.



1. **Drop cable**
2 **15-pin AUI port**
3. **N-Series transceiver**
4. **10BASE5 coax**

Figure 3-9
N-Series Transceiver



1. **Drop cable**
2. **15-pin AUI port**
3. **Vampire tap**
4. **10BASE5 coax**

Figure 3-10
Vampire Tap

10BASE-T Ethernet

See Figure 3-11 and the procedure following it.

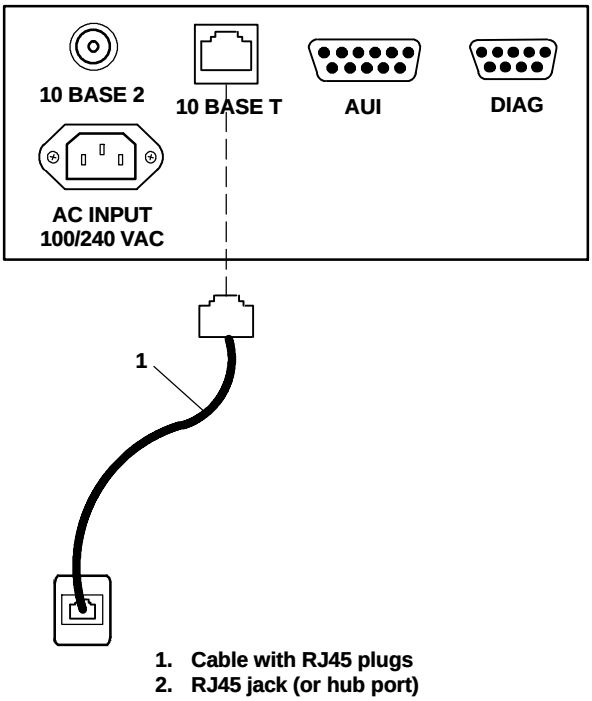


Figure 3-11
10BASE-T

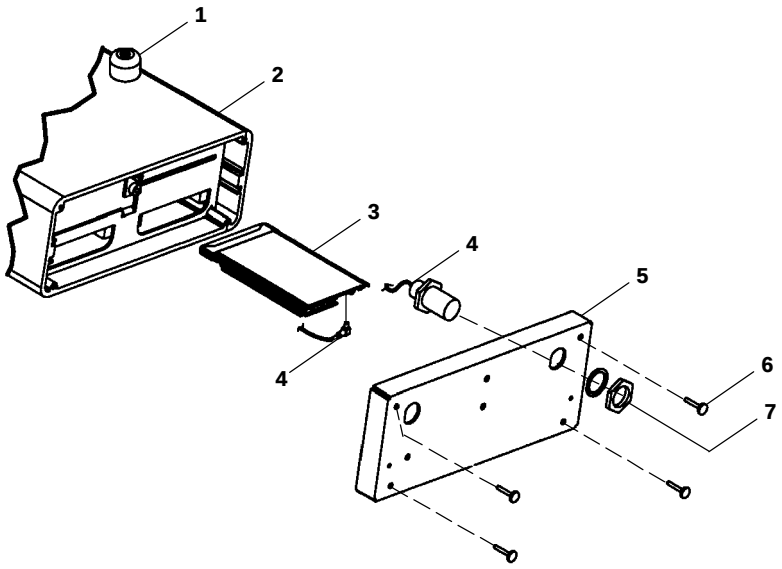
1. Plug the cable with RJ45 jacks (1) into the 10 BASE T port.
2. Plug the other end of the cable into RJ45 jack or hub port (2).

Installing PC Cards

The following pages describe how to install WLIF, 900 MHz, and S-UHF PC cards.

WLIF

The WLIF radio option is a Type III PC card that can be installed in either slot. To install the card, see Figure 3-12.

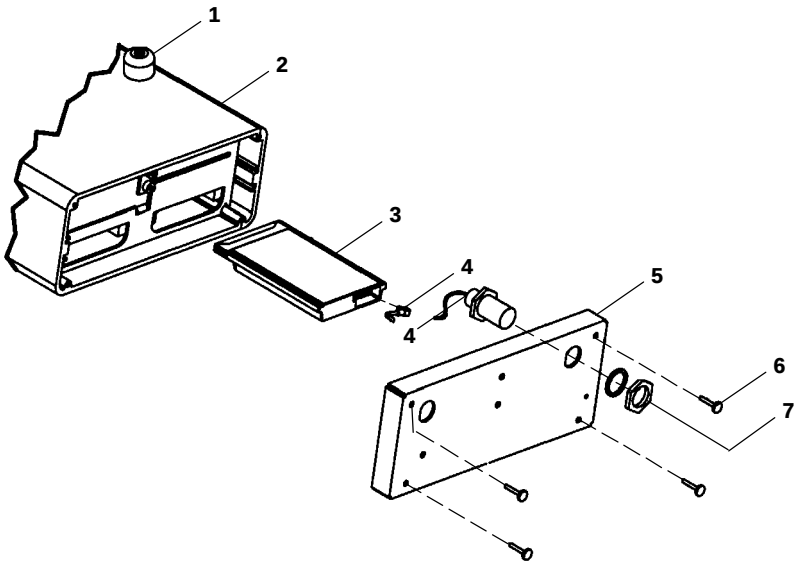


1. **Nonskid rubber feet (4)**
2 **Access point (no radio)**
3. **PC card (RM180)**
4. **Antenna cable**
5. **End plate**
6. **4–40 captive thumb screws**
7. **Hex nut and lock washer (supplied with antenna cable)**

Figure 3-12
WLIF PC Card Assembly

900 MHz

The 900 MHz radio option is a Type III PC card that can be installed in either slot. To install the card, see Figure 3-13.

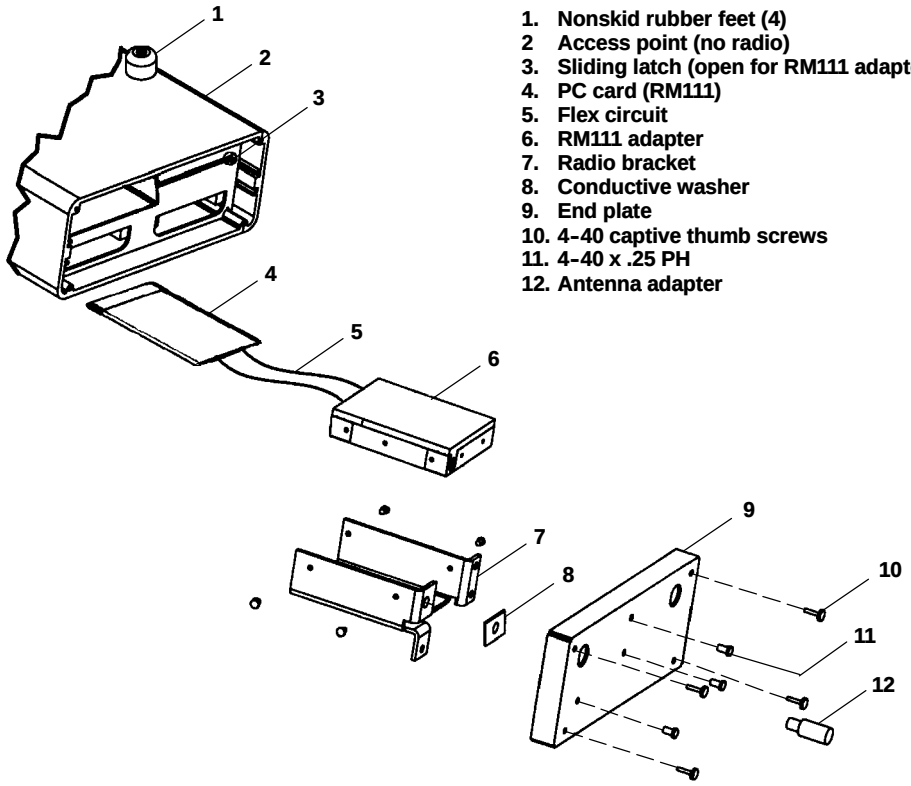


1. **Nonskid rubber feet (4)**
2 **Access point (no radio)**
3. **PC card (RM160)**
4. **Antenna cable**
5. **End plate**
6. **4–40 captive thumb screws**
7. **Hex nut and lock washer (supplied with antenna cable)**

Figure 3-13
900 MHz PC Card Assembly

S-UHF

The S-UHF radio option is a Type II PC card that can only be installed in the left-hand slot (with LEDs facing down). To install the card, see Figure 3-14.



1. Nonskid rubber feet (4)
2 Access point (no radio)
3. Sliding latch (open for RM111 adapter)
4. PC card (RM111)
5. Flex circuit
6. RM111 adapter
7. Radio bracket
8. Conductive washer
9. End plate
10. 4–40 captive thumb screws
11. 4–40 x .25 PH
12. Antenna adapter

Figure 3-14
S-UHF PC Card Assembly

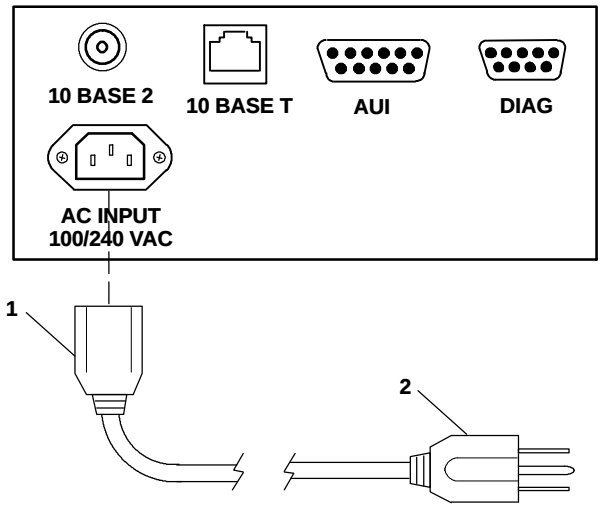
Applying Power

B CAUTION: **NEVER remove the cover of the access point with power applied. ALWAYS make the access point connection before making the connection at the source ("load to source"). Damage to the radio or other devices can occur with the cover removed.**

" NOTE: *Connect the access point to an uninterruptable power source — a power source that cannot be inadvertently turned off or otherwise disconnected.*

Power is applied to the access point through the grounded AC INPUT connector. See Figure 3-15 and the following procedure.

1. Plug the receptacle end of the power cord (1) into the AC INPUT connector.
2. Insert the three-prong plug on the other end of the power cord (2) into a grounded power outlet.
3. See Section 6, "Indicator Lights," for descriptions of the indicator lights.



1. **Receptacle on power cord**
2. **Three-prong plug**

Figure 3-15
AC Power Input Connection

Section 4

Configuration

This section describes how to:

- Create a local DIAG port, Telnet, and Web browser session with the access point.
- Access the access point's FLASH and ROM.
- Set up the access point through its configuration menus.

You can configure the access point locally through its DIAG port, or remotely through Telnet or a Web browser. The following chart shows the sessions you can use to do other tasks.

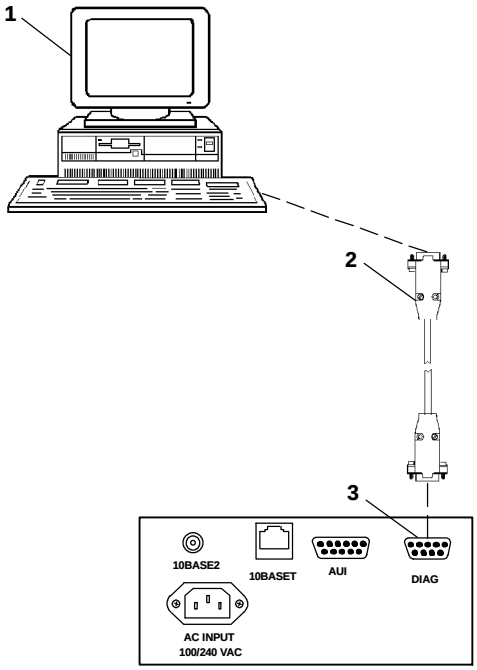
Task	DIAG Port	Telnet	Browser
Change configuration passwords	√	√	√
Modify the configuration	√	√	√
Upgrade FLASH	√	√	
Check the FLASH version	√	√	
Access ROM	√		
Check the ROM version	√		
Use online help	√	√	√

Only one type of session can be running at a time. For example, if someone starts a Telnet session while someone else is configuring the access point through its DIAG port, the configuration through the DIAG port will terminate.

Creating a Local DIAG Port Session

In summary, you establish a local DIAG port session with the access point through a VT100 terminal emulation program. Most general purpose communications software (such as PROCOMM PLUS) supports this emulation.

To create a session, see Figure 4-1 and the procedure following it. You should carefully review the procedure first to become familiar with the process.



1. **PC with terminal emulation program**
2. **Cable: 321-355-001 for a 25-pin PC COM port**
   or
   Cable: 226-106-001 for a 9-pin PC COM port (standard null modem cable)
3. **6710 Access Point DIAG port**

Figure 4-1
Local Session

1. Ensure the terminal emulation program is installed on the PC.
2. With both the PC and access point powered OFF, connect the communication cable to the appropriate PC COM port.

3. Connect the other end of the communication cable to the DIAG port on the access point. Turn the PC on.
4. After the PC boots, start the terminal emulation program.
5. Set the terminal emulation program's options according to what you want to do: Access the configuration menus, or access the ROM command monitor.

Accessing the Configuration Menus

1. Set the terminal emulation parameters in your communications software. If you are configuring this access point for the first time, set the parameters to the access point's default settings:

   9600, **8N1, full duplex**

   If you have already changed the default settings, set the parameters to those you set in FLASH mode through the configuration menus.
2. Plug the access point into the outlet. These messages appear:

QXS6700K <version> <date>
<Press any key within 5 seconds to enter the ROM monitor>
Executing file USTART29.BIN from segment <segment number>
Quickly press a key to perform configuration before startup
Starting system

3. To access the configuration menus, wait until you see the message "Quickly press a key to perform configuration before startup." Press any key to access the configuration menus.
4. See "Configuring the Access Point" on page 4-12.

Accessing the ROM Command Monitor

1. Set the terminal emulation parameters in your communications software. If you are configuring this access point for the first time, set the parameters to the default settings for ROM mode:

   9600, 8N1, full duplex

   If you have already changed the default settings, set the parameters to those you set in ROM mode through the ROM command monitor.

2. Plug the access point into the outlet. These messages appear:

QXS6700K <version> <date>
<Press any key within 5 seconds to enter the ROM monitor>
Executing file USTART29.BIN from segment <segment number>
Quickly press a key to perform configuration before startup
Starting system

3. Press any key within 5 seconds of the first ROM message.

   Note that if the access point is in Power-Up Quiet mode (versus Power-Up Normal mode, the default setting), the ROM messages do not display. More information about Power-Up Quiet (PQ) mode and Power-Up Normal (PN) mode starts on page 5-27 in Section 5, "Software Download."

4. See page 5-22 in Section 5, "Software Download," for information about the ROM command monitor.

Creating a Telnet Session

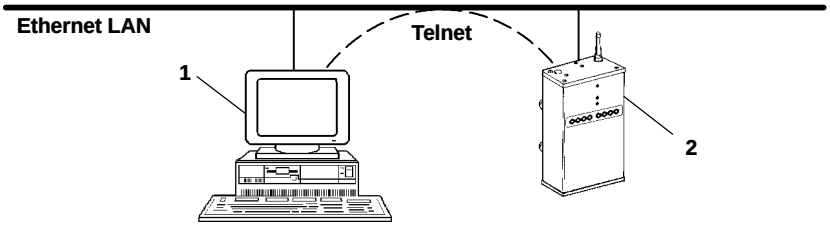
Before you can configure the access point through Telnet, you must connect the unit to the Ethernet cable. (See Section 3, "Installation," for help.) You must also perform initial configuration through the DIAG port to:

- Set an IP address or DHCP server name. You should also configure a subnet mask and IP router address.
- Set the Ethernet cable type.

" NOTE: *The access point includes an autodetect feature that senses the Ethernet medium if traffic is present. If no traffic is present on the cable, the system software defaults to 10BASE-T. For most installations, it is recommended that you explicitly set the Ethernet type.*

The access point must go through its boot sequence before you can create a Telnet session. If you reboot the unit while in a session, the session terminates. You can create a new session after the unit reboots.

To create a Telnet session, see Figure 4-2 and the procedure following it.



1. **PC or workstation with Telnet VT emulator (TNVT)**
2. **6710 Access Point**

Figure 4-2
Telnet Session

1. Ensure the access point is connected to the Ethernet cable, and has an assigned IP address and cable type.
2. Ensure the PC or workstation has an installed and configured Ethernet interface card.
3. Ensure the Telnet VT emulator is installed on the PC or workstation.
4. Open a new Telnet session on the PC or workstation.
5. Enter the access point's IP address in the host name or IP address field.
6. See "Configuring the Access Point" on page 4-12.

Default and Site Settings

The access point is factory configured with the default settings listed in the following charts. You may need to change the defaults to match the way your system is set up. You can record your site's settings in the table for reference.

TCP/IP

Option	Default	Site Setting
IP Address	0.0.0.0	
IP Subnet Mask	255.255.255.0	
IP Router	0.0.0.0	
IP Frame Type	DIX	
DHCP	Enabled, if IP Address is zero	
DHCP Server Name	Norand DHCP Server	
Auto ARP Minutes	5	

Security

Option	Default	Site Setting
Password	CR52401	
Service Password	Enabled	
Advanced Password	"" *(empty string)*	

Bridge

Option	Default	Site Setting
Serial Number	*(Read-only)*	
Lan ID	0	
[Root]		
Root Priority	1	
[Global Radio]		
UHF Rfp Threshold		
Set Globally	Disabled	
Value	70	
UHF Frag Size		
Set Globally	Disabled	
Value	250	
Falc Frag Size		
Set Globally	Disabled	
Value	250	
Awake Time		
Set Globally	Disabled	
Value	0	
[Global Flooding]		
Inbound		
Multicast	Primary	
Unicast	Disabled	
Outbound to Secondaries		
Multicast	Disabled	
Unicast	Disabled	
Outbound to Stations		
Multicast	Disabled	
Unicast	Disabled	

Option	Default	Site Setting
[Ports]		
Ethernet port:		
Name	omde	
MAC Address	*(Unique number)*	
Status	Enabled	
Hello Period	2 seconds	
[Ethernet]		
OWL Frame Type	DIX	
Cable Type	Auto Detect	
[Static Addresses]	00:00:00:00:00:00	
[Normal RX Filter]		
[Frame Types]		
Action	Pass	
Scope	Unlisted	
[SubTypes 1]		
Action	Pass	
SubType	*(Various)*	
Scope	*(Various)*	
[SubTypes 2]		
Action	Pass	
SubType	DIX-IP-TCP-Port	
Scope	00 00	
[Advanced RX Filter]		
[Expressions]		
ExprSeq	0	
Offset	0	
Op	EQ	
Value Id	0	
Action	And	
[Values]		
Value	0	
[Bridging]		
Bridge Priority	1	
Status	Enabled	
Flood Register	Disabled	

Option	Default	Site Setting
WLIF radio port:		
Name	omdpxma	
MAC Address	*(Unique number)*	
Status	Enabled	
Hello Period	2 seconds	
[WLIF]		
Security Id	NORANDOWL	
Node Type	Master	
[Master Parms]		
Channel	1	
Subchannel	1	
Wireless Hops	Disabled	
MAC Config	Default	
[Manual MAC Parms]		
Hop Period	200 ms	
Beacon Frequency	2	
Deferral Slot	Default	
Fairness Slot	Default	
Fragment Size	310	
Transmit Mode	AUTO	
Norm Ack Retry	255	
Frag Ack Retry	255	
Norm QFSK Retry	255	
Frag QFSK Retry	255	
900 MHz radio port:		
Name	omdflca	
MAC Address	*(Unique number)*	
Status	Enabled	
Hello Period	1 second	
[Falcon]		
File Name	falcon_d.29k	
Mode–Channel	*(First mode in list)*	
ARP Server Mode	Disabled	

Option	Default	Site Setting
S-UHF radio port:		
Name	omduhfb	
MAC Address	*(Unique number)*	
Status	Enabled	
Hello Period	2 seconds	
[UHF]		
File Name	synuhf_d.29k	
Call Sign	"" *(empty string)*	
Frequency	*(First frequency in list)*	
Master Mode	Disabled	
Attach Priority	High	
OWL/IP port:		
Name	omdip	
MAC Address	*(Unique number)*	
Status	Enabled	
Hello Period	2 seconds	
[OWL/IP]		
Mode	Listen	
[IP Addresses]		
Type	Unicast	
Address	*(None)*	
[TX Filter]		
[Frame Types]		
Action	Pass	
Scope	Unlisted	
[SubTypes 1]		
Action	Pass	
SubType	*(Various subtypes)*	
Scope	*(Various settings)*	
[SubTypes 2]		
Action	Pass	
SubType	DIX–IP–TCP–Port	
Scope	00 00	

Configuring the Access Point

When you create a local DIAG port or remote Telnet session with the access point, the configuration program's password screen appears:

```
Configuration of Access Point
Copyright (c) 1995-1997 Norand Corporation.  All rights reserved.

Portions copyright Epilogue Technology Corporation 1988-1995.
All rights reserved

IP:        0.0.0.0
Serial:    (Unique 10-digit number.)

Password:
```

" **NOTE:** *A different screen appears when you create a session through a Web browser.* *See page 4-88 for information about Web browser sessions.*

The password screen shows the current settings for the IP address and serial number. It also shows the prompt for the top-level password. Enter the password (case insensitive) to display the Main Menu. The default password is CR52401.

Main Menu

After you enter the top-level password, the Main Menu appears:

```
Loading configuration from EEPROM

Command  Description
File     File system menu
View     View/modify the configuration
Clear    Set the configuration to default values
Read     Read the configuration from EEPROM
Write    Write the configuration to EEPROM
Reboot   Restart using last written configuration
Exit     Disconnect
?        Display this help

>
```

The menu lists the commands you can use to do various tasks, described on the following pages. The screen also displays the command prompt (>). At the prompt, type the name of the command you want to perform and press [Enter]. (Commands are case insensitive.) The Main Menu redisplays when you enter an invalid command.

The following chart describes how to use the commands.

Use	To
File	List file system commands and descriptions. Section 5, "Software Download," describes the commands and file system methodology.
View	View or modify configuration program settings. See "Using the View Command" on page 4-14.
Clear	Reset the access point's configuration to the factory-set default settings, which start on page 4-7.
Read	Load the most recent configuration from EEPROM. The configuration that was written to EEPROM **since the access point was last rebooted** becomes the new configuration.

Use	To
Read *(Continued)*	The access point's configuration is stored in EEPROM. You reprogram the EEPROM whenever you change the configuration, write (save) the new configuration to EEPROM, and reboot the access point.
Write	Write (save) a new configuration to EEPROM. This command overwrites the previous configuration. **You must write the new configuration to EEPROM and reboot the access point for any changes to take effect.**
Reboot	Reboot the access point. You must reboot the unit for any changes you made to the configuration to take effect.
Exit	Quit the configuration program. If you exit a new configuration without writing it to EEPROM, any changes you made are **not** saved.
?	Display online help for a command, option, or setting.

Using the View Command

To view or modify configuration program settings, type View at the command prompt. The Main Options Menu appears:

```
[Tcpip]
[Bridge]
[Security]
```

The following chart describes how to use the options.

Use	To
[Tcpip] *Page 4-16*	Set options necessary for communications with this access point. The options apply to all TCP/IP ports. Telnet, SNMP, and HTTP communications are supported.
[Bridge] *Page 4-23*	Control the bridging of messages among the radio and Ethernet ports for this access point. Settings to control interaction with other access points are also under the [Bridge] option.
[Security] *Page 4-86*	Set the configuration program's top-level password and other security passwords.

The screens in this section show the options' default settings. Some settings (such as the serial number) are unique to each access point. Other settings (such as certain radio configurations) are automatically set and you cannot change them. This section identifies the settings you cannot change as "read-only."

The following chart shows how to navigate the View command's menus and edit data.

Press	To
[↑] or [–]	Scroll up through items in a list.
[↓], [+], [=], or [Tab]	Scroll down through items in a list.
[→], [Enter], or [Spacebar]	Display an option's settings or prompt after you highlight the option. Also use these keys to select the desired setting.
[←], [Esc], or [Backspace]	Exit a menu or prompt.
[Esc]	Cancel editing.
[Enter]	Complete editing.

TCP/IP Options

Use [Tcpip] to set options necessary for communications with this access point, such as IP addresses. Addresses are required for remote setup or SNMP network management. Options are:

```
IP Address          0.0.0.0
IP Subnet Mask      255.255.255.0
IP Router           0.0.0.0
IP Frame Type       <DIX>
DHCP                <Enabled, if IP address is zero>
DHCP Server Name    "Norand DHCP Server"
Auto ARP Minutes    5
```

IP Address

IP Address is the unique address locally assigned to this access point. The prompt is:

```
Range is:
4 nums 0..255
```

The default is 0.0.0.0, which disables the ability to use TCP/IP. Following are suggestions for setting the address:

- If you are installing this access point on an existing Ethernet segment, you should allocate the IP address from the same pool as the existing computers on the segment.
- If you are installing this access point on a new Ethernet segment that is not going to connect to the Internet, try using this Class B address:

  172.16.h.h

The host number is “h.h.” This Class B network address is reserved by the numbering authority for a company’s internal use. If the Class B address appears on the Internet, routers drop the data.

Note the following:

- If the IP address is 0.0.0.0 *and* DHCP is set to “Enabled, if IP address is zero,” this IP address is obtained through DHCP.
- If DHCP is set to Enabled, DHCP is used to obtain the IP address.
- If the IP address is 0.0.0.0 *and* DHCP is disabled, TCP/IP access to this access point is disabled.

A discussion of DHCP starts on page 4-19.

IP Subnet Mask

IP subnets partition traffic and are connected by routers. The subnet mask indicates how many bits of the IP address represent a network number and how many indicate a host number. The prompt is:

```
Range is:
4 nums 0..255
```

The default is 255.255.255.0. Following are suggestions for setting the subnet mask:

- If you are installing this access point on an existing Ethernet segment, the subnet mask should match the other computers on the segment.
- If you are using the 172.16.h.h address suggested for IP Address, you may want to use a subnet mask of 255.255.248.0. This mask provides the network 172.16 with 30 subnets of 2046 computers each.

  The IP address breakdown is:

- 16 bits of network address.
- 5 bits of subnet address. Do not use all 0's or all 1's.
- 11 bits of host address. Do not use all 0's or all 1's.

The following chart lists IP addresses when the submask is 255.255.248.0.

Subnet	First Address	Last Address
1	172.16.8.1	172.16.15.254
2	172.16.16.1	172.16.23.254
3	172.16.24.1	172.16.31.254
.		
.		
.		
30	172.16.240.1	172.16.247.254

If you are using DHCP to obtain an IP subnet mask for this access point, the subnet mask obtained from DHCP overrides the setting for the IP Subnet Mask option.

IP Router

" **NOTE:** *The IP address of the router is required only if this access point will communicate with devices on the other side of the router.*

IP Router identifies the default router used to forward data frames to addresses on another subnet. The prompt is:

```
Range is:
4 nums  0..255
```

The default is 0.0.0.0, which disables the ability to exchange TCP/IP traffic with another subnet or network.

A router that connects subnet 1 to subnet 2 might have the address 172.16.8.1 on subnet 1 and 172.16.16.1 on subnet 2. A host with IP address 172.16.16.5 would specify an IP router address of 172.16.16.1 to reach host 172.16.8.10.

IP routers are usually configured so a computer only needs to know one router's address. This is true even if several routers on the segment connect to several other segments.

If you are using DHCP to obtain an IP router address, and the DHCP server specifies a default IP router, the DHCP server specification overrides the setting for IP Router.

IP Frame Type

IP Frame Type sets the type of frame containing IP traffic:

DIX **802.3**

Setting	Description
DIX *(default)*	Sets Ethernet type to DIX (Ethernet 2.0) for IP frames.
802.3	Sets Ethernet type to 802.3 with a SNAP header for IP frames. Select 802.3 if other network computers use SNAP encapsulation for IP frames.

DHCP

DHCP provides a way for this access point (the client) to obtain IP addresses from a DHCP server on the network. Settings are:

Enabled **Enabled, if IP address is zero** **Disabled**

Setting	Description
Enabled	DHCP always obtains IP addresses for the access point, subnet mask, and (optional) default router when the access point reboots. It also obtains the lease expiration time.
Enabled, if IP address is zero *(default)*	If IP Address is 0.0.0.0, DHCP obtains IP addresses for the access point, subnet mask, and (optional) default router. It also obtains the lease expiration time. The access point ignores other DHCP configuration options.
Disabled	Disables DHCP. You must manually set the IP addresses before the TCP/IP stack is enabled.

" NOTE: *If you are using OWL/IP tunneling, you should not use DHCP to allocate IP addresses to super root candidates or designated bridges unless a permanent lease is used, and the access point is rebooted after getting an address.* *OWL/IP options start on page 4-79.*

The access point responds only to address offers from DHCP or Bootp servers. In either case the server is specified in the DHCP server name field.

DHCP Server Name

The prompt for the DHCP server name is:

```
Range is:
31 chars
```

The access point responds only to the named server. The default server name is "Norand DHCP Server." This name prevents the access point from inadvertently obtaining an IP configuration from existing servers on the network.

If the DHCP server name is configured with a null string (""), the access point responds to offers from any server.

The class identifier string for the access point is “Norand Access Point.” Servers use this string to identify the access point.

Bootp Operation

The access point can also accept addresses from a Bootp server identified in the DHCP server name field. An address offer from a Bootp server is treated as if it were an infinite lease from a DHCP server.

Networks With DHCP and Bootp Servers

If the DHCP server name is configured as “”, the access point responds to either DHCP or Bootp servers. The access point gives preference to DHCP offers. If a Bootp reply arrives at the access point before any DHCP offers are received, the access point waits an additional 4 seconds for a DHCP offer before responding. If a DHCP offer is received within the 4-second period, the Bootp reply is ignored and the DHCP offer is accepted.

Handshaking

When the access point responds to a DHCP or Bootp server, it broadcasts a single ARP request to the address offered. If no ARP response is received within 3 seconds, the access point assumes the IP address is unique and completes the negotiation for that address. If an ARP reply is received before the timeout, the access point assumes the address is a duplicate and declines the offer.

Infinite Leases

A DHCP server may be configured to grant an infinite lease to the access point. A Bootp grant is always treated as an infinite lease. The access point stores the IP address, subnet mask, and default router in the EEPROM configuration register and disables DHCP. These settings are maintained if the access point is powered off or rebooted through the ROM command monitor. To restore DHCP client operation, reconfigure the IP address to 0.0.0.0.

" **NOTE:** *DHCP is documented in RFCs 1533, 1534, and 1541. Bootp is documented in RFC 951.*

Auto ARP Minutes

The access point periodically sends an unsolicited ARP response so routers can update their routing tables. The response enables a network management platform to learn about the access point on the network by querying routers.

Auto ARP Minutes is the number of minutes between periodic ARP requests. The prompt is:

```
Range is:
0..120
```

The default is 5 minutes. A setting of 0 disables Auto ARP Minutes.

If the default router's address is 0, the ARP request is sent to the IP address of this access point. Without the Auto ARP Minutes option, an access point might not use its IP address for extended periods of time and expire from the router's ARP table.

Auto ARP Minutes enhances the discovery of the network architecture by network management tools, such as OpenView by Hewlett-Packard. The network management tool queries IP router ARP tables to locate the active IP addresses for the subnet IP addresses for access points should not be allowed to expire. The network management program would then need to ping all potential addresses on a subnet to locate active IP addresses, or require the user to enter a list.

Bridge Options

Use [Bridge] to configure options that define the bridging topology of the open wireless LAN. Options are:

```
Serial Number          "(Unique 10-digit number.)"
Lan ID                 0
[Root]
[Ports]
ARP Server Mode        <Disabled>
```

Serial Number

Serial Number is a read-only setting that displays this access point's unique 10-digit serial number, which identifies this unit on the network.

Lan ID

The LAN ID (also called *domain*) is a number that logically isolates adjacent but independent open wireless LANs. The prompt is:

```
Range is:
0..254
```

Following are ranges:

- 900 MHz and S-UHF radios: 0 *(default)* to 254.
- WLIF radio: 0 to 15.

" **NOTE:** *For mixed systems containing WLIF radios, you must use LAN ID 0 to 15.*

You should change the default of 0 to another number to avoid a potential conflict with an adjacent network. All access points and wireless stations in the same network **must** have the same LAN ID.

" **NOTE:** *See page 4-87 for information about combining WLIF, 900 MHz, and S-UHF radios in a common network by following basic guidelines for LAN ID and controller setup.*

[Root]

[Root] options apply to access points configured to operate as the super root. They should be set to the same settings in all access points with a nonzero root priority configured. Options are:

```
Root Priority
[Global Radio]
[Global Flooding]
```

Root Priority

Root Priority determines which access points are candidates to become the super root node on the distribution LAN (also called *primary LAN*). The prompt is:

```
Range is:
0..7
```

The default is 1.

Super Root Candidates

Access points assigned a root priority between 1 and 7 are candidates to become the super root. Access points assigned a root priority of 0 are prohibited from becoming the super root.

Super Root Selection

The access point with the highest assigned root priority becomes the super root whenever it is powered on and active. If the current super root goes offline, the remaining candidates negotiate to determine which one becomes the new super root. This normally takes about 1 minute.

The super root is always the access point with the highest root priority (other than 0). If two or more access points have the same root priority, the unit with the highest Ethernet address becomes the super root.

Super Root Redundancy

For *redundancy*, two or three access points should have a nonzero root priority. All other access points should have a root priority of 0. (Redundancy is the ability of another access point to take over if the super root goes offline.)

You should do the following:

- Configure one access point as a primary super root (with the highest root priority).
- Configure one or two access points as "fallback" super roots (with lower priority).
- Configure remaining access points with a root priority of 0.

[Global Radio]

" **NOTE:** *Use the same [Global Radio] settings in all super root candidates.*

[Global Radio] distributes network-wide configuration parameters. Settings in the super root are distributed throughout the network. Options are:

	Set Globally	Value
UHF Rfp Threshold	<Disabled>	70
UHF Frag Size	<Disabled>	250
Falcon Frag Size	<Disabled>	250
Awake Time	<Disabled>	0

The previous sample screen shows the options' default settings, which are optimum for most installations. It is recommended that you not change the defaults.

Option	Description
UHF Rfp Threshold	This option adjusts the S-UHF protocol characteristics for smaller data frames. The recommended setting in most cases is Disabled. For installations that primarily send very small frames, Enabled at the default value of 70 may improve network response time.
UHF Frag Size	For reliable transmission, large frames may be fragmented or split into several smaller frames. The receiver reassembles the fragments into a complete frame. The default is 250.
Falcon Frag Size	For reliable transmission, large frames may be fragmented or split into several smaller frames. The receiver reassembles the fragments into a complete frame. The default is 250.
Awake Time *(Does not apply to WLIF radio.)*	This option establishes an awake time after a station transmits. Portable stations do not enter a power managed state for this time period. The access point may deliver a response without using the pending message delivery mechanism during the awake time. The time is specified in tenths of seconds. When awake time is Disabled (the default), each station uses its own default (2 seconds for 900 MHz or S-UHF stations). Longer awake times may reduce station battery life.

Each [Global Radio] option has the following settings:

```
Set Globally      <Disabled>
Value             0
```

Set Globally

The value for all radios in the system is specified according to how Set Globally is configured.

Setting	Description
Enabled	If this access point is the super root, it sets the value for all stations and access points in the network. This setting has no effect in access points other than the super root.
Disabled *(default)*	The super root does not distribute global parameters. All radios in the network use local settings or defaults.

Value

Following are ranges and defaults for the Value option.

Value	Range	Default
UHF Rfp Threshold	0–250 octets	70
UHF Frag Size	0–250 octets	250
Falcon Frag Size	0–250 octets	250
Awake Time	0–255 (tenths of seconds)	0

[Global Flooding]

" **NOTE:** *Use the same [Global Flooding] settings in all super root candidates.*

Use [Global Flooding] to set system-wide flooding options. The settings are sent throughout the network when and if this access point becomes the super root. Options are:

	Multicast	Unicast
Inbound	<Primary>	<Disabled>
Outbound to Secondaries	<Disabled>	<Disabled>
Outbound to Stations	<Disabled>	<Disabled>

An access point normally forwards frames only to destination addresses it has learned and stored in the forwarding database. Frames are forwarded only on the port that provides the shortest path to the destination address. The access point can be configured to flood frames on one or more ports when the destination address is unknown.

Global flooding options allow for different flooding configurations to optimize performance. Settings in the super root are distributed to all other access points.

A frame flooded toward the distribution LAN (LAN segment containing the super root) is *inbound*. A frame flooded away from the distribution LAN is *outbound*. A special case of outbound is *outbound to secondary LANs*.

" **NOTE:** *A Flooding Level Checklist starts on page 4-31.*

Inbound

Flooding may be configured separately for unicast (single physical address) and multicast (group address) frame types. Many network protocols use multicast messages for establishing and maintaining connections, and use unicast messages for data exchange.

Inbound options are:

```
Multicast      <Primary>
Unicast        <Disabled>
```

Multicast and Unicast options have the following settings:

```
Enabled
Primary
Disabled
```

Setting	Description
Enabled	Access point floods to all ports, similar to a conventional bridge.
Primary *(Multicast default)*	Frames are flooded inbound only. This setting is useful in many wireless installations where the super root, servers, or gateways for wireless stations are on the same Ethernet segment.
Disabled *(Unicast default)*	Frames are not flooded. Use this setting only if the Outbound to Secondaries option is also set to Disabled.

Outbound to Secondaries

Outbound to Secondaries floods frames with unknown destinations to secondary LAN segments. Settings are:

```
Enabled
Registered
Disabled
```

Setting	Description
Enabled	All designated bridges flood to secondary LANs. This setting allows the super root to control flooding for all access points serving as designated bridges for secondary LANs (see page 4-57).
Registered	Designated bridges flood according to their individual flood register settings. This setting allows individual designated bridges to be configured separately.
Disabled *(Multicast and Unicast default)*	Flooding is disabled in all designated bridges. This setting allows the super root to control flooding for all access points serving as designated bridges for secondary LANs (see page 4-57). This setting should be used only if Inbound flooding is Disabled.

Outbound to Stations

Outbound to Stations applies only to access points with the WLIF radio option. Settings are:

Enabled
Disabled

Setting	Description
Enabled	Frames are flooded.
Disabled *(Multicast and Unicast default)*	Frames are not flooded.

Flooding Level Checklist

You can use the following list of questions to determine the required flooding levels for the Inbound and Outbound to Secondaries options. **The list is structured so that you should skip later questions as soon as you determine the appropriate flood level settings.**

If your answer is "I do not know," go to the next question. If you cannot determine the appropriate flooding levels, use the higher (multicast) flooding levels.

" **NOTE:** *If extensive flooding is enabled, it will be more important to set Ethernet filters to reduce unnecessary traffic in the radio network. In general, the need for filters increases with the amount of traffic on the distribution LAN and the flooding levels. Filtering starts on page 4-43.*

1. Is the open wireless LAN used only with NORAND® emulation terminals?

Answer	Settings
Yes	Inbound/Unicast/Disabled Inbound/Multicast/Enabled Outbound to Secondaries/Unicast/Disabled Outbound to Secondaries/Multicast/Disabled

Comments:

Unicast flooding is not required to support NORAND terminal emulation because the NORAND transport layer (used for terminal emulation) periodically generates traffic. Inbound multicast flooding is required. Outbound multicast flooding is not required because NORAND terminal emulation stations do not need to receive multicast frames.

2. Does the network contain only 900 MHz or S-UHF access points?

Answer	Settings
Yes	Inbound/Unicast/Disabled Outbound to Secondaries/Unicast/Disabled

Comments:

Unicast flooding is never required for 900 MHz or S-UHF access points, since stations supporting these media options establish reliable connections as they roam between access points. The correct port for S-UHF or 900 MHz stations is always known.

3. Do all nodes in the radio network routinely transmit a frame at least once every 4 minutes?

Answer	Settings
Yes	Inbound/Unicast/Disabled Outbound to Secondaries/Unicast/Disabled

4. Do any nodes in the radio network need to receive multicast or broadcast messages?

Answer	Settings
No	Inbound/Multicast/Enabled Outbound to Secondaries/Multicast/Disabled

Note: TCP/IP nodes must receive broadcast ARP frames.

Comments:

The destination of a multicast frame is never known. The Disabled setting should be used for any network where stations do not need to receive multicast frames. The Disabled setting can be used for secondary LANs that only need to receive ARP frames. When WLIF wireless stations must receive multicast frames, set Outbound to Stations to Enabled.

5. Do nodes in the radio network communicate with other nodes in the radio network?

Answer	Settings
Yes	Inbound/Unicast/Enabled Inbound/Multicast/Enabled
No	Inbound/Unicast/Primary Inbound/Multicast/Primary Outbound to Secondaries/Unicast/Registered Outbound to Secondaries/Multicast/Registered

Comments:

The Enabled settings facilitate peer-to-peer applications, where nodes in the open wireless LAN communicate with each other.

In general, the Primary and Registered settings are designed for client or terminal applications where nodes in the open wireless LAN communicate with server nodes on the distribution LAN.

6. Do radio-equipped wireless station nodes (open or non-wireless LAN) need to receive multicast or broadcast frames?

Answer	Setting
Yes	Outbound to Stations/Multicast/Enabled

7. Does the radio network contain WLIF nodes that do not periodically generate traffic?

Answer	Setting
Yes	Inbound/Unicast/Primary Outbound to Secondaries/Unicast/Registered* *or* Inbound/Unicast/Enabled**

* *Support communications with a distribution LAN.*
** *Supports general peer-to-peer communications.*

▪ **NOTE:** *WLIF nodes using NORAND terminal emulation periodically generate traffic, and do not require flooding.*

Comments:

You may need to enable unicast flooding if the radio network contains WLIF terminal nodes or nodes on a secondary Ethernet LAN that do not periodically generate traffic. Occasional traffic is needed to maintain information in the forwarding database.

You can also do the following:

- Use the Outbound to Secondaries/Unicast/ Enabled setting to force unicast flooding to WLIF nodes.
- Use the Inbound/Unicast/Primary or Outbound to Secondaries/Unicast/Registered setting in combination with the Flood Register/Unicast setting for selected secondary Ethernet LANs.

  These settings avoid network-wide universal flooding if nodes that do not periodically generate traffic are restricted to those secondary Ethernet LANs.

8. Does the radio network contain a secondary Ethernet LAN(s) with connected nodes that do not periodically generate traffic?

Answer	Setting
Yes	Outbound to Secondaries/Unicast/Enabled
	Alternatively, you can configure permanent addresses in the Static Address Table (page 4-42).

9. Does the radio network contain a secondary Ethernet LAN(s) with connected nodes that must receive multicast or broadcast frames?

Answer	Setting
Yes	Inbound/Multicast/Primary Outbound to Secondaries/Multicast/Registered *or* Inbound/Multicast/Enabled Outbound to Secondaries/Multicast/Registered

Comments:

- You can use the settings listed in the above chart in combination with a Flood Register setting of Multicast for selected secondary Ethernet LANs, if nodes in the radio network that must receive broadcast or multicast frames are restricted to those LANs.
- You should use the Outbound to Stations/Enabled setting if wireless stations must receive multicast frames. For example, TCP/IP wireless stations may need to receive broadcast ARP requests.
- You can use Ethernet filters to reduce multicast flooding for any Inbound or Outbound to Secondaries setting other than Disabled.

S-UHF Flooding Level

Because of its low bandwidth, S-UHF is vulnerable to excess traffic from busy backbones. The recommended settings for S-UHF is Inbound/Disabled *and* Outbound to Secondaries/Disabled (for the multicast and unicast options). These settings prevent excessive traffic from being forwarded onto the RF medium.

Flood Register

You can use the Inbound option and Outbound to Secondaries option in combination with the Flood Register setting for the Ethernet port. You can configure the network so that unicast or multicast frames are flooded only to secondary Ethernet LANs that have unicast or multicast flooding (or both) enabled. Unicast and multicast flooding options for secondary Ethernet LANs start on page 4-59.

ARP Server Mode

ARP Server Mode can convert multicast ARP requests to unicast ARP requests for stations in the forwarding database. ARP Server Mode can significantly improve wireless network performance in busy IP networks. Settings are:

Disabled
No Flooding
Delay Flooding
Normal Flooding

When ARP Server Mode is enabled, the IP addresses are included in the forwarding database entry for the station. The ARP server learns the IP addresses of wireless stations by monitoring ARP packets. Additionally, some stations may have the capability of explicitly registering IP addresses with the ARP server.

Setting	Description
Disabled *(default)*	No special action is taken when an ARP is received. Multicast ARP requests are subject to the Ethernet filters and the flooding settings. The Disabled setting is useful when a system has no IP radio traffic or has stations that do not register IP addresses.
No Flooding	ARP server converts ARPs from multicast to the unicast address of the destination station. No Flooding is the most efficient configuration, since multicast ARPs are never forwarded. Use of this setting requires stations to register IP addresses with the access point. Use No Flooding or Disabled if wireless stations do not need to respond to ARPs.
Delay Flooding	ARP server converts ARPs from multicast to the unicast address of the destination station. If the destination address is unknown, the initial ARP request is not forwarded. If the requesting device retries the ARP request, second and subsequent ARP requests are forwarded. ARP requests from wireless stations are flooded inbound. Delay Flooding is the preferred option when wireless stations should respond to ARPs, but are not capable of registering their IP addresses with the access point.
Normal Flooding	ARP server converts ARPs from multicast to the unicast address of destination station. If the destination address is unknown, the ARP request is flooded according to the multicast flood level settings. ARP requests from wireless stations are flooded inbound. Normal Flooding is useful when wireless stations need to respond to ARP requests, but are not capable of registering IP addresses with the access point. Normal Flooding sends more unnecessary ARPs over wireless links then delay flooding. Normal Flooding does not introduce occasional delays in ARP responses as Delay Flooding does.

[Ports]

Use [Ports] to define options for the access point's Ethernet port, radio ports, and OWL/IP (IP tunneling) port. The following sample screen shows all the ports.

```
   Name          MAC Address       Status    Hello Period
1  "omde"        00:00:00:00:00:00 <Enabled> <2 Seconds>
2  "omdpxma"     00:00:00:00:00:00 <Enabled> <2 Seconds>
3  "omdflca"     09:46:19:01:0a:02 <Enabled> <1 Second>
4  "omduhfb"     01:55:b2:b3:90:e5 <Enabled> <2 Seconds>
5  "omdip"       00:00:00:00:00:00 <Enabled> <2 Seconds>
```

Because the system software autosenses the type of radio option installed in each port, your screen displays only the ports for the installed radios.

The following chart defines options in the Name column.

Option	Description
omde	Ethernet port
omdpxma (or omdpxmb)	WLIF (Proxim 2.4 GHz) radio port
omdflca (or omdflcb)	Falcon (900 MHz) radio port
omduhfb	S-UHF radio port
omdip	OWL/IP port (IP tunneling)

Select a port to display its options:

```
Name              (Depends on the port.)
MAC Address       00:c0:b2:00:00:00
Status            <Enabled>
Hello Period      <2 Seconds>
[Ethernet]
[WLIF]
[Falcon]
[UHF]
[OWL/IP]
```

Name, MAC Address, Status, and Hello Period appear for all ports. The remaining options appear as follows:

[Ethernet]	Appears if you selected "omde." Options start on page 4-41.
[WLIF]	Appears if you selected "omdpxma" (or "omdpxmb") *and* a WLIF radio is installed in either PC card slot. Options start on page 4-60.
[Falcon]	Appears if you selected "omdflca" (or "omdflcb") *and* a 900 MHz radio is installed in either PC card slot. Options start on page 4-74.
[UHF]	Appears if you selected "omduhfb" *and* a S-UHF radio is installed in its PC card slot. Options start on page 4-76.
[OWL/IP]	Appears if you selected "omdip." Options start on page 4-79.

Name

The read-only Name setting displays the driver name for the type of device occupying this communication port. For example, "omde" is the driver name for the Ethernet port. The name is for internal system use.

MAC Address

MAC Address is a read-only option that displays the network address of the Ethernet port or radio port. The access point automatically identifies the addresses of devices installed in or attached to its communication ports.

" **NOTE:** *After you reconfigure and reboot the access point, wait for the power-up sequence to complete before you check the MAC address. The proper address should appear after you reboot the access point.*

If you do not wait for the access point to completely power up, the MAC address may display all zeros. However, the access point should still operate normally.

Status

The Status option sets the condition of the Ethernet port or radio port. Settings are:

Enabled
Disabled

Setting	Description
Enabled *(default)*	Port is available for use.
Disabled	Port is not available for use.

Hello Period

The hello period determines how frequently the access point broadcasts hello messages on the network. On Ethernet links and wireless links between access points, hello messages are used to maintain the spanning tree. On wireless links, hellos also serve as beacon messages to synchronize communications with power managed stations.

Settings for Hello Period are:

1 Second
2 Seconds
3 Seconds

The hello period can be 1 or 2 seconds *(default)* on 900 MHz or S-UHF radio links. A 1-second hello period requires the wireless station to wake up more often, which increases battery usage. However, a 1-second hello period can reduce the delay before a pending message is received. For most installations, the default (2 seconds) is recommended.

The Ethernet hello period can be set to 2 or 3 seconds.

Ethernet Options

Use [Ethernet] to set Ethernet port options:

```
OWL Frame Type          <DIX>
Cable Type              <Auto Detect>
[Static Addresses]
[Normal RX Filter]
[Advanced RX Filter]
[Bridging]
```

OWL Frame Type

OWL Frame Type is the Ethernet type for communication among access points (open wireless LAN frames). Settings are:

```
DIX
SNAP
```

Setting	Description
DIX *(default)*	Adds DIX (Ethernet 2.0) header to open wireless LAN frames. DIX is the default because it adds less overhead to the wireless data.
SNAP	Adds an 802.3 SNAP header to open wireless LAN frames. In some cases, open wireless LAN frames must be encapsulated in SNAP frames.

Cable Type

Cable Type specifies the type of Ethernet medium to which the access point is connected. It is recommended that you explicitly set the cable type. Settings are:

10BaseT
10Base2
AUI
Auto Detect

Setting	Description
10BaseT	Selects the RJ11 connector (sets type to 10BASE-T, twisted pair). The cable type defaults to 10BASE-T if no traffic is heard on any Ethernet port (10BASE2, 10BASE5, or 10BASE-T) during a 10-second time window when the access point starts up.
10Base2	Selects the BNC connector (sets type to 10BASE2, thinnet).
AUI	Selects the AUI 15-pin D-sub connector (sets type to 10BASE5 thicknet, and other types).
Auto Detect *(default)*	Automatically selects the correct cable type by listening for traffic on the Ethernet ports during initialization. For this to work, the access point must be connected to the Ethernet medium during system start-up, and another device on the Ethernet medium must be transmitting at least one frame every 10 seconds.

[Static Addresses]

Use [Static Addresses] to define a list of 20 or fewer permanent unicast 802 MAC addresses connected to this Ethernet port. The Static Address Table displays the addresses:

```
1  00.00.00.00.00.00
2  00.00.00.00.00.00
3  00.00.00.00.00.00
.
.
.
20   00.00.00.00.00.00
```

Select an address, then type 6 hexadecimal pairs for the new address at the prompt:

```
Range is:
6 hex pairs
```

Static addresses become permanent entries in the route table. This is useful when configuring designated bridges for secondary LANs, since it reduces the need to flood frames to wired stations on the secondary LAN segment. See page 4-57 for discussion of designated bridges for secondary LANs.

[Normal RX Filter]

Ethernet filters allow elimination of frame types that do not need to be forwarded to wireless stations. The main benefit of filtering is reduction in unnecessary wireless transmissions. Options are:

```
[Frame Types]
[SubTypes 1]
[SubTypes 2]
```

[Frame Types] allows filters to be established for common networking protocols such as IP, Novell IPX, and 802.2 LLC (Logical Link Control). Separate selections are available for each of the three Ethernet standards: DIX (Ethernet 2.0), 802.3, and 802.3 SNAP.

A filter may be configured to pass or drop all frames of a given type. Alternatively, filters may be set to operate on selected subtypes within each frame type category. [SubTypes 1] lists several *predefined* frame types as well as *user-defined* frame types. Settings under [SubTypes 2] allow additional *user-defined* frame subtypes to be specified. The default access point configuration passes all frame types.

[Frame Types]

[Frame Types] options are:

	Action	Scope
DIX-IP-TCP Ports	<Pass>	<Unlisted>
DIX-IP-UDP Ports	<Pass>	<Unlisted>
DIX-IP-Other Protocols	<Pass>	<Unlisted>
DIX-IPX Sockets	<Pass>	<Unlisted>
DIX-Other EtherTypes	<Pass>	<Unlisted>
SNAP-IP-TCP Ports	<Pass>	<Unlisted>
SNAP-IP-UDP Ports	<Pass>	<Unlisted>
SNAP-IP-Other Protocols	<Pass>	<Unlisted>
SNAP-IPX Sockets	<Pass>	<Unlisted>
SNAP-Other EtherTypes	<Pass>	<Unlisted>
802.3-IPX Sockets	<Pass>	<Unlisted>
802.2-IPX Sockets	<Pass>	<Unlisted>
802.2-Other SAPs	<Pass>	<Unlisted>

Frame Type	Description
DIX–IP–TCP Ports DIX–IP–UDP Ports SNAP–IP–TCP Ports SNAP–IP–UDP Ports	Primary Internet Protocol Suite (IP) transport protocols.
DIX–IP–Other Protocols SNAP–IP–Other Protocols	IP protocols other than TCP or User Datagram Protocol (UDP).
DIX–IPX Sockets SNAP–IPX Sockets 802.3–IPX Sockets	Novell NetWare protocol.
DIX–Other EtherTypes SNAP–Other EtherTypes	DIX or SNAP registered protocols other than IP or IPX.
802.2–IPX Sockets	Novell running over 802.2 LLC.
802.2–Other SAPs	SAPs other than IPX or SNAP.

" **NOTE:** *Some IP protocol ports cannot be filtered because they are used for configuration and management of the access point. These include HTTP, Telnet, SNMP, and Internet Control Message Protocol (ICMP). Filters set for these protocols are ignored for the Ethernet frame type configured in the access point's [Tcpip] menu.*

Frame types have the following settings:

```
Action    <Pass>
Scope     <Unlisted>
```

Setting	Description	
Action	Defines how the frame is processed:	
	Pass *(default)*	Frame is passed to the bridging function for further processing.
	Drop	Frame is discarded.

Setting	Description	
Scope	Defines whether the action applies to all frames of this type, or is restricted to selected subtypes:	
	Unlisted *(default)*	Applies only to subtypes that are not configured under [SubTypes 1] or [SubTypes 2].
	All	Applies to all frames of this type. [SubTypes 1] and [SubTypes 2] settings for this frame type are ignored.

[SubTypes 1]

The predefined subtypes in the [SubTypes 1] menu provide preconfigured filters that are useful in many networks. The values for these subtypes cannot be changed. Subtypes are:

	Action	SubType	Value
DIX-ARP	<Pass>	<DIX-EtherType>	08 06
SNAP-ARP	<Pass>	<SNAP-EtherType>	08 06
802.2-IPX-RIP	<Pass>	<802.2-IPX-Socket>	04 51
802.2-IPX-SAP	<Pass>	<802.2-IPX-Socket>	04 53
NNL	<Pass>	<DIX-EtherType>	87 5b
NETBIOS	<Pass>	<802.2-SAP>	f0 f0
1	*(User-defined subtypes.)*		
(through)			
16	*(User-defined subtypes.)*		

User-Defined Subtypes in [SubTypes 1] and [SubTypes 2]

The value under *user-defined subtypes* allow individual protocol ports, sockets, or SAPs to be specified for each of the listed frame types. The filter takes action if either the source or destination fields in the frame match the specified port, socket, or SAP. A value of 00 00 denotes the subtype as *Unlisted*.

Subtypes for [SubTypes 2] are:

```
   Action      SubType              Value
1  <Pass>  <DIX-IP-TCP-Port>    00 00
2  <Pass>  <DIX-IP-TCP-Port>    00 00
3  <Pass>  <DIX-IP-TCP-Port>    00 00
.
.
.
22 <Pass>  <DIX-IP-TCP-Port>    00 00
```

Subtype	Value
DIX–IP–TCP–Port	Port value in hexadecimal.
DIX–IP–UDP–Port	Port value in hexadecimal.
DIX–IP–Protocol	Protocol number in hexadecimal.
DIX–IPX–Socket	Socket value in hexadecimal.
DIX–EtherType	Specify the registered DIX type in hexadecimal.
SNAP–IP–TCP–Port	Port value in hexadecimal.
SNAP–IP–UDP–Port	Port value in hexadecimal.
SNAP–IP–Protocol	Port value in hexadecimal.
SNAP–IPX–Socket	Socket value in hexadecimal.
SNAP–EtherType	SAP in hexadecimal. To filter on both SAP and OUI (Organizationally Unique Identifier), use advanced filters.
802.3–IPX-Socket	Socket value in hexadecimal.
802.2–IPX-Socket	Socket value in hexadecimal.
802.2–SAP	SAP in hexadecimal.

" **NOTE:** *Port values may be entered in decimal, by adding a period to the entry. For example, "23." for port 23. The Value field displays the hexadecimal equivalent.*

Filtering Examples

The following network examples illustrate how filters may be set to optimize wireless performance. The sample network in Figure 4-3 contains the following:

- Wireless stations using IP.
- A secondary LAN containing IP and IPX hosts, linked by access points (AP) 2 and 4.
- An IPX router connecting to another Novell network.
- DIX and 802.3 SNAP frames.

" **NOTE:** *Many networks use only one Ethernet frame type. DIX is the most common type. Set filters only for the Ethernet frame types found on your network.*

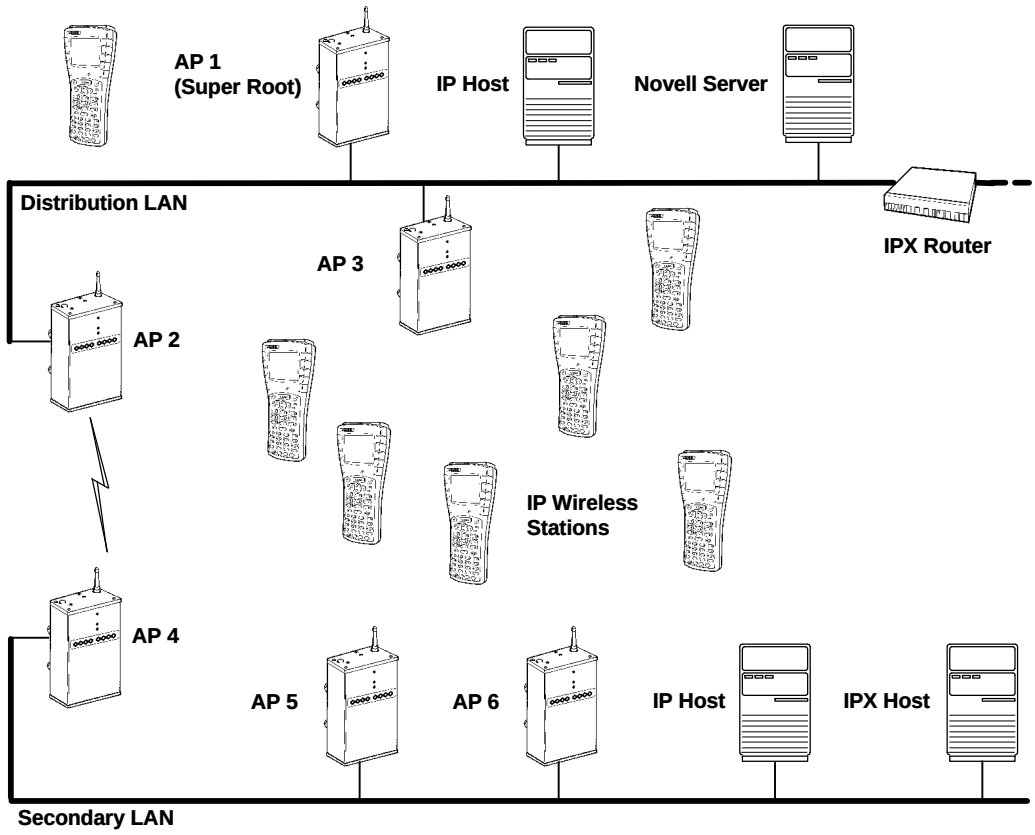


Figure 4-3
Access Points Servicing IP Wireless Stations

Example 1

Access points 1, 3, 5, and 6 in Figure 4-3 service only IP wireless stations. In these access points it is desirable to pass necessary IP traffic, but eliminate unnecessary IPX traffic. These do not need to be forwarded to the secondary LAN. In this case it is not necessary to use the [SubTypes 1] or [SubTypes 2] configuration.

In example 1, [Frame Types] is set as follows:

	Action	Scope
DIX-IP-TCP Ports	<Pass>	<All>
DIX-IP-UDP Ports	<Pass>	<All>
DIX-IP-Other Protocols	<Pass>	<All>
DIX-IPX Sockets	<Drop>	<All>
DIX-Other EtherTypes	<Pass>	<Unlisted>
SNAP-IP-TCP Ports	<Pass>	<All>
SNAP-IP-UDP Ports	<Pass>	<All>
SNAP-IP-Other Protocols	<Pass>	<Unlisted>
SNAP-IPX Sockets	<Drop>	<All>
SNAP-Other EtherTypes	<Pass>	<Unlisted>
802.3-IPX Sockets	<Pass>	<Unlisted>
802.2-IPX Sockets	<Pass>	<Unlisted>
802.2-Other SAPs	<Pass>	<Unlisted>

Example 2

Access points 2 and 4 in Figure 4-3 service IP wireless stations as well as wired IP and IPX hosts on the secondary LAN. These access points have an additional requirement to pass IPX traffic.

The IPX router in this network periodically sends IPX-RIP (Routing Information Protocol) frames for coordinating with other routers. These do not need to be forwarded to the secondary LAN because the secondary LAN does not contain a router.

To filter the RIP frames, it is necessary to use the [SubTypes 1] configurations. The example sets filters for three different cases: DIX, 802.2, or 802.3 SNAP frames. In many actual networks, only one of these would be required, since all stations would be configured for one of the three options.

In example 2, [Frame Types] is set as follows:

	Action	Scope
DIX-IP-TCP Ports	<Pass>	<All>
DIX-IP-UDP Ports	<Pass>	<All>
DIX-IP-Other Protocols	<Pass>	<All>
DIX-IPX Sockets	<Pass>	<Unlisted>
DIX-Other EtherTypes	<Pass>	<Unlisted>
SNAP-IP-TCP Ports	<Pass>	<All>
SNAP-IP-UDP Ports	<Pass>	<All>
SNAP-IP-Other Protocols	<Pass>	<Unlisted>
SNAP-IPX Sockets	<Pass>	<Unlisted>
SNAP-Other EtherTypes	<Pass>	<Unlisted>
802.3-IPX Sockets	<Pass>	<Unlisted>
802.2-IPX Sockets	<Pass>	<Unlisted>
802.2-Other SAPs	<Pass>	<Unlisted>

[SubTypes 1] options are configured to drop IPX RIP for 802.2, DIX, and 802.3 frames. DIX is already specified as a predefined filter. For 802.2 and 802.3 frames, it is necessary to use a user-defined filter.

In example 2, [SubTypes 1] is set as follows:

	Action	SubType	Value
DIX-ARP	<Pass>	<DIX-EtherType>	08 06
SNAP-ARP	<Pass>	<SNAP-EtherType>	08 06
802.2-IPX-RIP	<Drop>	<802.2-IPX-Socket>	04 51
802.2-IPX-SAP	<Pass>	<802.2-IPX-Socket>	04 53
NNL	<Pass>	<DIX-EtherType>	87 5b
NETBIOS	<Pass>	<802.2-SAP>	f0 f0
1	<Drop>	<DIX-IPX-Socket>	04 51
2	<Drop>	<802.3-IPX-Socket>	04 51
3	<Pass>	<DIX-IP-TCP-Port>	00 00
4	<Pass>	<DIX-IP-TCP-Port>	00 00

[Advanced RX Filter]

If you need more flexibility than that provided by [Normal RX Filter], you can use the tables for [Advanced RX Filter] to specify additional filters. Settings for [Advanced RX Filter] execute after those for [Normal RX Filter]. For example, if [Normal RX Filter] dropped a frame, the frame cannot be "undropped." If [Normal RX Filter] passed a frame, [Advanced RX Filter] then executes.

Specifying an advanced filter for [Advanced RX Filter] is more complicated than specifying one for [Normal RX Filter]. If possible, use [Normal RX Filter] to set filters.

[Advanced RX Filter] options are:

[Expressions] **[Values]**

[Expressions]

Use [Expressions] to enter expressions used to match the patterns stored in pattern lists to consecutive bytes in received Ethernet frames. Settings for Expressions execute in sequence until a determination is made to pass or drop the frame, as follows:

- If the last Then listed in this table is Then Drop, the table's default is an implied Else Pass.
- If the last Then is Then Pass, the default is an implied Else Drop.

The Value Table displays the filter expressions to be executed:

```
ExprSeq Offset      Mask    Op     Value Id  Action
1       0           0         <EQ>              0 <And>
2       0           0         <EQ>              0 <And>
3       0           0         <EQ>              0 <And>
.
.
.
22      0           0         <EQ>              0 <And>
```

Filter expressions have the following settings:

```
ExprSeq          0
Offset           0
Mask
Op               <EQ>
Value Id         0
Action           <Pass>
```

ExprSeq

ExprSeq contains a sequence number that orders expressions in ascending order. It is a method of changing the sequence execution. The prompt is:

```
Range is:
0..65535
```

The default is 0. Change these numbers as needed for reordering. After you save the changes (through the Write command), the statements are physically reordered and renumbered.

Offset

This setting defines the offset in a received Ethernet frame to match the patterns. The prompt is:

```
Range is:
0..65535
```

A frame matches a pattern list if the masked bytes at the specified offset in the frame match any of the masked patterns in the pattern list. The default is 0.

Mask

This setting indicates the bits that are significant at the specified offset. The prompt is:

```
Range is:
8 hex pairs
```

The default is "" *(an empty string).*

The length of this mask determines the number of characters compared at the offset. If this field is "" *(an empty string,* the default*),* the length of the field is determined by the longest value in the Value Table with the matching Value Id.

Op

Op is a memory comparison operator in the following chart.

Operator	Description
LT	Less than one value.
LE	Less than or equal to one value.
EQ *(default)*	Equal to any in the list.
NE	Not equal to any in the list.
GE	Greater than or equal to one value.
GT	Greater than one value.

Value Id

The field at the specified offset is compared with values in the Value Table with the Value Id. The prompt is:

```
Range is:
0..255
```

The default is 0. When using a comparison operator that requires a single value (LT, LE, GE, and GT), only the first value found will be compared.

Action

The Action setting instructs the Ethernet driver and indicates what should happen when this expression is true. Settings are:

```
And
Pass
Drop
```

Setting	Description
And	Instructs Ethernet driver to continue with the next simple expression, if the expression condition is satisfied. Two or more simple expressions are ANDed together to form a complex expression.
Pass *(default)*	Instructs Ethernet driver to accept the frame for further processing and pass the frame up to the bridging layer (the frame is not discarded).
Drop	Instructs Ethernet driver to reject the frame.

[Values]

Use [Values] to enter pattern lists that contain byte patterns that match consecutive bytes in received Ethernet frames. Settings for [Values] are referenced by the Value Id from the Expression Table. The values to be used in a filter expression are as follows:

Value Id	Value
1	0
2	0
3	0
.	
.	
.	
22	0

Filter expression values have the following settings:

```
Value Id      0
Value
```

Setting	Description
Value Id	An identifier used by an expression in the Expression Table. The range is 0 *(default)* to 255. All values with the same identifier are considered to be in the same list. When used in an expression that allows only one value (that is, LT, LE, GE, or GT), only the first value in the list is used.
Value	One of the values to be compared. The range is 8 hexadecimal pairs.

[Bridging]

[Bridging] options are:

```
Bridge Priority      1
Status               <Enabled>
Flood Register       <Disabled>
```

Bridge Priority

The bridge priority allows selection of the access point serving as a designated bridge for a secondary LAN. As with the root priority, the bridge priority allows designation of access points as primary or fallback bridges. The prompt is:

```
Range is:
0..7
```

" **NOTE:** *The S-UHF radio option does not support designated bridging.*

Designated Bridge Candidates

Access points with a bridge priority between 1 *(default)* and 7 are candidates to become the designated bridge; access points with a bridge priority of 0 are prohibited from bridging. The access point with the highest bridge priority (other than 0) becomes the designated bridge whenever it is connected (powered on and active) to the secondary LAN.

If two access points have the same bridge priority, the access point with the highest Ethernet address becomes the designated bridge. However, a lower bridge priority access point may become the designated bridge if the wireless link to a higher bridge priority access point is unacceptable.

Designated Bridge Selection

If the current designated bridge goes offline, the remaining candidates negotiate to determine which one becomes the new designated bridge.

Summary

In summary, the designated bridge:

- Physically connects to a secondary Ethernet LAN.
- Is within the radio coverage area of an access point on the distribution LAN.
- Has the highest nonzero bridge priority. If it has the same bridge priority as another access point, then it has the highest Ethernet address (unless the access point with the highest priority is out of radio range).

Status

The Status option determines if the access point can function as a designated bridge. Settings are:

Enabled **Disabled**

Setting	Description
Enabled *(default)*	This access point may function as the designated bridge for the secondary Ethernet LAN.
Disabled	This access point cannot be the designated bridge for the secondary Ethernet LAN. The Disabled setting has the same effect as setting Bridge Priority to 0. The Disabled setting is valuable for debug.

Flood Register

As the designated bridge for this secondary Ethernet LAN, the access point can register the type of frames it expects to flood — unicast, multicast, or both. This information is registered with other access points. Setting [Global Flooding] settings in the super root overrides individual Flood Register settings in designated bridges.

Flood Register settings are:

Disabled
Multicast
Unicast
Enabled

" **NOTE:** *Set the same Flood Register setting in any access point that is a candidate to become the designated bridge for a secondary Ethernet LAN.*

Setting	Description
Disabled *(default)*	No flooding occurs. (The super root, however, enables flooding if the Outbound to Secondaries Multicast or Unicast option is set to Enabled.*)
Multicast	Enables multicast flooding. (The super root disables multicast flooding if the Outbound to Secondaries Multicast option is set to Disabled.*)
	No unicast flooding occurs. (The super root enables unicast flooding if the Outbound to Secondaries Unicast option is set to Enabled.*)
Unicast	Enables unicast flooding. (The super root disables unicast flooding if the Outbound to Secondaries Unicast option is set to Disabled.*)
	No multicast flooding occurs. (The super root enables multicast flooding if the Outbound to Secondaries Multicast option is set to Enabled.*)

* *See page 4-29 for more information about Outbound to Secondaries.*

Setting	Description
Enabled	Multicast and unicast flooding occurs. (The super root disables flooding if the Outbound to Secondaries Multicast or Unicast option is set to Disabled.*)

* *See page 4-29 for more information about Outbound to Secondaries.*

Global flooding settings in the super root take precedence over Flood Register settings.

WLIF Options

" **NOTE:** *Appendix B provides additional information about the WLIF radio.*

Use [WLIF] to set Proxim 2.4 GHz radio options:

```
Security Id          "NORANDOWL"
Node Type            <Master>
[Master Parms]
MAC Config           <Default>
[Manual MAC Parms]
```

" **NOTE:** *[Slave Parms] appears instead of [Master Parms] if Node Type is set to Slave. [Manual MAC Parms] appears if MAC Config is set to Manual.*

Security Id

Security Id prevents unauthorized wireless stations from associating with this access point. The prompt is:

```
Range is:
20 chars
```

The default security ID is NORANDOWL.

All WLIF access points and wireless stations in the network **must** have the same security ID to communicate. The security ID is case sensitive. That is, if the access point's security ID is in uppercase, the wireless station's must also be in uppercase. Refer to the wireless station's user guide for more information about setting its security ID.

Node Type

Node Type determines if this radio is a Master to which wireless stations attach, or is a Slave radio that must attach to a Master. Configuration of a WLIF radio as a Slave is necessary if the access point is configured as a wireless access point, or the designated bridge for a secondary LAN.

Configuration as a wireless access point requires installation of two WLIF radios: one Master and one Slave. The Master radio services stations local to the wireless access point. The Slave radio provides communications between the wireless access point and the network infrastructure. Figure 4-4 on page 4-65 shows a network example.

Node Type options are:

Master **Slave**

Setting	Description
Master *(default)*	The port is configured to communicate with wireless stations.
Slave	The port is configured to communicate with other access points.

[Master Parms]

[Master Parms] contains parameters the access point needs when you configure it as a Master radio. Settings are:

```
Channel              1
Subchannel           1
Wireless Hops        <Disabled>
```

Channel and Subchannel

Channel sets this radio's hopping sequence. Subchannel enables access points to share the same channel without receiving another access point's frames. The prompt for Channel and Subchannel is:

```
Range is:
0..15
```

The default for Channel and Subchannel is 1.

The channel **must** be unique for each access point located close enough together (within the same coverage area) such that a wireless station may choose to connect with any of them. To maximize the available bandwidth, the channel and subchannel pair should be unique for each closely located access point.

When channels are different among access points, an access point cannot receive another access point's traffic. An access point discards frames if the channel and subchannel IDs in the frame header do not match the access point's channel and subchannel settings.

Two access points on different subchannels share the same hopping sequence, but behave as if they were on different channels.

Network With 15 or Fewer Access Points

If 15 or fewer access points are on the network, the channel should be different for all access points. The subchannel can be the same as or different than the channel.

EXAMPLE 1: The channel and subchannel could be set as follows (the access point number in the first column is arbitrary):

Access Point	Channel	Subchannel
1	1	1
2	2	1
3	3	1
4	4	1
5	5	1
6	6	1
7	7	1
8	8	1
9	9	1
10	10	1
11	11	1
12	12	1
13	13	1
14	14	1
15	15	1

Network With 16 or More Access Points

When the number of in-range access points is 16 or more, channels must be reused. The channel can be the same for two or more, but they should have different subchannels.

In this case, access points using the same channel receive traffic for another access point but discard frames with the incorrect subchannel. To minimize interference, access points using the same channel (but different subchannels) should be physically located outside the radio range of one another.

EXAMPLE 2: If 43 access points are on the network, 1 to 15 could be assigned the channel and subchannel numbers in the previous example. Access points 16 to 43 could be set as follows (the access point number in the first column is arbitrary):

Access Point	Channel	Subchannel
16	1	2
17	2	2
18	3	2
19	4	2
20	5	2
21	6	2
22	7	2
23	8	2
24	9	2
25	10	2
26	11	2
27	12	2
28	13	2
29	14	2
30	15	2
31	1	3
32	2	3
33	3	3
34	4	3
35	5	3
36	6	3
37	7	3
38	8	3
39	9	3
40	10	3
41	11	3
42	12	3
43	13	3

Wireless Hops

To create a wireless hop, you must enable one or more WLIF radios on the distribution LAN as wireless hopping Masters and then configure the Slave stations (through [Slave Parms]) to connect to these Masters.

EXAMPLE: In Figure 4-4, two access points have two WLIF radios. One radio is configured as a Master to provide the wireless connection to the distribution LAN. The other radio is configured as a Slave to service wireless station traffic.

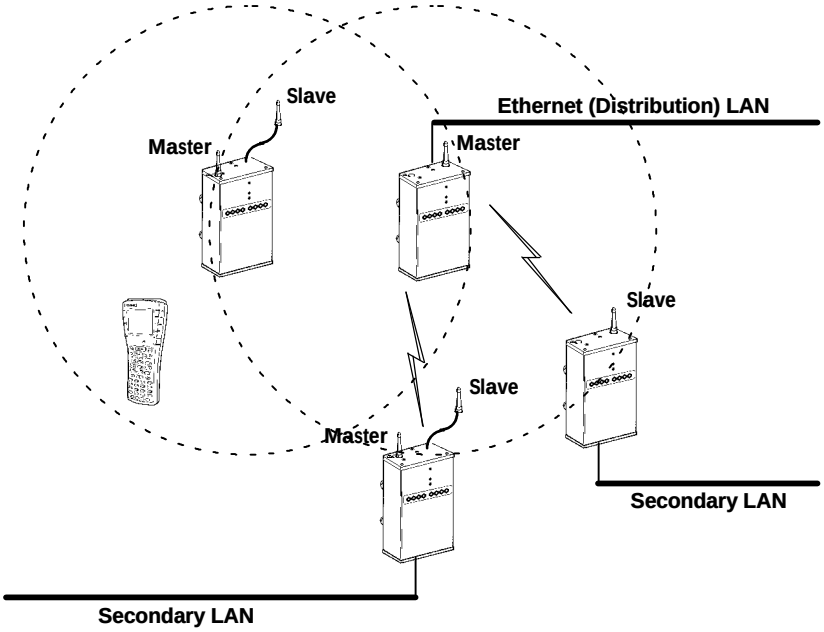


Figure 4-4
Wireless Hopping Through WLIF Radios

" **NOTE:** *For best performance, use one or two external antenna kits when using two WLIF radios. A minimum separation of 10 feet (3 meters) between antennas is required.*

Settings for the Master are:

Enabled
Disabled

Setting	Description
Enabled	Sets up this access point's radio port to wireless hop. This access point honors connections from an access point with a Slave radio.
Disabled *(default)*	Prevents this access point's radio port from wireless hopping. This access point does not honor connections from an access point with a Slave radio.

[Slave Parms]

[Slave Parms] contains parameters this radio needs when you configure it as a Slave radio. Options are:

	Channel	Subchannel
Master 1	**1**	**1**
Master 2	**0**	**0**
Master 3	**0**	**0**
Master 4	**0**	**0**
Master 5	**0**	**0**
Master 6	**0**	**0**
Master 7	**0**	**0**
Master 8	**0**	**0**

For the WLIF radio to wireless hop, at least one access point on the secondary LAN must be equipped with a WLIF radio configured for Slave mode. The secondary LAN can be one of the following:

- An Ethernet segment.
- The radio range of a single access point with two radios. One radio must be operating as a Master to service wireless station traffic. The other radio must be operating as a Slave to provide the wireless hop to the distribution LAN.

" **NOTE:** *You must set the Root Priority for the access point with the Slave radio to 0 to prevent it from becoming the open wireless LAN super root.*

You must prevent the access point with the Slave radio from synchronizing with Master radios in access points attached to the same secondary LAN. To identify the Masters with which the Slave is allowed to synchronize, do the following:

1. Identify eight or fewer Master stations with which the Slave is allowed to synchronize by selecting Master <*number*>.
2. Enter the channel and subchannel pairs that you set for Channel and Subchannel, as follows:

Channel	**1**
Subchannel	**1**

Setting*	**Description**
Channel	Channel the Master WLIF radio is using *(default is 1).*
Subchannel	Subchannel the Master WLIF radio is using *(default is 1).*

** Channel and Subchannel are discussed on page 4-62.*

The Slave access point synchronizes with Masters whose channel and subchannel appear in the list of configured Masters. Precedence is given by the order of the list. Master 1 has highest precedence; Master 8 has lowest.

Channel and subchannel settings can be 0, where 0 means "do not care." For example:

- You can set the Master 1 channel to 0 and subchannel to 1. The Slave synchronizes with any Master on any channel as long as the Master's subchannel is 1.
- You can set the Master 1 channel to 0 and subchannel to 0, which means "do not care." The Slave synchronizes with any Master.

Remember that:

- Any Master with which the Slave is allowed to synchronize must have Wireless Hops enabled.
- A Slave station must have a root priority of 0.
- A Slave station must not be allowed to synchronize with a Master connected to its own secondary LAN.

MAC Config

Use MAC Config options to enhance the performance of the WLIF radio. Options are:

Default
Interference
Throughput
Manual

" **NOTE:** *An inefficient MAC Config radio setting can adversely affect the performance of your open wireless LAN. You should change MAC Config radio settings only under the direct supervision of a Systems Engineer.*

Setting	Description
Default *(default)*	Uses the factory-set settings for the radio protocol (settings are located under [Manual MAC Parms]). The Default setting should be used for normal operation.
Interference	Optimizes the settings for the radio protocol for better performance in environments with high interference or multipath.
Throughput	Optimizes the settings for the radio protocol for better performance of file transfer operations in open or uncongested environments, such as office areas.
Manual	Allows you to adjust WLIF MAC parameters (located under [Manual MAC Parms]) individually. *Do not select this setting unless a Systems Engineer directs you to do so.*

[Manual MAC Parms]

" **NOTE:** *Adjusting the settings for [Manual MAC Parms] is not advised unless instructed by Technical Support.*

Occasionally, a site's WLIF radio parameters may need to be fine-tuned. Options for [Manual MAC Parms] enable the Customer Response Center to fine-tune this access point's performance. Settings are:

```
Hop Period          <200ms>
Beacon Frequency    2
Deferral Slot       <Default>
Fairness Slot       <Default>
Fragment Size       310
Transmit Mode       <AUTO>
Norm Ack Retry      255
Frag Ack Retry      255
Norm QFSK Retry     255
Frag QFSK Retry     255
```

Hop Period

Hop Period sets the hopping time period, which determines how long the radio stays on a frequency in the hopping sequence before stepping to the next frequency. Settings are:

```
100 ms
200 ms
400 ms
```

The default is 200 ms. A longer period results in better throughput. A shorter period results in faster roaming response and better immunity from interference.

Beacon Frequency

The access point periodically transmits a beacon to allow Slave radios (wireless stations) to quickly scan each frequency to find a Master (an access point). Beacon Frequency is the number of hops that occur between beacons. The prompt is:

```
Range is:
1..7
```

A setting of 1 is one beacon on every hop. A setting of 7 is one beacon every 7 hops. The default is 2.

You can reduce the scan time and, therefore, the time required for roaming by increasing the beacon frequency. More beacons may let wireless stations synchronize faster, but beacons use bandwidth otherwise available for data.

Deferral Slot and Fairness Slot

The number of deferral and fairness slots determines the average back-off time when the channel is sensed to be busy.

Settings for both options are:

Default
1
3
7

The default setting is Default. You can do the following:

- Reduce the number of slots on lightly-loaded networks to increase throughput.
- Increase the number to help prevent repeated collisions under a heavy load.

You can set Fairness Slot as follows:

- Increase the number to prioritize the channel access for nodes that have been waiting the longest to access the channel.
- Decrease the number to minimize initial back-off delays.

Fragment Size

Fragment Size determines the maximum size of a fragment to be sent over this radio during interference. The prompt is:

Range is:
1..1540

The default is 310.

If two ACK errors occur in a row during the transmission of a large data frame, it splits into two or more fragments and each fragment transmits separately. An ACK error occurs if a acknowledgment frame is not received from the destination node.

Smaller fragments may allow successful operation in an environment with a high level of interference at the expense of throughput.

Transmit Mode

Transmit Mode modulates the transmit signal and sets the bits per second. Settings are:

```
BFSK
QFSK
AUTO
```

Setting	Description
BFSK	Binary Frequency Shift Keying. Transmits at 0.8 Mbps per second. Data is transmitted by shifting between two frequencies to represent one bit of 0 or 1. BFSK has extended range over QFSK at the expense of throughput.
QFSK	Quadrature Frequency Shift Keying. Transmits at 1.6 Mbps per second. Data is transmitted by shifting among four frequencies to represent two bits of 0 or 1. QFSK has better throughput over BFSK at the expense of range.
AUTO *(default)*	Automatically adapts the bit rate to the error conditions. The transmit mode is automatically selected for the best range and throughput.

Norm Ack Retry

Norm Ack Retry is the number of times any unfragmented frame (QFSK or BFSK) is resent unsuccessfully before fragmenting. The prompt is:

```
Range is:
1..255
```

The number includes retries that occurred in QFSK mode, and should be larger than Norm QFSK Retry. A value of 255 *(default)* indicates that the radio may choose an optimum value.

Frag Ack Retry

Frag Ack Retry is the number of times any fragmented frame (QFSK or BFSK) is resent unsuccessfully before failure. The prompt is:

```
Range is:
1..255
```

Frag Ack Retry should be larger than Frag QFSK Retry. A setting of 255 *(default)* indicates that the radio may choose an optimum value.

Norm QFSK Retry

Norm QFSK Retry is the number of times an unfragmented QFSK frame is resent unsuccessfully before switching to BFSK when Transmit Mode is AUTO. The prompt is:

```
Range is:
1..255
```

The retries that occur are also counted by Norm Ack Retry. Norm QFSK Retry should be smaller than Norm Ack Retry. The default is 255.

Frag QFSK Retry

Frag QFSK Retry is the number of times a fragmented QFSK frame is resent unsuccessfully before switching to BFSK when Transmit Mode is set to Auto. The prompt is:

```
Range is:
1..255
```

The default is 255.

The retries that occur are also counted by Frag Ack Retry. Frag QFSK Retry should be smaller than Frag Ack Retry.

900 MHz Options

" **NOTE:** *Appendix C provides additional information about the 900 MHz radio.*

Use [Falcon] to set 900 MHz radio options:

```
File Name       "falcon_d.29k"
Mode-Channel    <DS 225K Channel 25>
```

File Name

File Name is the name of the radio's driver software. Only change this name when directed to do so by a Systems Engineer. Normally, the program's file name should not be changed.

Mode-Channel

Mode sets the bit rate option for the 900 MHz radio. Generally, the higher the bit rate, the lower the range of the access point. Channel defines a frequency range that is a small portion of the available bandwidth.

Various communication modes are available, which enable you to balance the need for radio coverage with the need for speed. Select the Mode–Channel option to display the list of mode and channel combinations, which are country-dependent.

For example, in the United States the following combinations are valid:

```
DS 225K-Channel 25
DS 090K-Channel 10
DS 090K-Channel 15
DS 090K-Channel 20
DS 090K-Channel 25
DS 090K-Channel 30
DS 090K-Channel 35
DS 090K-Channel 40
DS 450K-Channel 25
```

The following chart describes the settings shown in the previous sample screen:

Setting	Description
DS 225K–Channel 25	Uses one Direct Sequenced channel at 225,000 bits per second. This one moderate-speed channel uses all available bandwidth. DS 225K is mode 1.
DS 090K–Channel 10 *through* DS 090K–Channel 40	Use one of several Direct Sequenced channels at 90,000 bits per second. Seven low-speed channels share the available bandwidth. DS 90K is mode 2.
DS 450K–Channel 25	Uses one Direct Sequenced channel at 450,000 bits per second. This one high-speed channel uses all available bandwidth. DS 450K is mode 3.

900 MHz radio options for a wireless station are set through its Advanced Setup firmware menus. Wireless station and access point settings **must** match. Refer to the wireless station's user guide for more information about Advanced Setup.

S-UHF Options

" **NOTE:** *Appendix D provides additional information about the S-UHF radio.*

Use [UHF] to set S-UHF radio options:

```
File Name          "synuhf_d.29k"
Call Sign          ""
Frequency          (First frequency in list.)
Master Mode        <Disabled>
Attach Priority    <High>
```

" **NOTE:** *Attach Priority displays if Master Mode is set to Disabled.*

File Name

File Name is the name of the radio's driver software. Only change this name when directed to do so by a Systems Engineer. Normally, the program's file name should not be changed.

Call Sign

" **NOTE:** *Ignore this option if your site is outside of the United States.*

Call Sign displays your network's callsign. The prompt is:

```
Range is:
12 chars
```

Agencies that allocate S-UHF frequencies, such as the Federal Communications Commission (FCC) in the United States, may require that this access point periodically transmit a callsign.

The callsign is granted as part of the FCC license process. Insert the callsign from the FCC license certificate at the callsign prompt.

Frequency

The Frequency option displays a list of frequencies programmed at the factory. Some radios have multiple frequencies. For example:

466170000 Hz
530000000 Hz

The default frequency is the first frequency programmed into the list. Due to regulatory constraints in most countries, frequencies can only be programmed by the factory or service centers equipped to make this change.

Master Mode

Access points with the S-UHF option installed can operate with Master Mode enabled or disabled. Master Mode may improve performance in some environments. It should only be enabled if the access point radio coverage area does not overlap other access points operating on the same frequency. If Master mode is disabled, this restriction does not apply. An access point operating with Master Mode disabled may overlap coverage areas with access points on the same or different frequencies.

Master Mode settings are:

Enabled
Disabled

Setting	Description
Enabled	The access point controls channel access for stations in its coverage area.
Disabled *(default)*	Access point and stations coordinate channel access.

Attach Priority

If the access point is operating with Master Mode disabled, the attach priority of the access point can be specified. Stations in the coverage area of two access points with different attach priorities normally attach to the higher priority access point. However, attach priority is used in combination with other factors such as loading and signal strength, and a station may attach to a lower priority access point that provides a better wireless link. Stations ignore the attach priority when selecting between two access points with the same attach priority.

Attach Priority is useful when it is desirable to have a redundant network with some access points serving as standby units. If the higher priority unit fails, stations fall back to the lower priority unit within the same coverage area.

Attach Priority settings are:

High
Medium
Low

Setting	Description
High *(default)*	High priority access point.
Medium	Medium priority access point.
Low	Low priority access point.

OWL/IP Options

" **NOTE:** *Appendix E provides additional information about OWL/IP and contains configuration examples.*

Overview

The OWL/IP extension to the open wireless LAN architecture enables a wireless LAN installation to span multiple IP subnets. OWL/IP is an advanced capability that requires basic knowledge of IP addressing conventions and routing to configure and use. You should review the following pages and Appendix E before using this capability.

OWL/IP does the following:

- Enables access points on different IP subnets to belong to the same wireless network.
- Supports transparent roaming of wireless stations between access points on different subnets without losing network connections for:
  - Wireless stations using Internet Protocol (IP).
  - Wireless stations using other network protocols, such as NORAND Network Layer (NNL), that are normally not routable.

OWL/IP is activated by enabling the OWL/IP port in the access point. The port is an entryway to an IP tunnel originated by the super root on the *home subnet*, and terminated by a designated bridge operating on a *remote subnet* (Figure 4-5). Frames forwarded through the tunnel are encapsulated using the Generic Router Encapsulation (GRE) protocol running over IP.

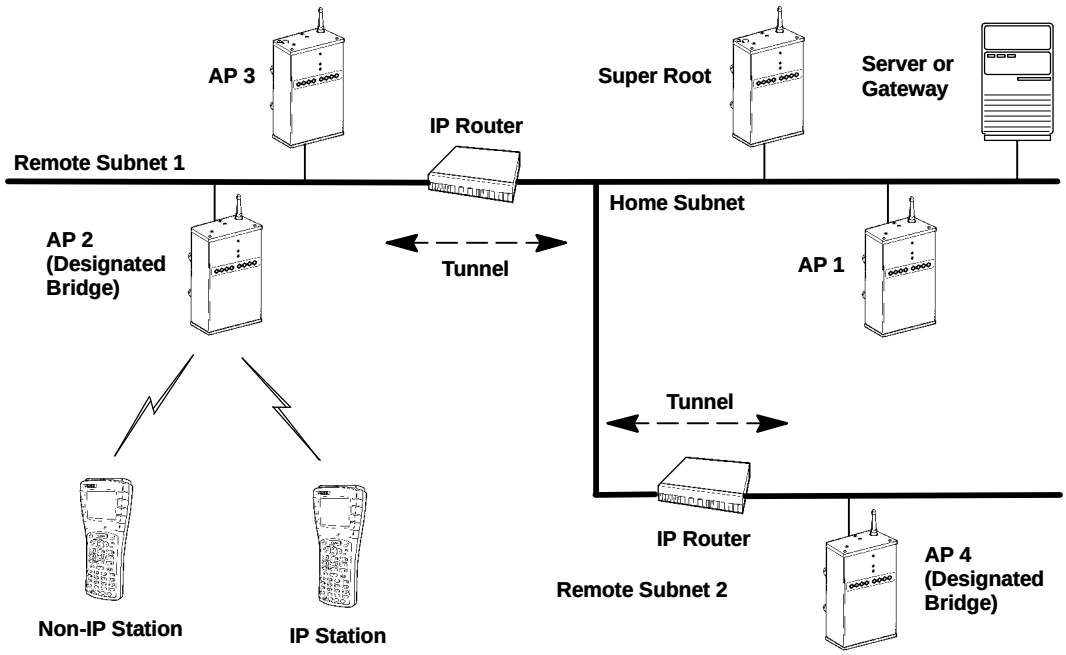


Figure 4-5
OWL/IP Overview

The super root can originate IP tunnels to eight or fewer IP addresses. The number of tunnels supported may be more than or fewer than eight, depending on the type of addressing used and redundancy needs within the installation.

OWL/IP tunnels are configured using the following steps:

1. Choose which subnet is the home subnet, and which subnets are remote subnets. If possible, choose the subnet that contains gateways or servers for wireless stations as the home subnet; however, these servers may be on other subnets if necessary.

Select primary and fallback super root access points on the home subnet. IP addresses for wireless stations used with OWL/IP must belong to the home subnet. See OWL/IP limitations in Appendix E.

2. Select access points on each remote subnet to serve as designated bridges for those subnets. Configure primary and fallback bridge priorities under the [Bridging] menu, described on page 4-57.

   Configure and record the IP addresses of all designated bridges. Designated bridge candidates must have permanent IP addresses. (DHCP should not be used to assign IP addresses to OWL/IP designated bridges unless a permanent lease is specified, and the access points are rebooted prior to configuring OWL/IP.)

   It is not necessary to configure Global Flooding or Flood Register settings for OWL/IP designated bridges. These do not apply to OWL/IP designated bridges.

3. Use the [OWL/IP] menu to configure super root candidates to Originate if Root (described on page 4-82). Configure the IP Addresses Table (page 4-83) using the appropriate addressing for designated bridges on each subnet. All super root candidates should be configured identically.
4. Configure OWL/IP [TX Filter] settings in all super root and designated bridge candidates. A discussion of [TX Filter] starts on page 4-84.
5. For networks using IP networking on wireless stations, use of the ARP server capability in the access point is strongly recommended. A discussion of ARP server starts on page 4-36.

OWL/IP Menu

OWL/IP configuration menu options are:

```
Mode                <Listen>
[IP Addresses]
[TX Filter]
```

In summary:

- The Mode value specifies the operation of the access point when the OWL/IP port is enabled. This value determines whether the access point is configured to serve as the originator or termination of a tunnel.
- The [IP Addresses] table in the menus provides the super root with the information necessary to establish communications with designated bridges on remote subnets.
- The [TX Filter] configuration menu specifies the frame types that are forwarded through OWL/IP tunnels.

Mode

The OWL/IP port may be configured with the following options:

```
Listen
Originate if Root
```

Setting	Description
Listen *(default)*	Access points can serve as the termination of a tunnel if they are the designated bridge for the subnet, but cannot originate a tunnel.
Originate if Root	Access points originate tunnels if they are functioning as super root for the network.

[IP Addresses]

The configuration screen for [IP Addresses] is:

```
                Type          Address
1  <Unicast>          0.0.0.0
2  <Unicast>          0.0.0.0
3  <Unicast>          0.0.0.0
4  <Unicast>          0.0.0.0
5  <Unicast>          0.0.0.0
6  <Unicast>          0.0.0.0
7  <Unicast>          0.0.0.0
8  <Unicast>          0.0.0.0
```

Each line in the IP Addresses Table contains one IP address entry. Settings are:

```
Type          <Unicast>
Address       0.0.0.0
```

Type

The Type setting specifies the type of Ethernet MAC address used by the super root when forwarding frames through the OWL/IP port. This setting allows flexibility in configuring OWL/IP routing. In most cases, IP and MAC address types should match. The MAC frame type and IP address in combination dictate how GRE encapsulated frames are forwarded to IP routers. Settings are:

```
Unicast
Multicast
Broadcast
```

Setting	Description
Unicast *(default)*	Standard IP routing is used. Frames are forwarded to the unicast MAC address of the router. This is either the default router specified in the [Tcpip] configuration menu of the access point, or an alternative router assigned by ICMP redirect.
Multicast	Reserved for future use.
Broadcast	OWL/IP frames are sent using an Ethernet broadcast address. This capability allows use of directed, and *All Subnets* IP addressing.

Address

The Address setting is the target IP address of the access point to which OWL/IP frames are addressed. The address should be consistent with the type (unicast, multicast, or broadcast). The prompt is:

```
Range is:
4 nums 0..255
```

Entries are cleared by setting addresses to 0.0.0.0.

[TX Filter]

Configuration of filters for the OWL/IP port is done using the transmit filter ([TX Filter]) option. Filter setup is similar to the normal Ethernet filter menu, described on page 4-43. Note that the Ethernet receive filters and the OWL/IP transmit filters are both applied to frames forwarded through a tunnel.

OWL/IP filters restrict the frame types that are allowed to be forwarded from the home subnet to remote subnets. By default, filters are programmed to drop all protocol types except for three protocols specified in the [SubTypes 1] screen. The types are NNL DIX type 875b, IP Address Resolution Protocol (ARP) DIX 0806, and ICMP 0001.

The filter configuration must be changed to allow forwarding of other desired protocols, including TCP or UDP. See Appendix E for discussion of OWL/IP restrictions and permanent filters. Filters must be configured in all super root candidates and OWL/IP designated bridges.

Default filter settings for OWL/IP are shown below.

	Action	Scope
DIX-IP-TCP Ports	<Drop>	<Unlisted>
DIX-IP-UDP Ports	<Drop>	<Unlisted>
DIX-IP-Other Protocols	<Drop>	<Unlisted>
DIX-IPX Sockets	<Drop>	<All>
DIX-Other EtherTypes	<Drop>	<Unlisted>
SNAP-IP-TCP Ports	<Drop>	<All>
SNAP-IP-UDP Ports	<Drop>	<All>
SNAP-IP-Other Protocols	<Drop>	<All>
SNAP-IPX Sockets	<Drop>	<All>
SNAP-Other EtherTypes	<Drop>	<All>
802.3-IPX Sockets	<Drop>	<All>
802.2-IPX Sockets	<Drop>	<All>
802.2-Other SAPs	<Drop>	<All>

Default filter settings for [SubTypes 1] are shown below.

	Action	SubType	Value
DIX-ARP	<Drop>	<DIX-EtherType>	08 06
SNAP-ARP	<Drop>	<SNAP-EtherType>	08 06
802.2-IPX-RIP	<Drop>	<802.2-IPX-Socket>	04 51
802.2-IPX-SAP	<Drop>	<802.2-IPX-Socket>	04 53
NNL	<Pass>	<DIX-EtherType>	87 5b
NETBIOS	<Drop>	<802.2-SAP>	f0 f0
1	<Drop>	<DIX-IP-TCP-Port>	00 00
2	<Drop>	<DIX-IP-TCP-Port>	00 00
3	<Drop>	<DIX-IP-TCP-Port>	00 00
.			
.			
16	<Drop>	<DIX-IP-TCP-Port>	00 00

Security Options

Use [Security] to set these passwords:

```
Password              "************"
Service Password      <Enabled>
Advanced Password     "************"
```

Password

This option is the top-level password you need to access the configuration menus. The prompt is:

```
Range is:
16 chars
```

Enter 16 or fewer alphanumeric characters for this password. It is case insensitive and can be any combination of letters, numbers, and symbols. For security, the password appears as asterisks on the screen.

Service Password

Intermec maintains a service password so its Customer Response Center can configure this access point if necessary. For example, if you forget what the configuration menus' top-level password is, the Customer Response Center can access the menus through the service password.

By default, the Service Password is enabled. If setting a service password violates your security guidelines, you can disable it. If it is already disabled and you forget the configuration menus' password, you may need to send this access point to a Service Center to be reconfigured.

Contact the Customer Response Center for more information about the service password. See the Preface for contact information.

Advanced Password

When you set an advanced password, it is required to configure the following:

Security/Advanced Password *and* Bridge/Ports/omdip

The prompt is:

```
Range is:
16 chars
```

Enter 16 or fewer alphanumeric characters for this password. It is case insensitive and can be any combination of letters, numbers, and symbols. For security, the password appears as asterisks on the screen.

Combining Radio Options

You can combine WLIF, 900 MHz, and S-UHF radios in a common network by following basic guidelines for LAN ID. Two alternatives are possible: same LAN ID and different LAN IDs.

Same LAN ID

Using the same LAN ID for all radio options configures all access points into a single network regardless of radio type. This approach allows management of a single network using the OWLView network management application.

An Ethernet path or wireless hop must exist from all access points to the super root and back-up super root candidates. In addition, globally distributed system parameters — particularly flooding levels — must be appropriate for all of the installed radio options.

Different LAN IDs

Using separate LAN IDs for each radio option configures all access points with different radios into a distinct network regardless of radio type. It may be more appropriate if the installation topology or applications supported do not fit the alternative that uses the same LAN ID. OWLView shows two distinct LANs for this type of installation.

Creating a Web Browser Session

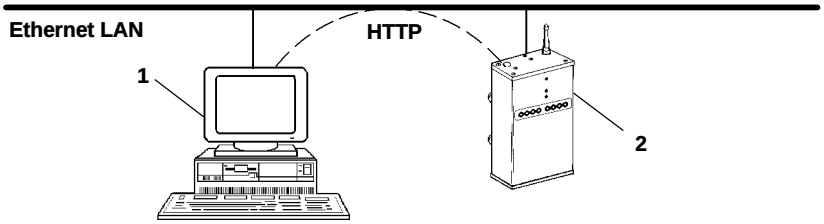
" **NOTE:** *The access point's configuration menus are designed for HTML Level 2.0 or higher.*

Before you can configure the access point through a Web browser, you must connect the unit to the Ethernet cable. (See Section 3, "Installation," for help.) You must also perform initial configuration through the DIAG port to:

- Set an IP address or DHCP server name. You should also configure a subnet mask and IP router address.
- Set the Ethernet cable type.

" **NOTE:** *The access point includes an autodetect feature that senses the Ethernet medium if traffic is present. If no traffic is present on the cable, the system software defaults to 10BASE-T. For most installations, it is recommended that you explicitly set the Ethernet type.*

The access point must go through its boot sequence before you can configure it through the browser. If you reboot it while you are configuring it through the browser, the session terminates. You can create a new session after the access point reboots. To establish a browser session, see Figure 4-6 and the procedure following it.



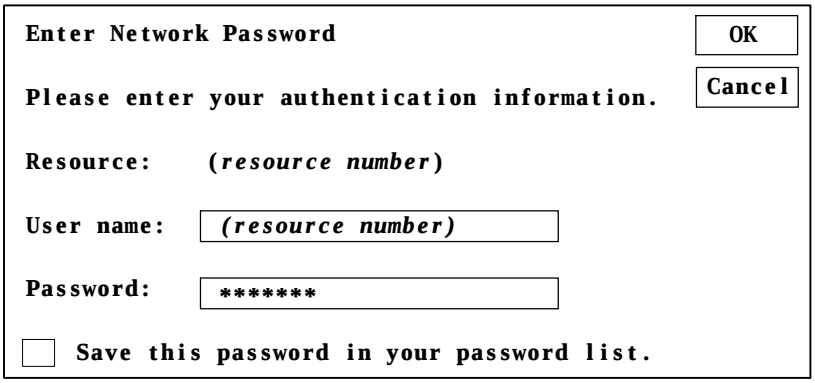
1. **Platform with Web browser**
2. **6710 Access Point**

Figure 4-6
Web Browser Session

1. Ensure the access point is connected to the Ethernet cable and has an assigned IP address.
2. Ensure the Web browser is installed on the platform.
3. Start the browser application.
4. Enter the access point's IP address in the browser's Uniform Resource Locator (URL) field. For example:

   http://999.999.99.99

   After you enter the correct IP address, the Enter Network Password screen appears:



5. Enter the user name and password. Refer to the following chart for help with all fields.

Setting	Description
Resource	A number assigned to this session. The number changes every time you access the Enter Network Password screen.
User name	The Resource number. For example, if the Resource number is 3550, the user name is 3550.
Password	Configuration menus' top-level password. The default password is CR52401 (case insensitive). For security, the password appears as asterisks on the screen.
Save this password in your password list	If you check this option, the browser saves the password. You do not need to select this option because the Resource number changes every time you access this screen.

" **NOTE:** *Only one computer at a time can access the configuration menus. If you unexpectedly receive a request for the user name and password, another user may be trying to view or modify the configuration through Telnet or the DIAG port. If a different computer tries to start another Web browser session, it is refused until the current session logs out.*

Following is the initial screen that appears after you enter the correct user name and password. Configure the access point by following the directions provided on this screen and the help screens. In addition, this user guide's Index lists the page numbers for all menu options.

Intermec **Access Point Configuration**

F Configuration Menus
F Review/write Changes
F Logout

F Reboot

Security

Once you've successfully entered the user name and password into your browser, you are authorized to access the configuration. If five (5) minutes elapses without configuration activity, you will become unauthorized again.

Only one computer at a time is allowed to be authorized for access to the configuration menus. If you unexpectedly receive a request for user name and password, it's possible that another user is currently attempting to view or modify the configuration via telnet or the serial port. An attempt to start another HTTP session from another computer will be refused until this session has been logged out.

How to use the Configuration Menu

1. Select Review/write changes to see the existing changes from the defaults. Optionally select an Undo option to remove changes.
2. Locate and change configuration items by navigating in the Configuration Menu.
3. Select the Submit Changes button to submit the changes on each form.
4. Repeat the above steps until all changes have been submitted.
5. Select Review/write changes and review the changes you have made.
6. Select Commit to write the changes.

Note: Some early browser versions can't be convinced by the server to always get a fresh copy of a document that was previously fetched. This might cause old and misleading information to be displayed. Updating the browser, pressing the reload button, or disabling the browser's cache may be helpful.

Configuration Guidelines

Planning Your Installation

To plan your installation, refer to "Finding the Best Location" in Section 3 for installation guidelines.

Using the Configuration Guide

The configuration guide in Table 4-1 summarizes the necessary steps to set up an open wireless LAN. The left-hand column provides basic setup information for a simple network using 6710 Access Points on a single Ethernet segment. This type of network may contain bridges or hubs, but may not contain OWL/IP links through routers, secondary LANs, or wireless access points. The right-hand column provides additional steps for more complex networks that include these additional components.

Table 4-1
Configuration Guide

z = required step; **Z** = recommended step

Simple Network	Advanced Functions
1. Configuration Planning	
z Select which access points will be primary and fallback super root candidates *(page 4-24)*.	**z** **Secondary LANs** and **OWL/IP:** Select which access points will be primary and fallback designated bridges *(pages 4-57 and 4-79)*.

Table 4-1 (Continued)
Configuration Guide

z = required step; **Z** = recommended step

Simple Network	Advanced Functions
2. Preliminary Configuration Before Installation **Z** Set LAN ID to a nonzero value *(page 4-23)*.	**(Through DIAG Port):**
z Configure access points with IP address configuration *(page 4-16)* or DHCP server name *(page 4-20)*.	**z** **OWL/IP:** Configure IP addresses in access points serving as super root candidates or OWL/IP designated bridge candidates. DHCP may not be used to assign addresses to these access points unless a permanent lease is assigned, and the access points are rebooted prior to configuring OWL/IP.
z Configure the Ethernet port cable type *(page 4-42)*. **z** For the open wireless LAN frame type, use DIX (the default) *(page 4-41)*.	
z Configure the root priority in super root candidates to specify primary and fallback access points. Set all other access points to root priority 0. *(Page 4-24.)*	**z** Set the highest root priority in the primary super root, and lower root priorities in no more than two fallback super roots *(page 4-24)*.
	z **Secondary LANs or wireless access point:** If using WLIF (2.4 GHz) radios, configure the Slave radio setup in wireless access points or secondary LAN designated bridges *(page 4-61)*.

Table 4-1 (Continued)
Configuration Guide

z = required step; **Z** = recommended step

Simple Network	Advanced Functions
3. Additional Configuration **Z** Set LAN ID to a nonzero value *(page 4-23)*. **z** Set Global Flooding parameters in super root candidates *(page 4-28)*.	**(Through DIAG Port, or Remotely Using Telnet or HTTP):** **z** **Secondary LANs:** Set the Flood Register values *(page 4-59)* in designated bridge candidates if Global Flooding options are set to Registered *(page 4-30)*. **z** **Secondary LANs and OWL/IP:** Set the Bridge Priority in all designated bridge candidates *(page 4-57)*.
z Configure the radio ports: **WLIF:** Security ID *(page 4-60)*, Node Type *(page 4-61)*, and Channel and Subchannel *(page 4-62)*. **900 MHz:** Mode–Channel *(page 4-74*). **S-UHF:** Frequency *(page 4-76)*.	
Z Enable the Proxy ARP Server if IP wireless stations are being supported *(page 4-36)*.	
Z Set Ethernet filters to optimize frames forwarded to wireless stations *(page 4-43)*.	**z** **OWL/IP:** Configure all super root candidates to Originate if Root *(page 4-82)*, **and** configure the IP Addresses Table in each candidate *(page 4-83)*. **z** **OWL/IP:** Configure [TX Filter] in super root candidates and designated bridges *(page 4-84)*.

Section 5

Software Download

This section describes the file system structure, File Menu commands, and ROM command monitor for the access point.

File System Structure

The access point's file system has four separate segments (analogous to a directory in most computer file systems):

Boot Segments 1 and 2

The first two segments (1 and 2) are .75 Mb boot segments. Either boot segment can hold the bootable (executable) FLASH file USTART29.BIN, which loads when you reboot the access point. You can store different versions of USTART29.BIN in the boot segments and then configure the access point to use one of them.

Data Segments 3 and 4

The next two segments (3 and 4) are .25 Mb data segments. Either data segment can hold the data file for the 900 MHz radio (FALCON_D.29K) or the synthesized UHF radio (SYNUHF_D.29K).

When you reboot the access point, the data files load into the radio module. (Note that the WLIF radio does not have a data file.)

Active and Inactive Segments

The access point can have an active boot and data segment, as well as an inactive boot and data segment:

- The inactive segment is where you can download a new file.
- The active segment contains the files that are loaded at boot time. An active boot segment pointer and an active data segment pointer point to the appropriate "active" segments. The segment not pointed to by one of these "active" pointers is the inactive boot or data segment.

After you load an inactive segment with a new file, you can change the "active" pointers to the segment that holds the new file. You then reboot the access point so the changes take effect. At this point the following occur:

- The access point is running the new version of software.
- The segment holding the new files is now the "active" segment.
- The old version of software is in an inactive segment.

" **NOTE:** *If the active segment is empty when you reboot the access point, you must establish a new session through the DIAG port to reload the access point with software.*

RAM Segment

The file system supports a fifth segment known as the RAM segment. The RAM segment is similar to the other segments, except the file contents are stored in RAM and the segment's contents are lost when you reboot the access point.

The RAM segment is limited to a maximum of 4096 bytes. It is used to hold small script files during the software download process.

When you view the file directory, the program currently executing displays as if it were in the RAM segment. This program, however, is not really a part of the RAM segment. You cannot delete or erase it, and TFTP commands cannot read or write to it. It displays as part of the file directory so you can determine which version of software is running.

Segment Names

You must enter a segment for most access point file system commands. You can type the numeric digits (1, 2, 3, or 4) corresponding to the respective file segments, or you can use the following mnemonics (the access point translates them to a segment number):

Mnemonic	Description
AB	Active boot segment.
IB	Inactive boot segment.
AD	Active data segment.
ID	Inactive data segment.
RAM	RAM segment.

File Names

Several file system commands require you to enter file names. You can precede file names by a segment number or name followed by a colon.

EXAMPLE 1: AB:USTART29.BIN refers to the file USTART29.BIN in the active boot segment (segment 1 or 2).

EXAMPLE 2: 1:USTART29.BIN refers to the file USTART29.BIN in segment 1.

If you omit the segment number or segment name, the access point searches the segments in this order until it finds a file matching the file name:

RAM, 1, 2, 3, 4

Downloading Programs

You can download new programs to the access point while it is operating. The unit has two program FLASH directories so that if an issue exists with the download of the new FLASH, the system can reboot to the previous version. An internal timer allows the activation of the new software program to be immediate or activated at a later time.

File Menu Commands

Commands for software download and other processes are located on the File Menu. To display the commands, type the following at the Main Menu prompt:

>**file**

The File Menu appears:

```
Loading configuration from EEPROM

Command   Description
Fb        fb <boot segment> <data segment>
Fd        fd (<segment> | all) - directory list
Fdel      fdel <filename> - delete file
Fe        fe (<segment> | all) - erase segment(s)
Tftp      File transfer
Script    Execute script files
SDVars    Software download variables
Exit      Return to main menu

File>
```

Fb Command

Use Fb to make inactive segments active. The format is:

File>**fb <boot segment> <data segment>**

- <boot segment> is the name or number of the boot segment to be activated. Boot segments are 1 and 2, or AB (active boot) and IB (inactive boot).
- <data segment> is the name or number of the data segment to be activated. Data segments are 3 and 4, or AD (active data) and ID (inactive data).

EXAMPLE 1: This command makes segment 1 the active boot segment:

File>**fb 1**

EXAMPLE 2: This command makes segment 1 the active boot segment and segment 4 the active data segment:

File>**fb 1 4**

You can use an asterisk (*) in place of either <boot segment> or <data segment> to tell the access point to not change that segment. For example, this command leaves the active boot segment unchanged and changes the active data segment to 4:

File>**fb * 4:**

This can also be accomplished by:

File>**fb ab: 4:**

" **NOTE:** *Colons are optional but you can use them for better command consistency.*

Fd Command

Use Fd to display the FLASH file system directory, including information about the boot file. For example:

Boot File=USTART29.BIN ***<FLASH boot file>***
Boot Address=250ef0 ***<boot file's starting address>***
Boot Segment=1 ***<active boot segment>***
Data Segment=3 ***<active data segment>***

File Directory:	seg	type	length	date	time	ver
USTART29.BIN	R	E	279299	12-05-97	15:25:58	v01.27
USTART29.BIN	1	E	331444	12-19-97	15:28:22	v01.27
FALCON_D.29K	3	D	014965	12-15-97	13:30:01	v02.20
SYNUHF_D.29K	4	D	019159	12-11-97	09:10:35	v02.20

Following are field descriptions:

- "File Directory name" lists the names of all files currently loaded in FLASH.
- "seg" is the segment in which the boot file is loaded. (R indicates the RAM segment.)
- "type" is the type of file: E for executable (boot file), D for data.
- "length" is the file size in bytes.
- "date" and "time" are the date and time the file was created.
- "ver" is the file version number in the format vxx.xx.

You should use the Fd command often to ensure that the correct version of FLASH file USTART29.BIN is in the active boot segment.

" **NOTE:** *If the active segment contains no files when you reboot the access point, the unit enters the ROM command monitor and you lose the ability to Telnet to it during this session. In this case you must access the unit through its DIAG port to correct the problem.*

Fdel Command

Fdel deletes the file name from the access point file system. When you delete a file, it is marked as invalid but remains in the file system. To reclaim the space from a deleted file, you must erase the segment in which the file resides.

The command's format is:

File>**fdel <file name>**

EXAMPLE: This command erases the file USTART29.BIN saved in the inactive boot drive:

File>**fdel ib:USTART29.BIN**

Fe Command

Fe erases files in a specified segment of FLASH memory. Once you have erased the files, you can restore them only by reloading them from another source. The command's format is:

File>**fe **

 is a segment number, a segment name, or the word "all." Specifying "all" erases all FLASH file segments but does not erase the RAM segment.

EXAMPLE 1: This command erases FLASH segment 1:

File>**fe 1:**

EXAMPLE 2: This command erases the inactive boot segment:

File>**fe ib:**

TFTP Command

Use the Tftp command to display the following screen:

```
Argument    Description
Get         Get <host IP addr> <foreign File> <local File>
Put         Put <host IP addr> <foreign File> <local File>
Server      Start/Stop/Query TFTP Server
?           Display this help

File>
```

An access point (client) can obtain files from a TFTP server. The server may be one access point configured to act as the server, or another device on the network. The server must operate in octet (8 bit) mode.

- As a server, the access point can service read and write requests from an access point client. To operate as a TFTP server, the access point must be loaded with these software versions:
  - ROM version 1.13 or greater
  - FLASH (USTART29.BIN) version 1.23 or greater
- As a client, the access point can read files from and write files to any TFTP server on the network. The client always requests octet mode.

In general, TFTP client sessions should fail only if the server is not responding because it is busy serving other clients or because it has not been started. In either case, the access point back-off algorithm should prevent excessive network traffic when many access points are trying to contact a TFTP server. When you type TFTP client commands at the command line, the access point does not retry failed transfers.

" NOTE: *Near the end of this section is a detailed example of how to use TFTP to upgrade an access point with a new version of FLASH. The example incorporates most of the TFTP commands.*

TFTP Server

Use the Server command to display TFTP commands. The format is:

File>**tftp server**

These commands are supported:

```
Help for Server command:
Argument    Description
Start       Start TFTP server
Stop        Stop TFTP server
Log         Display TFTP server message log
?           Display this help

File>
```

Server Start

Use Server Start to enable the access point as a TFTP server. The format is:

File>**tftp server start**

After you issue this command, the access point responds to TFTP client requests directed to its IP address. When acting as a server, the access point TFTP supports up to four concurrent TFTP sessions.

Server Stop

Use Server Stop to stop the access point from being a TFTP server when you are done transferring files. The format is:

File>**tftp server stop**

After you issue this command, the access point no longer responds to TFTP client requests. Current TFTP sessions with the server are completed, however.

Server Log

Server Log saves a history of TFTP client requests. The command's format is:

File>**tftp server log**

The TFTP server log contains useful TFTP server status information starting from when you set up the server. You must reboot the access point to clear the log.

TFTP Client Commands

The TFTP client in the access point supports standard Get and Put commands.

Get

Use Get on an access point client to download software from a TFTP server (a PC or another access point). The format is:

File>**tftp get <ip address> <foreign file name> <local file name>**

- <ip address> is the IP address of the server (or "*" which indicates the value of the ServerIpAddress variable, described later in this section).
- <foreign file name> is the name of the file to get from the server. The file name can contain directory path information and must be in the format required by the server's operating system.

  The file must have an appropriate 29K file header. Boot files and data files are normally delivered with the proper file header attached, but script files you create must have the file header appended before transfer to an access point.
- <local file name> is the name of the file to be stored in the access point. The name must include a segment number or name followed by a colon and an optional file name. If only the segment name is supplied, the file name is set equal to the file name embedded in the file header.

EXAMPLE 1: This command line gets file USTART29.BIN from a directory on a PC server with IP address 1.2.3.4, and stores the file in the access point's inactive boot segment:

File>**tftp get 1.2.3.4 c:\flash\ap\ustart29.BIN ib:**

EXAMPLE 2: This command line gets file USTART29.BIN from segment 2 on the access point server with IP address 1.2.3.4, and puts the file in segment 1 on the access point client:

File>**tftp get 1.2.3.4 2:ustart29.bin 1:**

Put

Use Put on an access point client to copy a file to the server (a PC or another access point).

The format is:

File>**tftp put <ip address> <foreign file name> <local file name>**

- <ip address> is the IP address of the server, or "*" which stands for the value of the ServerIpAddress variable (described on page 5-18).
- <foreign file name> is the name of the file as it will appear on the server. The file name can contain directory path information and must be in the format required by the operating system running on the server.
- <local file name> is the name of the file to be sent from the access point client.

EXAMPLE: This command takes boot file USTART29.BIN saved in the active boot drive on the access point client, and stores it in the active boot segment on the access point server with IP address 1.2.3.4:

File>**tftp put 1.2.3.4 ustart29.bin ab:**

Script Command

You can initiate an automatic software download through SNMP by setting the appropriate server IP address and script file name, and then setting the software download time. The following two commands execute automatically as if you had typed them on the command line:

File>**tftp get * <remote script file name> ram:sysswd1**
File>**script ram:sysswd1**

The first command establishes a TFTP session with the server, gets the script file from the server, and places the file in the RAM file segment, giving it the name “sysswdl.” The second command runs the script from the RAM segment.

The script file should contain the same commands you would use from the command line to erase the appropriate file segments, download the new file(s), and reboot using the new software. To test the script file manually to ensure it functions, log onto an access point and type the script file commands from the command line.

Creating Script Files

Script files are ASCII text files with a 32-byte file system header appended. The total file size including the 32-byte header must be less than the 4096 bytes in order to fit into the RAM file segment.

Each script file line must be fewer than 80 characters and be terminated by a line feed or a carriage return. Only one command is permitted per line. Spaces on a line are insignificant; commands and arguments may be preceded by any number of tabs or spaces as long as the total line length is fewer than 80 characters.

The script files can contain comments, designated by the “#” character. All characters on a line after a “#” are ignored.

Program FHDR29K.EXE appends the file system header to the script file. Assuming the ASCII text script file is named SCRIPT.TXT, the following command line appends the appropriate file header and places the output in file SCRIPT.DAT:

FHDR29K -d -v1.00 SCRIPT.TXT SCRIPT.DAT

- "-d" marks the file as data instead of executable. This prevents the access point from trying to execute the file.
- "-v1.00" sets the file's version to 1.00. The file type and version appear in the directory information on the access point.

Sample Script File

```
#This sample script file assumes the server IP
#address has been set either from the command
#line or via SNMP.  It also assumes the files
#USTART29.BIN and falcon_d.29k can be accessed
#from the server using no path information.

#Erase the inactive file segments.
file fe ib: #inactive boot segment
file fe id: #inactive data segment

#Get the new files into the inactive segments.
file tftp get 1.2.*.4 c:\flash\ap\ustart29.bin ib:
file tftp get 1.2.*.4 c:\flash\ap\falcon_d.29k id:

#Make the inactive segments active.
file fb ib: id:

#Reboot so changes take effect.
reboot
```

Script File Command Summary

Following is a description of the commands you can include in a download script file. You can issue these commands manually from the access point from the ">" prompt on the command line.

Most script file commands are executed from within the file command submenu. You or the script file can issue these commands in either of two ways:

- Use the File command to descend into the file submenu level where you can execute file system commands, until you use the Exit command to return to the ">" prompt.
- You can preface any file level command with the word "File," which causes the command processor to execute one command in the file command level and return to the ">" prompt.

For example, the command sequences in the following two charts are equivalent:

Command Sequence 1	**Description**
file	Descend to the "File>" command prompt.
fe ib:	Erase the inactive boot segment.
fe id:	Erase the inactive data segment.
exit	Return to the ">" prompt.

Command Sequence 2	**Description**
file fe ib:	Erase the inactive boot segment.
file fe id:	Erase the inactive data segment.

In addition, all commands are case insensitive, so:

FILE FE ID:

is the same as:

file fe id:

TFTP Client Command Retry

When executing a script file, the access point retries TFTP client commands GET and PUT until the command completes successfully. If the first attempt to transfer the file fails, the access point retries after a one-minute delay. With each successive failure, the retry time doubles until it reaches 8 minutes. Once this limit is reached, it remains at 8 minutes until the command completes.

Reboot Command

The Reboot command (located on the Main Menu) forces the access point to restart immediately. If it is issued within a script file, commands following it are not executed. If used, Reboot should always be the last command in the file.

Because Reboot causes an immediate reboot before the script file processing is completed, the software download status is not updated to accurately reflect the result of the software download. While this has no adverse effect on access point operation, you can not tell whether the download completed successfully without examining the version numbers of the active boot and data files after the access point has rebooted.

The preferred method of rebooting after a script file has completed is to set the next power up time variable. This should be the last thing the script file does, to allow the script file processing to complete and the software download status variable to be updated before the reboot occurs.

SDVars Command

Use the SDVars command to display the following arguments:

```
Argument  Description
Get       Get <software download object>
Set       Set <software download object> <value>
?         Display this help

File>
```

Use the Set argument with a range of software download variables. To display the variables, type:

File>**sdvars set**

The following variables are supported:

```
Argument          Description
ServerIpAddress   serveripaddress <ip address>
ScriptFilename    scriptfilename <filename> - filename can include path
StartTime         starttime <dd:hh:mm:ss> - days:hours:minutes:seconds
Status            status is read-only
CheckPoint        checkpoint <value>
Terminate         terminate - stop the current software download
SetActivePointers setactivepointers (none | boot | data | both)
NextPowerUpTime   nextpoweruptime <dd:hh:mm:ss> - days:hours:minutes:second
?                 Display this help

File>
```

Use the Get argument to display the value you enter for a variable.

ServerIpAddress

ServerIpAddress contains the IP address of the TFTP server to use to retrieve the download script file. This address is also used when you specify an asterisk as the IP address of the tftp get or tftp put command.

The format of the ServerIpAddress variable is:

File>**sdvars set serveripaddress <ip address>**

EXAMPLE: This command line sets the IP address of the server to 1.2.3.4:

File>**sdvars set serveripaddress 1.2.3.4**

ScriptFilename

ScriptFilename contains the file name of the script to be retrieved from the TFTP server. The file name can contain directory path information and must be in the format required by the operating system running on the server.

The format of the ScriptFilename variable is:

File>**sdvars set scriptfilename <foreign file name>**

EXAMPLE: This command line sets the script name to SCRIPT.DAT:

File>**sdvars set scriptfilename script.dat**

StartTime

StartTime is a relative time at which to begin the software download process. The value of this variable is how long into the future the access point will begin the software download process by downloading the script file. If you do not want to start the software download process after setting this variable, you can set this variable to zero.

As long as the StartTime has not counted to zero on its own, the timer stops and the software download process halts. When the timer does count down to zero, it uses the ServerIpAddress value and the ScriptFilename value to get the script file. If either of these is not set, an error is noted in the status variable and the software download process is aborted.

The variable's format is:

File>**sdvars set starttime <dd:hh:mm:ss>**

EXAMPLE: This command line sets the download start time to begin in 5 minutes:

File>**sdvars set starttime 00:00:05:00**

Status

Status is a read-only variable set by the software download mechanism to indicate whether the download completed successfully.

CheckPoint

CheckPoint is a numeric variable that is used to check on the progress of an active download in an access point. By setting CheckPoint to a different value after each command in the script file, you can read the value to determine how far the access point progressed through the script file. You can also test for failure if a script file aborts. The variable's format is:

File>**sdvars set checkpoint <value>**

For example, consider the following script file commands:

```
file sdvars set checkpoint 1
file fe ab:
file sdvars set checkpoint 2
file tftp get * ustart29.bin ab:
file sdvars set checkpoint 3
reboot
```

When the software download is started, you can use SNMP to query its progress by reading the checkpoint variable. If the variable has a value of 2, for example, you know that the access point is trying to execute the `tftp get` statement. If the value is 3, you know the script has completed and the reboot statement was executed.

Terminate

Use Terminate to stop the download process in an access point. The variable's format is:

File>**sdvars set terminate <value>**

If StartTime is counting down, setting this variable stops the timer, halting the software download process.

Use caution with this variable. If the script file is being downloaded, or the commands in the script file are being executed, setting this variable interrupts the processing at its current location, halting the software download process. This can leave the access point in an unknown state.

It is your responsibility to determine this state and take any corrective action necessary. If the NextPowerUpTime variable is counting down, setting this variable stops the timer, halting the reboot process.

SetActivePointers

Use SetActivePointers to make inactive access point segments active, but only immediately before rebooting. The variable's format is:

File>**sdvars set setactivepointers <none|boot|data|both>**

The default value is "none." Setting the value to "boot" or "data" affects only the given segment. Setting the value to "both" changes both segments. When the NextPowerUpTime variable counts down to zero, this field is checked to see if any inactive segments should be made active. This value resets to its default of "none" whenever the access point reboots.

NextPowerUpTime

NextPowerUpTime is a relative time at which to reboot the access point. The variable's format is:

File>**sdvars set nextpoweruptime <dd:hh:mm:ss>**

The value of this variable is how long into the future the access point should reboot itself. If you do not want to reboot the access point after setting this variable, you can set this variable to zero.

As long as the NextPowerUpTime variable has not counted to zero on its own, the access point does not reboot. When the timer does count down to zero, it checks the value of the SetActivePointers variable, takes the appropriate action as described above, and then reboots the access point.

ROM Command Monitor

Certain functions available through the ROM command monitor can erase your configuration information. Intermec STRONGLY RECOMMENDS that you only use this option when absolutely necessary (for example, to upgrade your FLASH software or when instructed to do so, and under the supervision or direction of qualified Intermec personnel).

Starting the Command Monitor

You can access the ROM command monitor only through the DIAG port. Start the command monitor by turning the access point off, then back on. After the access point has completed its power-up self tests, you have about 5 seconds to open the ROM command monitor by pressing any key on the PC keyboard. See "Creating a Local DIAG Port Session" in Section 4 for more information on how to access ROM mode.

▪ **NOTE:** *You cannot invoke the command monitor once the access point has started the FLASH program. If the access point enters its boot sequence, you have to reboot the access point to open the ROM command monitor.*

When the ROM command monitor opens, the following displays on the PC:

```
QXS6700K Vx.xx  MMM DD YYYY
ap>
```

- QXS6700K is the program name of the ROM.
- x.xx is the version of the ROM command monitor.
- MMM DD YYYY is the month, day, and year the version was released.
- ap> is the command prompt.

Viewing ROM Commands

To view ROM commands, type any invalid command (such as "?") to display the command monitor's Main Menu:

```
B       - Reboot                    FR      - Run Flash Boot File
FX s    - Ymodem File Download      PWD     - Password Menu
FC s    - Move file to Flash        NPWD    - Norand Password Menu
FD      - File System Directory     SR z    - Serial Baud Rate

ap>
```

The following paragraphs describe each option.

" **NOTE:** *When executing a command that has an option (for example Fx s) separate the option from the command by a space.*

B

Reboot resets the access point's system software. Reboot is similar to turning the access point off (removing power), and then starting it up again (reapplying power).

FX s

FX s performs a Ymodem batch protocol download of a file into the specified **s** FLASH segment. Typing FX 1, 2, 3, or 4 (depending upon which FLASH segment you want the file loaded to) automatically copies the file to the specified FLASH segment.

FD

FD displays the FLASH file system directory, including information about the boot file. See "Fd Command" on page 5-6 for more information.

FR

" **NOTE:** *The first executable file in the access point boot segment must be the access point boot file.*

FR finds the first executable file in the access point's boot segment, and tries to run the file.

NPWD

NPWD is for internal use by service personnel only.

SR z

Serial baud rate command SR z sets the baud rate of the access point. The format is:

ap>**sr <baud rate>**

Baud rates are:

2400
4800
9600 *(default)*
14400
19200
28800
38400
57600

Type the desired baud rate as a whole number (no decimal equivalent), with no commas. For example, to enter a baud rate of 19,200, type 19200 — not 19.2 or 19,200.

PWD

PWD opens a password-protected menu that contains file management commands. Some of the commands delete files. Others redefine the access point's file structure. In either case the commands can cause undesirable results if not properly executed. If in doubt on the proper procedure to use, contact Technical Support for assistance.

To open the password menu, type the following:

ap>**pwd**

The following displays:

Enter password:

The password is CR52401OWL (must be in uppercase). Following is the password menu.

```
FD          - File System Directory     FPD         - PCMCIA File Directory
FE<s/all>   - Erase Segment(s)          FPE         - Erase PCMCIA Card
FI          - File System Reset         FPX         - Ymodem File to PCMCIA
FS s n      - Define File Segment       PQ          - Power-Up Quiet
FB s        - Set Boot Segment          PN          - Power-Up Normal
FFR f       - Run File                  MI string   - Set Modem Init String
FPC f s     - PCMCIA File to Flash      RMI         - Reset Modem Init String
                                        X           - Exit
```

FD

The FD command displays the segment allocation table and file directory. See "Fd Command" on page 5-6 for more information.

FE <s|all>

FE erases specified or all segments of FLASH memory. See "Fe Command" on page 5-8 for more information.

FI

FI is a destructive command that erases all downloaded files in FLASH memory.

FS s n

FS is a destructive command that redefines the default (factory set) file segments in FLASH memory.

FB s

FB s designates which segment(s) of FLASH memory the boot program is located in. If the access point boot program is located in a segment other than what is designated, the boot program will not run. See "Fb Command" on page 5-5 for more information.

FFR f

FFR f runs the specified file (f). The file specified with the FFR command must be an executable file.

FPC f s

FPC f s copies a specified file (f) from an SRAM card installed in PC card slot NIC2 to a specified segment (s) of the access point FLASH.

" **NOTE:** *The FPC f s command copies the first file of the specified file name it finds. Attempting to load multiple files with the same file name will result in unreachable or unreadable files.*

FPD

FPD shows the file system directory of an installed SRAM card. The card must be inserted in PC card slot NIC2 on the access point. The FPD command will not work on a card inserted in slot NIC1.

The following information about the PC card file system is returned:

- Names of all files on the card.
- Type of file (executable, data, text).
- Size (in bytes) of each file.
- Date of each file.
- Version number of each file, in the format Vxx.xx.

FPE

FPE erases the entire contents of a PC card installed in PC card slot NIC2 on the access point. *Individual files cannot be deleted*. When you issue the FPE command, each location on a PC card installed in slot NIC2 is overwritten with 0's.

FPX

FPX performs a Ymodem batch protocol download of a file into an SRAM card installed in slot NIC2 on the access point. The downloaded file appends to any existing files on the PC card.

PN

PN turns off Power-Up Quiet mode (PQ).

PQ

PQ turns on Power-Up Quiet mode. When you configure the access point to boot in quiet mode, it does not display ROM power-up messages while it boots. More importantly, it does not allow a single received character to invoke the ROM command monitor and prevent the access point from booting when a host is connected to it and trying to communicate.

After you issue the PQ command, every ROM power-up message is done in quiet mode. When you turn on quiet mode you cannot access the ROM command monitor by pressing a single keystroke during the boot sequence.

When the ROM command monitor is in quiet mode you must send three or more consecutive exclamation points (!) to the DIAG port during the boot sequence to invoke the command monitor prompt (ap>).

Because the access point is in quiet mode no prompts appear to show you when to type the exclamation points. The easiest way to do this is to apply power to the access point, wait until the WLINK indicator light stops flashing for about 1 second, and then type three or more exclamation points.

MI String

MI String allows a custom modem initialization string to be used in the access point. When a custom modem initialization string is entered, it overrides the default string issued by the ROM on powerup.

During powerup, the ROM checks the EEPROM for a valid modem initialization string (custom initialization strings *must* start with the letters AT or at). If the ROM finds a valid string in the EEPROM, it uses this string instead of the default string in the ROM. To remove a custom modem initialization string, issue the RMI command.

RMI

RMI removes a custom modem initialization string from the access point EEPROM (see “MI String”). The next time the access point is powered on, the default modem initialization string (located in ROM) is loaded.

X

Command X exits the password submenu and returns to the Main Menu.

Exiting the ROM Command Monitor

Exit the command monitor by running the Reboot command (B) or Run Flash Boot File command (FR) on the ROM command monitor's Main Menu.

Software Download Example

The FLASH program for the access point is called USTART29.BIN. A simple method for upgrading an access point with new FLASH is to set one up as a TFTP server and then download new FLASH into another access point (the client). This method is "simple" because you can easily configure an access point as a TFTP server.

The general procedure is as follows:

1. Upgrade one access point with a new version of FLASH through the DIAG port.
2. Enable the upgraded access point as a TFTP server.
3. Use Telnet and TFTP to upgrade another access point (client).

This procedure may also download new HTML and GIF files, which enable you to configure the access point through a Web browser.

Upgrading Through DIAG Port

The following pages show an example of how to upgrade an access point through its DIAG port. This unit will become the TFTP server. The example assumes that:

- You have established a connection between a PC and the access point's DIAG port, and have accessed the ROM command monitor.
- An old version of FLASH is in segment 1.
- The new version of FLASH is going into segment 1.
- Segment 2 is the active boot segment.

1. When the access point has entered the ROM command monitor, type the following commands to upgrade the unit.

Command	Description
ap>**pwd**	Enter the password menu.
Enter the password.	The default password is CR52401OWL (must be upper-case).
passwd>**fe 1**	Erase FLASH segment 1.
passwd>**x**	Exit the password menu.
ap>**fx 1**	Download the new FLASH file into segment 1.
passwd>**fb 1**	Change the boot segment number from 2 (in this example, the active boot segment) to 1.
ap>**fr**	Run the new FLASH boot file by restarting the access point.

2. After the access point reboots and is running in FLASH mode, use the Fd command to display the file directory and verify that the new version of FLASH is in segment 1.
3. Ensure that this access point has a valid IP address. Change the address if necessary and remember what it is. You need the IP address to configure TFTP clients in other access points.

Starting the TFTP Server

1. Configure the access point that you just upgraded to be the TFTP server by typing:

   File>**tftp server start**

2. To check the status of the TFTP server, type:

   File>**tftp server log**

   If the server is active its response is:

   The TFTP server is running.

Upgrading TFTP Clients

The following procedure assumes that you are downloading USTART29.BIN into an inactive boot segment and the 900 MHz radio's data file into an inactive data segment.

1. After you have started the access point server, establish a TELNET session with the access point to be upgraded (the client).
2. Access the client's File Menu.
3. On the client, type the following commands to upgrade it.

Command	Description
File>**fe ib:**	Erase the client's inactive boot segment.
File>**fe id:**	Erase the client's inactive data segment.
File>**tftp get 1.2.3.4 ustart29.bin ib:**	Copy executable file USTART29.BIN from the server (IP address is 1.2.3.4) to the client's inactive boot segment.

Command	Description
File>**tftp get 1.2.3.4 falcon_d.29k id:**	Copy self-extracting data file FALCON_D.29K from the server to the client's inactive data segment.
File>**fb ib: id:**	Make the client's inactive boot and data segments the active segments.
File>**fd**	Display the FLASH file directory to verify that the boot and data segments are the active segments.
File>**exit**	Exit the File Menu and return to the Main Menu.
>**reboot**	Run the new FLASH file by restarting the access point. Note that when you reboot the access point client, the Telnet connection is lost. Wait about 30 seconds for the unit to start up again before trying to establish another Telnet connection.
File>**fd**	Display the FLASH file directory to verify that the correct files are in the active segment.

4. Repeat the above commands for each access point client that needs a new version of FLASH.
5. After you have upgraded all access point clients, stop the TFTP server process in the access point you used as the server by typing:

   File>**tftp server stop**

Section 6
Indicator Lights

This section describes the access point's indicator lights and how to read them. This section also provides troubleshooting information you can use to isolate a faulty access point.

Overview

The eight indicator lights on the access point's front panel are the best indicators of how the unit is working. By observing the indicator lights you can tell the following:

- Mode in which the unit is operating (error, network, boot, or command).
- Type of network link the unit has established when it is in network mode.
- Baud rate of DIAG port when in command mode.
- Possible cause of an error condition when in error mode.

The indicator lights are grouped into four pairs (Figure 6-1).

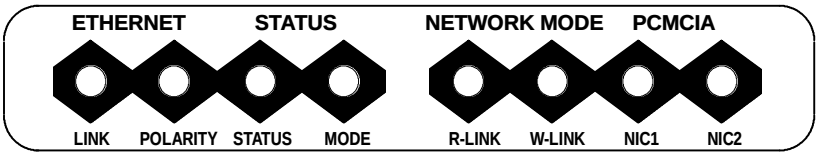


Figure 6-1
Indicator Lights

Each indicator light is labeled according to function. The following chart lists the groups and their indicator lights.

Group	Indicator Lights
ETHERNET	LINK and POLARITY
STATUS	STATUS and MODE
NETWORK MODE	R-LINK and W-LINK
PCMCIA	NIC1 and NIC2

ETHERNET Lights

ETHERNET indicator lights show the status of the access point's Ethernet connection. Table 6-1 shows what the lights mean when ON and OFF.

Table 6-1
ETHERNET Indicator Lights

Light	Status	Indication
LINK	ON	Unit has successfully attached to the Ethernet network.
	OFF	Unit has not attached to the Ethernet network.
POLARITY	OFF	TX and RX lines on a 10BASE-T cable are reversed.

STATUS Lights

STATUS indicator lights are labeled STATUS and MODE.

STATUS

The STATUS (left) light indicates the access point's operating status. When the light is OFF, the access point is operating normally. When the light is ON, it is in error mode.

" **NOTE:** *In certain cases the following text refers to the indicator lights by number. Lights are numbered from left to right. Light 1 is labeled LINK and Light 8 is labeled NIC2.*

The access point enters error mode when it detects a malfunction during the power-on self tests or when certain hardware malfunctions occur during normal operation. When the STATUS light is ON to indicate the error mode, indicator lights 4 through 8 (the STATUS MODE light and the NETWORK and PCMCIA light pairs) display a binary error status code between 1 and 31. This code indicates the specific condition causing the error status as shown in Table 6-2. Descriptions of errors are on page 6-4.

Table 6-2
Error Mode Status Codes

Status	Mode	R-LINK	W-LINK	NIC1	NIC2	Error Status
ON	OFF	OFF	OFF	OFF	ON	Hardware error 1.
ON	OFF	OFF	OFF	ON	OFF	Hardware error 2.
ON	OFF	OFF	OFF	ON	ON	Hardware error 3.
ON	OFF	OFF	ON	OFF	OFF	Internal serial loop-back test failed.
ON	OFF	OFF	ON	OFF	ON	Internal MACE AUI loopback test failed.
ON	OFF	OFF	ON	ON	OFF	Internal 10BASE-T loopback test failed.
ON	OFF	OFF	ON	ON	ON	Timer test failed.

" **NOTE:** *Contact the Customer Response Center for help with the following.*

Error Status	Description
Hardware errors 1, 2, and 3	These errors indicate an internal hardware error or malfunction. The errors can occur when you apply power to the access point. If it encounters a hardware error, it no longer functions.
Internal serial loopback test failed	This failure occurs if the access point does not successfully complete the power-on self-test. The error indicates a probable hardware malfunction associated with the DIAG port. In most cases, the unit continues to operate normally, but the error condition still exists.
Internal MACE (Media Access Controller for Ethernet) AUI loopback test failed	This failure occurs if the access point does not successfully complete the power-on self-test. The error indicates a probable hardware malfunction associated with the AUI port. In most cases the unit continues to operate normally, but the error condition still exists.
Internal 10BASE-T loopback test failed	This failure occurs if the access point does not successfully complete the power-on self-test. The error indicates a probable hardware malfunction associated with the 10BASE-T port. In most cases the unit continues to operate normally, but the error condition still exists.
Timer test failed	This failure occurs when the access point timer circuit malfunctions. If a timer error occurs, the unit no longer functions.

MODE

The right STATUS light is labeled MODE. It indicates the current status of the access point (Table 6-3).

Table 6-3
MODE Indicator Light

Status	Indication
ON	Unit is not functional and is locked up.
BLINK	Unit is in network mode, the normal operating condition.
OFF	Unit is in command mode. It enters this mode when it detects a key press from an attached PC *before it enters the boot mode*, or when it detects an incoming signal from an attached modem.

NETWORK MODE Lights

NETWORK MODE indicator lights show the status of the access point's network link. The lights are labeled R-LINK (left indicator) and W-LINK (right indicator). They work together to indicate the type of network link the access point has established. Table 6-4 shows links.

Table 6-4
NETWORK MODE Indicator Lights

R-LINK	W-LINK	Network Link Description
OFF	OFF	No network link established (unit is not connected to a network, or is reconfiguring).
OFF	ON	Unit is attached to network through an Ethernet port.
OFF	BLINK	Unit is attached to network through its OWL/IP port and is the designated bridge for a secondary Ethernet LAN.
ON	OFF	Unit is attached to the network through an RF (radio) connection.
ON	ON	Unit is operating as the super root.
ON	BLINK	Unit is attached to network through an RF connection and is the designated bridge for a secondary Ethernet LAN.

PCMCIA Lights

PCMCIA indicator lights show the status of the two PC card slots, which are labeled NIC1 and NIC2. The left light shows the status of NIC1; the right light shows the status of NIC2. Table 6-5 shows light indications for both ports.

Table 6-5
PCMCIA Indicator Lights

Status	Indication
OFF	A functional or enabled radio is not installed in the slot.
ON	A functional and enabled radio is installed in the slot.
BLINK	Installed radio is active and has communicated with a wireless station in the past 10 minutes.

When the access point reboots in ROM mode, the R-LINK, W-LINK, NIC1, and NIC2 indicator lights show — for about nine seconds — the DIAG port's baud rate. The lights show the status about eight seconds after the W-LINK light stops blinking. Table 6-6 shows baud rates.

Table 6-6
DIAG Port Baud Rates, ROM Mode

R-LINK	W-LINK	NIC1	NIC2	Baud Rate
OFF	OFF	OFF	ON	2400
OFF	OFF	ON	OFF	4800
OFF	OFF	ON	ON	9600
OFF	ON	OFF	OFF	14400
OFF	ON	OFF	ON	19200
OFF	ON	ON	OFF	28800
OFF	ON	ON	ON	38400
ON	OFF	OFF	OFF	57600

Power-Up Sequence

When you power on the access point, it performs a power-up sequence that does the following:

- Tests the indicator lights.
- Tests the functional circuits.
- Determines the operational status.
- Determines the boot sequence.

You can monitor the power-up sequence through the indicator lights. During power-up the lights operate in this order:

1. LINK indicator light turns ON and stays ON.
2. STATUS, MODE, R-LINK, W-LINK, NIC1, and NIC2 lights blink three times to indicate they are operational.
3. After the previous lights stop blinking, W-LINK light blinks three more times.
4. About eight seconds after W-LINK stops blinking, R-WINK, W-LINK, NIC1 and NIC2 lights either turn ON or stay OFF to indicate the DIAG port's baud rate (see page 6-6).
5. MODE light blinks constantly to indicate it is in network mode, the normal operating condition.

After the access point completes its boot sequence, it enters its normal operating mode. During normal operation the STATUS indicator light is OFF.

Appendix A
Access Point Specifications

Product Specifications

Processor:	AMD 29200 RISC
Memory:	4 MB RAM/2 MB FLASH ROM
Distribution LAN compatibility:	ANSI/IEEE 802.3 (Ethernet communication standard) and DIX Version 2.0
Interface:	10BASE2 (thinnet), 10BASE5 (AUI or thicknet), and 10BASE-T (twisted pair) through ports on bottom panel
Card slots:	Two PC-card–compatible slots
Mounting options:	Tabletop, wall, or ceiling

Electrical Specifications

The access point has one IEC connector for industry-standard three conductor ac input. The access point's internal power supply automatically detects the voltage level and frequency of the source power. Following are source power specifications.

Voltages:	Autosensing 100, 110, 220, 240 V ac
Frequency:	50 to 60 Hz
Safety:	UL/CSA (Underwriters Laboratory/ Canadian Standards Association), United States and Canada; CB (Competent Body) report for Europe

The access point complies with the following standards.

Immunity:	EN (Euro Norm) 50082-1 Generic Immunity Standard and ETS (European Telecommunication Standard) 300–339 Radio Equipment and Systems; Generic EMC (Electromagnetic Compatibility) for Radio Equipment
Emissions:	FCC Class B verified and CISPR* 22 (EN 55022) Class B radiated and conducted emissions under EN 50081-1, Generic Emissions Standard

* Comite International Special des Perturpations Radio-electurques/International Special Committee on Radio Interference

Environmental Specifications

Operating temperature (standard):	–22 dF to 122 dF (–30 dC to 50 dC)
Humidity:	Remains operational when exposed to 90 percent humidity, noncondensing conditions

" **NOTE:** *Operating temperatures for the WLIF, 900 MHz, and S-UHF radio options are listed in Appendixes B, C, and D, respectively.*

Physical Characteristics

Approximate size:	3.75 in x 6.88 in x 14.5 in (LWH) (9.5 cm x 17.5 cm x 36 cm)
Approximate weight:	3.75 lbs (1.70 kg)

Appendix B

WLIF Specifications and Antennas

RM180

The model name for the WLIF radio option is RM180, a Type III PC card. Following are networking specifications.

Frequency band:	2.401 to 2.480 GHz spread spectrum, frequency hopping
Compatibility:	Interoperable with WLIF, open air, and open wireless LAN products
Range:	Up to 500 feet line of sight
Coverage:	25,000 square feet (2,322 square meters) in typical indoor installations
Data rate:	800 Kbps or 1.6 Mbps, manual or autoselecting
6710 Access Point:	Requires communications driver included with the 6710 Access Point software
Ethernet compatibility:	Ethernet packet types and Ethernet addressing
Output power:	100 mW
MAC protocol:	RangeLAN2
Wireless hop capability:	Yes

Optional interbuilding wireless bridge:	Yes
Operating temperature:	–4 °F to 122 °F (–20 °C to 50 °C)
Regulatory compliance:	FCC 15.247 Industry Canada RSS 210 European Union ETS 300-328 CE EMC-EEC in Europe MKK standard in Japan *Consult a Sales Representative for availability.*

Radio Operation

Wireless devices with the WLIF radio can operate in most areas that allow use of spread spectrum wireless communications at 2.4 GHz, including Australia and countries in North and South America, Europe, and Asia. Contact a Sales Representative for current information about countries in which the product is approved for use and countries in which submission for type approval is planned.

Part Numbers

The following chart lists RM180 part numbers.

RM180 Part Number	Compatibility and Comments
245-149-100	Kit, used with 219-008-001.
219-008-001 *(for PC card slot 1 or 2)*	RM180 only. Used with 245-149-100.
245-149-105	Kit, used with 219-009-001.
219-009-001 *(for PC card slot 1 or 2)*	RM180 only, for Japan. Used with 245-149-105.

Antenna Regulations

For WLIF systems, regulations require the antenna and antenna connector on the access point to be unique and not commercially available. This ensures that the RF output of the radio stays within the limits specified by the regulating agencies.

Whip Antenna

The standard WLIF whip antenna can be used throughout Europe. Its part number is 805-486-001.

Remote Antenna Kits

Remote antenna kits allow a variety of antenna configurations (for a radio installed in the access point) to be located up to 30 feet from the access point. All remote antenna kits include a mounting bracket. Contact your Sales Representative for information about the antenna kit most suitable for your installation.

" **NOTE:** *FCC and DOC regulations require that qualified personnel install remote antennas. Contact your Sales Representative for more information.*

Medium Gain Patch

The medium gain patch is a circular polarized antenna that mounts on the wall. The antenna is well-suited for office areas where low profile is necessary. Circular polarization also works well in areas with many reflections. The following chart lists kit part numbers.

Cable Length	Kit Part Number
10 feet	203-423-001
20 feet	203-423-002
30 feet	203-423-003

Medium Gain Collinear Dipole

The medium gain collinear dipole is a linear polarized antenna that works best in semi-open areas such as loading dock bays, open high ceiling office environments and in areas where penetration through several racks or a single office wall is required.

The following chart lists kit part numbers.

Cable Length	Kit Part Number
10 feet	203-423-004
20 feet	203-423-005
30 feet	203-423-006

High Gain Collinear Dipole

The high gain collinear dipole is a linear polarized antenna that works similar to the medium gain collinear dipole except it has higher gain, can cover larger open areas, and can penetrate through more racks.

This antenna should only be used when it can reduce the number of access points in the system. The following chart lists kit part numbers.

Cable Length	Kit Part Number
10 feet	203-423-010
20 feet	203-423-011
30 feet	203-423-012

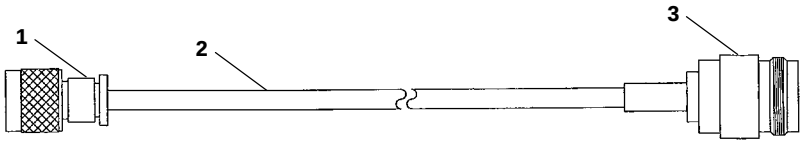
High Gain Yagi

The high gain yagi is a linear polarized antenna typically used in heavy racking where there are long corridors that cannot be penetrated through the side using collinears. The following chart lists kit part numbers.

Cable Length	Kit Part Number
10 feet	203-423-007
20 feet	203-423-008
30 feet	203-423-009

Antenna Adapter Cable

The antenna adapter cable (Figure B-1) enables INTERMEC® Model 110 or 2100 antennas to be used with the 6710 Access Point. The cable's part number is 226-295-001.



1. **RF plug (custom threaded)**
2. **Coaxial cable (6 inches)**
3. **N-type connector**

Figure B-1
Antenna Adapter Cable

Consult your Sales Representative for the regulatory status and availability of this part outside of North America.

Model 2100 Antennas and Cables

2.4 GHz Antennas

Part Number	Antenna, 2.4 GHz
805-486-001	Whip (page B-3)
066147	Omni
063363	3 dBi omni
065349	9 dBi omni
067261	3 dBi mini omni
067262	5 dBi dual flat
067263	9 dBi flat panel

2.4 GHz Antenna Cables and Connectors

Part Number	Description
226-295-001	6710 adapter cable (to cable) (page B-5)
064616	Cable, 2.5 feet (76 cm)
063245	Cable, 5 feet (152 cm)
063246	Cable, 20 feet (610 cm)
063198	Splitter
061868	Lightning suppressor and bracket
586610	Lightning suppressor capsule
589377	LMR400 cable prep tool
064432	LMR400 cable, 100 feet
061475	Type N polarized cable connector
063146	Type N cable connector

Appendix C
900 MHz Specifications and Antennas

RM160

The model name for the 900 MHz radio is RM160, a Type III PC card. Following are networking specifications.

Frequency band:	902 to 928 MHz spread spectrum, direct sequence
Range:	Up to 1300 feet line of sight
Coverage:	100,000–350,000 square feet in typical indoor installations
Data rate:	90, 225, or 450 Kbps (depends on installation)
Channelization:	7 @ 90 Kbps, 1 @ 225 or 450 Kbps
Software compatibility:	Requires communications driver included with the 6710 Access Point software
Output power:	250 mW
MAC protocol:	Open wireless LAN MAC radio protocol
Optional interbuilding wireless bridge:	Yes
Operating temperature:	–4 °F to 122 °F (–20 °C to 50 °C)
Regulatory compliance:	FCC 15.247 Industry Canada RSS 210 *Consult a Sales Representative for availability.*

Radio Operation

Wireless devices with the 900 MHz option can operate in Australia and in most countries in North and South America. Contact a Sales Representative for current information about countries in which the product is approved for use and countries in which submission for type approval is planned.

Part Numbers

The following chart lists RM160 part numbers and special comments.

RM160 Part Number	Compatibility and Comments
226-120-001	Kit (cable only), used with 219-010-001.
219-010-001 *(for PC card slot 1 or 2)*	RM160 only. Used with 226-120-001.

Antenna Regulations

For 900 MHz systems, regulations require the antenna and antenna connector on the access point to be unique and not commercially available. This ensures that the RF output of the radio stays within the limits specified by the regulating agencies.

Whip Antenna

The standard WLIF whip antenna can be used throughout Europe. Its part number is 805-472-001.

Remote Antenna Kits

Remote antenna kits allow a variety of antenna configurations (for a radio installed in the access point) to be located up to 30 feet from the access point. Contact your Sales Representative for information about the antenna kit most suitable for your installation.

" **NOTE:** *FCC and DOC regulations require that qualified personnel install remote antennas. Contact your Sales Representative for more information.*

The following chart lists 900 MHz radio antenna kits.

Antenna	Kit Part Number
3 dB gain, 10 ft cable	203-325-001
3 dB gain, 20 ft cable	203-325-002
3 dB gain, 30 ft cable	203-325-003
Low profile ceiling mount, 20 ft cable	203-367-001

Appendix D

S-UHF Specifications and Antennas

RM111

The model name for the S-UHF radio option is RM111, a Type II PC card. Following are networking specifications.

Frequency band:	430 to 450 MHz or 450 to 470 MHz
Range:	Up to 3500 feet line of sight
Coverage:	800,000 square feet (72,000 square meters) in typical indoor installations
Data rate	19.2 Kbps (14.4 Kbps with forward error correction) (four-level frequency shift keying)
Channelization:	20 kHz or 25 kHz
Transmit power:	27 dBm (.5 Watts)
Receiver sensitivity:	–105 dBm
Output power:	500 mW
MAC protocol:	Open wireless LAN MAC radio protocol
Wireless hop capability:	No (see page D-3)
Optional interbuilding wireless bridge:	No
Operating temperature:	–4 °F to 122 °F (–20 °C to 50 °C)

Regulatory compliance:	FCC Part 90 (pending) ETS 300-220 CE 300-339 (Europe) MPT 1329 FTZ 2014 *Consult a local sales office for the current regulatory status.*

Radio Operation

Wireless devices with the S-UHF option can operate in selected countries in Europe, Asia (except Japan), Australia, and most countries in North and South America. Contact a Sales Representative for current information about countries in which the product is approved for use and countries in which submission for type approval is planned.

Part Numbers

The following chart lists radio part numbers.

Part Number	Comments
245-149-102	Kit, used with 219-006-001 or 219-007-001.
219-006-001 *(PC card slot 2 only)*	RM111 only. Used with 245-149-102. Band is 450 to 470 MHz. *Multiple frequencies must be separated by at least 40 KHz (20 KHz spacing) or 50 KHz (25 KHz spacings).*
219-007-001 *(low band) (PC card slot 2 only)*	RM111 only. Must be used with 245-149-002. Band is 430 to 450 MHz. *Multiple frequencies must be separated by at least 40 KHz.*

Wireless Hops

Because of the low data rate, wireless hops are not supported for S-UHF systems.

Antenna Connector

The S-UHF antenna uses a standard BNC connector.

Whip Antennas

For S-UHF, the standard whip antenna is the primary antenna. Its part number is 805-511-001.

A cabled external antenna is required in cases where the access point and antenna cannot be installed at the same location. Antennas should be installed to maximize separation distance from metal obstructions. The recommended minimum separation distance is 19 feet (6 meters).

The following chart lists cabled external whip antennas.

Length	Part Number
5 feet	203-449-002
18 feet	203-449-003
36 feet	203-449-001
50 feet	203-449-004
75 feet	203-449-005
100 feet	203-449-006

Site License

Operation of S-UHF requires a site license in the United States and some other countries. Consult Sales Administration (in the United States) or the appropriate National Regulatory Agency (outside the United States) for information about the appropriate application process.

Technology

S-UHF technology provides an extended range solution for installations requiring small populations of terminal emulation stations operating at low transaction rates. In regions where 900 MHz operation is permitted (United States, Canada, Australia, and several countries in Central and South America), S-UHF is recommended only for the following:

- Sites in excess of 500,000 square feet (50,000 square meters).
- Sites requiring 10 or fewer terminal emulation stations.
- System transaction rates less than 1 per second.

S-UHF may be appropriate for larger sites on an individual basis. Consult your Sales Representative for more information.

Transaction Rates

S-UHF performance is sensitive to transaction rate and terminal count. The installation guideline is 32 or fewer wireless stations per frequency. The following chart shows guidelines for multiple frequency installations.

# Frequencies	# Wireless Stations
1	32
2	60
3	80
4	100

Installation Guidelines

The following pages contain guidelines for predicting the coverage area and installing single and multiple access points.

Predicting Coverage

Table D-1 shows predicted indoor coverage areas for an access point with the S-UHF radio. The table was generated using a mathematical mode. Areas are in square meters. For square feet, multiply the area in square meters by 10.

Table D-1
Coverage Prediction

Increased Coverage Overlap Between Access Points ⇒		⇒		⇒
Increased obstructions	120K*	100K	80K	64K
⇓	100K	84K**	64K**	51K
⇓	82K	68K**	52K**	42K
⇓	68K	56K	43K	34K*

* *The extremes of 120K and 34K square meters are indicative of best and worst case coverage results using this model.*

** *Reflects typical expected coverage for industrial and warehousing applications.*

Installing a Single Access Point

You can install a single access point when wireless station populations, system transaction rates, and coverage requirements permit. Following are some factors to consider:

- For large coverage areas, it is necessary to locate the access point optimally to maximize coverage.
- At sites where the structure and operations within provide a uniform RF signal propagation environment, the location is generally centralized within the facility.
- For nonuniform sites, the location needs to be adjusted for best coverage.
- For small sites, location is less critical and may be adjusted to minimize LAN wiring.

Location of S-UHF access points within computer rooms is not recommended, because RF emissions from the higher speed processors used in current generation computers may reduce system range.

Installing Multiple Access Points

Multiple access points can extend coverage, reuse a frequency, and increase system throughput.

Extending Coverage

Multiple access points may be installed to extend coverage. Figure D-1 shows an installation where maximizing coverage is the main objective.

" **NOTE:** *A site survey is required for this type of installation.*

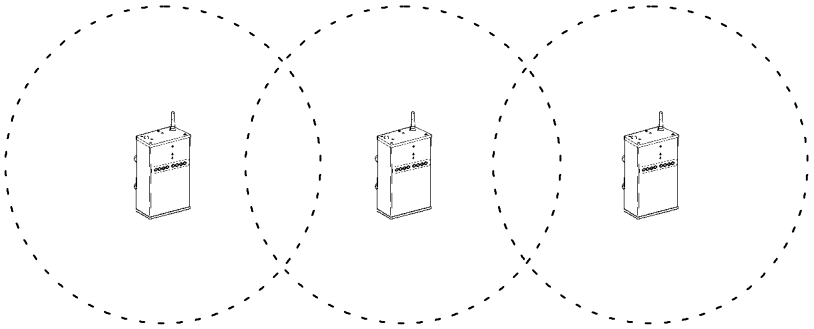


Figure D-1
Extending Coverage

In this type of installation, the access point coverage areas are overlapped minimally to provide seamless coverage. The access points may all use a common frequency, requiring adherence to the system terminal population and transaction rate limits for one frequency.

You can also install access points on different frequencies. In this case, you *may* be able to increase the wireless station population and transaction rate. However, the single frequency wireless station population and transaction rate must be maintained per access point. The installation must consider whether the system may at any time be required to operate with more than the maximum number of wireless stations in any one access point coverage area.

Reusing the Frequency

If access points are separated by sufficient distance, you can reuse a frequency, as illustrated in Figure D-2.

" **NOTE:** *A site survey is required for this type of installation.*

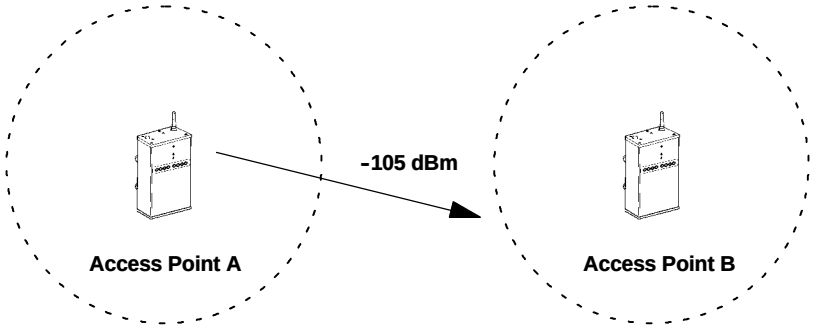


Figure D-2
Frequency Reuse

In this type of installation, you can install access points on the same frequency. Each access point can sustain the single frequency wireless station population and transaction rate. The guideline for frequency reuse is:

> The signal level produced by access point "A" must be less than –105 dBm at the required coverage limit of access point "B."

Increasing System Throughput

To increase the wireless station population or system transaction rate, you can overlap access point coverage areas and use multiple frequencies. The system design allows up to four frequencies, 100 stations, and three transactions per second. Large wireless station populations or transaction rates require use of one of the high speed RF media.

Two configuration options are possible:

Option 1:	Configure wireless stations for frequency agile operation.
Option 2:	Configure wireless stations for single frequency operation, splitting the wireless station population equally among the available frequencies.

Both options require that you configure the access points on unique frequencies.

Option 1

Option 1 is recommended when the system cannot be installed so that each access point covers the entire area. In this case, you must install the access points so that all of them overlap in high usage area where wireless station populations and transaction rates are greatest.

Frequency agile software in the wireless stations allows roaming between frequencies. The wireless stations employ a load balancing algorithm so that the number of wireless stations on each frequency is about the same at all times.

If frequency agility is used, and the wireless stations are normally powered up in an area of overlapping coverage, you can speed up network attachment by setting different default frequencies in the wireless stations for initial load balancing. This shortens the period required for the load balancing algorithm to adjust.

Option 2

Option 2 is recommended if the coverage area is small enough that all access points can be installed to cover the full area. See Figure D-3.

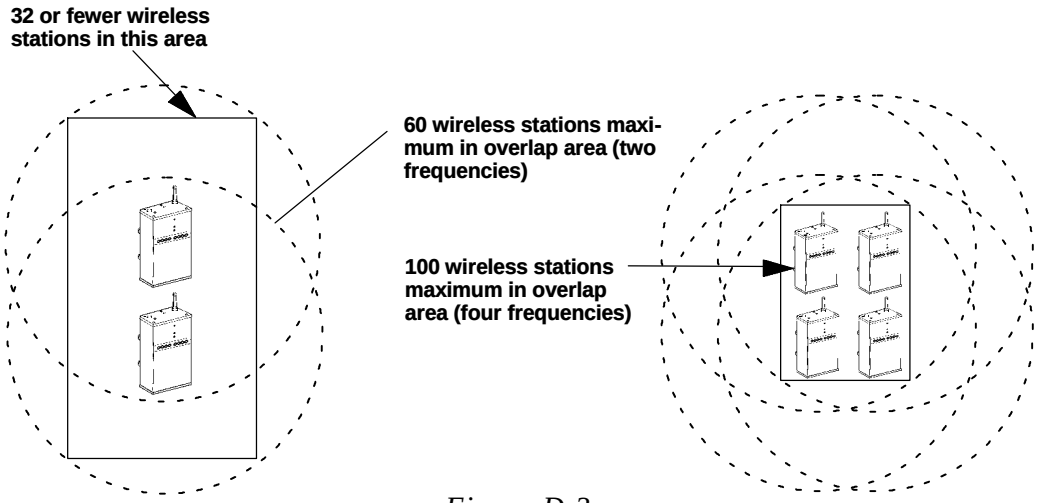


Figure D-3
Increased System Throughput

Frequency and Separation Guidelines

When using overlapping access points, you must provide minimum physical separation between access point antennas. The recommended minimum frequency separation between frequencies used within an installation is 200 KHz, with separation of 1 MHz preferred.

In some cases, you may need to use separations as small as 40 KHz (for 20 KHz spacings) or 50 KHz (for 25 KHz spacings) because of regulatory limitations. In this case, the physical separation between access point antennas must be increased. The recommended minimum physical separation between access points is 30 meters (100 feet).

Absolute minimum separations are based on frequency separation, as indicated in the following chart.

Frequency Separation	Absolute Minimum
50 KHz	100 feet (30 meters)
≥ 200 KHz	20 feet (7 meters)

Appendix E

OWL/IP

Introduction

Wireless networks may be installed in environments that are segmented by IP routers. If OWL/IP is not enabled, the presence of a router generally defines the physical boundary of the wireless network. Wireless coverage can be provided by installing multiple independent wireless networks, each with its own LAN ID, super root and set of wireless stations. In this environment, stations can only operate within the limited coverage area of its own network and cannot roam across subnet boundaries. OWL/IP provides the capability of installing a single, extended wireless system in the routed environment.

OWL/IP provides:

- Extension of the open wireless LAN spanning tree to include access points operating on different IP networks or subnetworks.
- Transparent roaming of wireless stations across router boundaries without loss of connectivity.
- Support of wireless stations using both IP and ordinarily nonroutable protocols.

OWL/IP is activated by enabling the OWL/IP port in the access point. The port is an entryway to an IP *tunnel* originated by the super root on the *home subnet*, and terminated by a designated bridge operating on a *remote subnet*. Frames are encapsulated using the GRE protocol running over IP.

The super root can originate IP tunnels to eight or fewer IP addresses. The number of tunnels supported may be more than or fewer than eight, depending on the type of addressing used and redundancy needs within the installation.

The OWL/IP port differs from the physical NIC1, NIC2 and Ethernet ports within the access point. It is a *logical* port that provides IP encapsulation services for frames that must be routed to reach their destination. Once encapsulated, frames are transmitted or received through one of the three physical ports.

OWL/IP Restrictions

Addressing Limitations

Wireless stations using IP must be assigned IP addresses on the home subnet. Servers may be located on any subnet. However, it is preferable to choose the subnet that contains servers for wireless stations as the home subnet if possible.

Installation Limitations

OWL/IP tunnels should not be used:

- For network protocols that an IP router is configured to bridge. Many routers may be installed to bridge specific frame types. These routers are often referred to as B-routers.
- For network protocols a router is capable of routing. For example, IPX frames should not be tunneled through a router capable of routing both IP and IPX frames.

If access points are installed so that a wireless secondary LAN can be established between access points separated by a router, it is possible to inadvertently bridge around the router. This can be avoided by choosing designated bridge locations, or choosing radio channels to avoid inadvertent wireless bridging.

OWL/IP Safeguards

The purpose of a router is to segment traffic on a local network, and selectively forward frames destined to addresses on other networks. OWL/IP is designed to minimize the impact on existing installations, while supporting mobility for wireless stations. The safeguards on the following pages are built into OWL/IP.

Default Settings

By default, OWL/IP is disabled and must be manually enabled before tunnels are originated. Additionally, once enabled, default filter settings prevent forwarding of all protocols except NORAND Network Layer (NNL), ARP for IP address resolution, and ICMP, which supports diagnostic capabilities such as PING. Extensive filtering capabilities are provided to allow traffic to be restricted to that known to be destined to wireless stations.

Addressing Limitations and Flooding Restrictions

Wireless stations using IP must be assigned addresses on the home subnet. The ARP server capability can be enabled to reduce propagation of ARPs through tunnels. IP servers can be located on any subnet; however, it is desirable to choose the subnet containing servers used extensively by client wireless stations as the home subnet if possible.

For stations or servers using protocols other than IP, there are no restrictions on location of servers or address assignments. Routing is minimized if servers are located on the home subnet.

OWL/IP does not flood outbound unicast frames. Multicast IP frames are forwarded outbound from the home subnet. Designated bridges forward unicast and multicast frames inbound to the home subnet if the IP address belongs to the home subnet. (See “Subnet Filtering,” page E-6.) Global Flooding settings and Flood Register settings do not apply to OWL/IP tunnels.

Permanent Filters

Certain frame types are never forwarded through tunnels. These include those IP protocols used for coordinating routers, or MAC frames used for coordinating bridges.

These frames are not forwarded:

- 802.1d bridge frames.
- IP frames with a broadcast or multicast Ethernet address.
- IP frames with the following (router) protocol types and decimal values:

DGP (86) (Dissimilar Gateway Protocol)
EGP (8) (Exterior Gateway Protocol)
IDPR (35) (Inter-Domain Policy Routing Protocol)
IDRP (45) (Inter-Domain Routing Protocol)
IGP (9) (Interior Gateway Protocol)
IGRP (88) (Interior Gateway Routing Protocol)
MHRP (48) (Mobile Host Routing Protocol)
OSPFIGP (89) (Open Shortest Path First Interior Gateway Protocol)

- IP ICMP types, including:

  IPv6
  Mobile IP
  Router Advertisement
  Router Selection

- IP/UDP frames with these destination protocol port numbers:

  BGP (179) (Border Gateway Protocol)
  RAP (38) (Route Access Protocol)
  RIP (520) (Routing Information Protocol)

- IP/TCP frames with these destination or source protocol port numbers:

  BGP (179) (Border Gateway Protocol)
  RAP (38) (Route Access Protocol)

These frames are always forwarded:

- DIX 0875C open wireless LAN inter-access point coordination frames
- DIX 0800 Internet Protocol
- IP Protocol (47) GRE

Default Filter Settings

The default settings for [TX Filter] are set to pass the following frame types (and drop all others):

- DIX 0875B NNL
- DIX 0806 ARP
- IP Protocol ICMP (1) supporting the following frame types:

  Address Mask Reply (18)
  Address Mask Request (17)
  Alternate Host Address (6)
  Destination Unreachable (3)
  Echo Reply (0)
  Echo Request (8)
  Parameter Problem (12)
  Redirect (5)
  Source Quench (4)
  Time Exceeded (11)
  Time Stamp (13)
  Time Stamp Reply (14)
  Trace Route (30)

Subnet Filtering

OWL/IP automatically provides subnet filtering for IP wireless stations. Designated bridges never forward frames to the home subnet, unless the IP address belongs to the home subnet. This feature prevents inbound flooding of undesired IP traffic.

Password Security

The access point has two levels of password security. Knowledge of the standard password allows general access to the configuration menus. If desired, the OWL/IP configuration can be access protected by enabling the Advanced Password in the [Security] menu.

Operation

OWL/IP uses IP encapsulation to establish a virtual LAN segment through an IP router. The OWL/IP tunnel becomes a branch in the spanning tree. Access points on the remote subnet are linked to the super root through a designated bridge. Operation is analogous to secondary LANs, where wireless links are used to connect Ethernet segments. Figure E-1 shows Ethernet segments connected by a wireless link; Figure E-2 shows an OWL/IP tunnel.

For Ethernet secondary LANs, a wireless link is established between an access point on the distribution LAN and a designated bridge on a secondary Ethernet segment. Frames to or from a secondary Ethernet LAN are bridged at the MAC layer. In the case of OWL/IP, a virtual MAC layer link is established through an "IP tunnel" between the super root and a designated bridge.

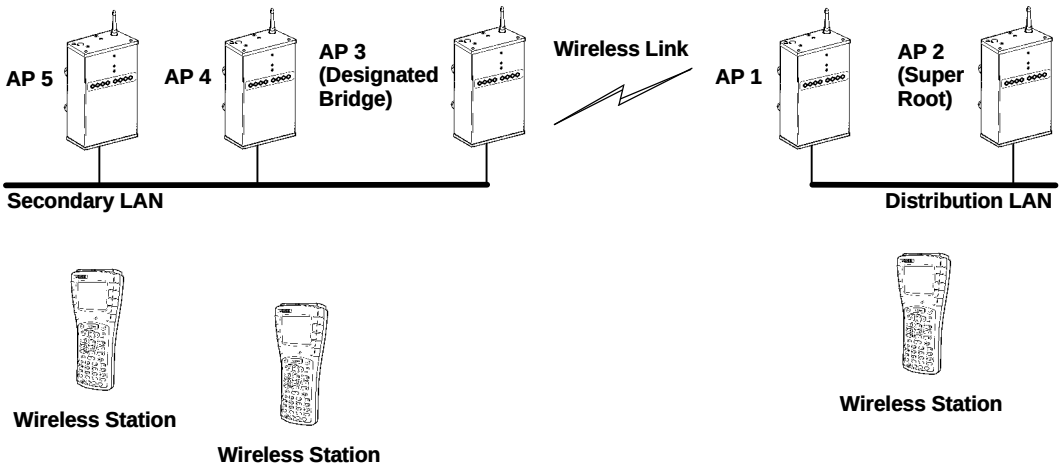


Figure E-1
Secondary LAN

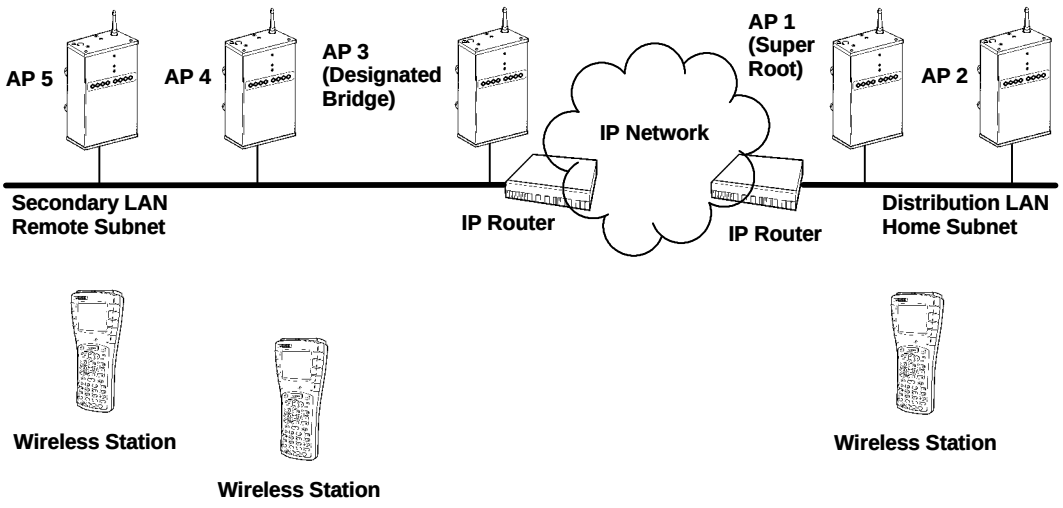


Figure E-2
OWL/IP Tunnel

Following are three primary differences between secondary LANs separated by wireless links and secondary LANs separated by OWL/IP tunnels:

- Any access point on the distribution LAN can provide wireless connectivity for a designated bridge on a secondary Ethernet LAN. Only the super root can originate OWL/IP connections to designated bridges on remote subnets.
- Flooding parameters for designated bridges on secondary Ethernet LANs can be adjusted through the global settings in the super root, or through local configuration in the designated bridge. Flooding parameters for OWL/IP tunnels are not adjustable.
- The super root and designated bridges for OWL/IP tunnels include additional configurable output (transmit) filters, allowing frame types forwarded through tunnels to be tightly controlled. These filters are provided in addition to the standard Ethernet input filters available in all access points.

Tunnel Origination

Building the Spanning Tree

The open wireless LAN spanning tree is established and maintained by short hello messages originating at the super root. “Hellos” are broadcast periodically at intervals of a few seconds. These frames contain network coordination information, including root priority.

At power up, all super root candidates listen for hello messages. If they do not detect hellos, or detect hellos from a lower priority root candidate, they begin to send hello messages.

If a super root candidate receives a hello from an access point with a higher root priority (or equal root priority from a higher MAC address), it stops sending hellos. This root election protocol continues until only one super root access point sends hellos. After the super root is established, other access points attach to the super root forming the spanning tree.

Establishing and Maintaining Tunnels

Once a super root is elected, it begins to forward hello messages to IP addresses configured in the OWL/IP menu. Designated bridge candidates on a remote subnet use bridge priority in a similar election procedure to determine which access point serves as designated bridge for that subnet.

Once a designated bridge is elected, it attaches to the super root, indicating that it is the designated bridge for the subnet. Designated bridges are responsible for forwarding hellos to other access points on the local subnets. These hellos indicate to other access points that they are the designated bridge for that subnet.

Redundancy

The super root and designated bridge election procedure are repeated if the current super root or designated bridge stops sending hellos. This provides redundancy in the event of an isolated access point, router, power, or cabling failure.

Normally, one primary and one or two fallback super root candidates are sufficient for super root redundancy. One primary designated bridge and one fallback are recommend for most remote subnet installations. The number of remote subnets and redundancy needs on each subnet influences the selection of address types in the [IP Addresses] menu. See the configuration examples on page E-13.

Frame Forwarding

MAC frames originating on the home subnet are encapsulated in the super root, forwarded through the IP network, deencapsulated in the designated bridge, and forwarded to the appropriate access point for delivery to the intended wireless station. The same process is used in reverse between the designated bridge and the super root for inbound frames. The encapsulation uses the standard IP GRE protocol.

Outbound

Data frames are forwarded outbound through an IP tunnel if:

- A wireless station is known to be attached to an access point on a particular remote subnet.
- The frame type is specified in the [TX Filter] menu.

Designated bridges are responsible for forwarding attach status for wireless stations to the super root. The super root maintains entries for these stations in its forwarding database indicating the correct subnet for outbound forwarding.

IP ARP (Address Resolution Protocol) and ICMP frames are normally forwarded outbound through all tunnels. Enabling the ARP server in the super root can reduce the number of ARPs forwarded.

Inbound

The same forwarding rules apply for frames inbound from remote subnets. Designated bridges maintain entries in their forwarding database for addresses that require routing through tunnels.

Frames destined for servers or stations on the local subnet are not forwarded through tunnels. Only frame types configured in the [TX Filter] menu are forwarded.

Additionally, IP frames are only forwarded inbound if the IP address belongs to the home subnet (see “Subnet Filtering,” page E-6).

Station Mobility

As stations move through a facility, they roam between access point coverage areas. In large installations, these access points may be on different IP subnets. OWL/IP is designed to support rapid roaming in these environments. A “roam” requires updates to the forwarding databases in the new access point, super root, previous access point, and any intermediate designated bridges.

A roam is initiated when a station attaches to a new access point. This access point sends an attach message to the super root, which in turn forwards a detach message to the previous access point, allowing each access point to update its forwarding database. Designated bridges monitor these exchanges and update their forwarding databases.

Mobile IP Comparison

The Internet Engineering Task Force has developed RFC 2002, *IP Mobility Support*, commonly referred to as *Mobile IP*. Mobile IP is designed primarily to address the needs of IP stations that may move between geographically separated locations.

OWL/IP is designed primarily to operate in local area environments, where handcarried or vehicle mounted stations may move rapidly between access point coverage areas on a subnetted LAN. The two technologies are complimentary and may coexist. Table E-1 summarizes some differences.

Table E-1
Mobile IP Comparison

Comparison	Mobile IP	OWL/IP
Software compatibility:	Requires a Mobile IP client software stack in IP wireless stations.	Allows use of existing IP software stacks in wireless stations.
Addressing limitations for IP stations:	None.	Requires that IP station addresses belong to the home subnet.
Routing of non-IP protocols:	Is not allowed.	Is configurable through [TX Filter]. Limitations are detailed under "OWL/IP Restrictions," page E-2.
Scalability:	Has no inherent limitations.	Limits tunnel origination to eight IP addresses. The number of remote subnets supported may be more than or fewer than eight, depending on the selected addressing approach.
Special network software:	Requires home and foreign agents located on each network or subnetwork.	Is a standard feature in open wireless LAN system software.

OWL/IP Configuration Examples

Example 1: Class C IP Addresses

The sample network in Figure E-3 illustrates OWL/IP setup for a location with several Class C IP addresses. Subnet addressing is not used. For illustrative purposes, IP addresses have been selected from those allocated for private networks that are not connected to the Internet.

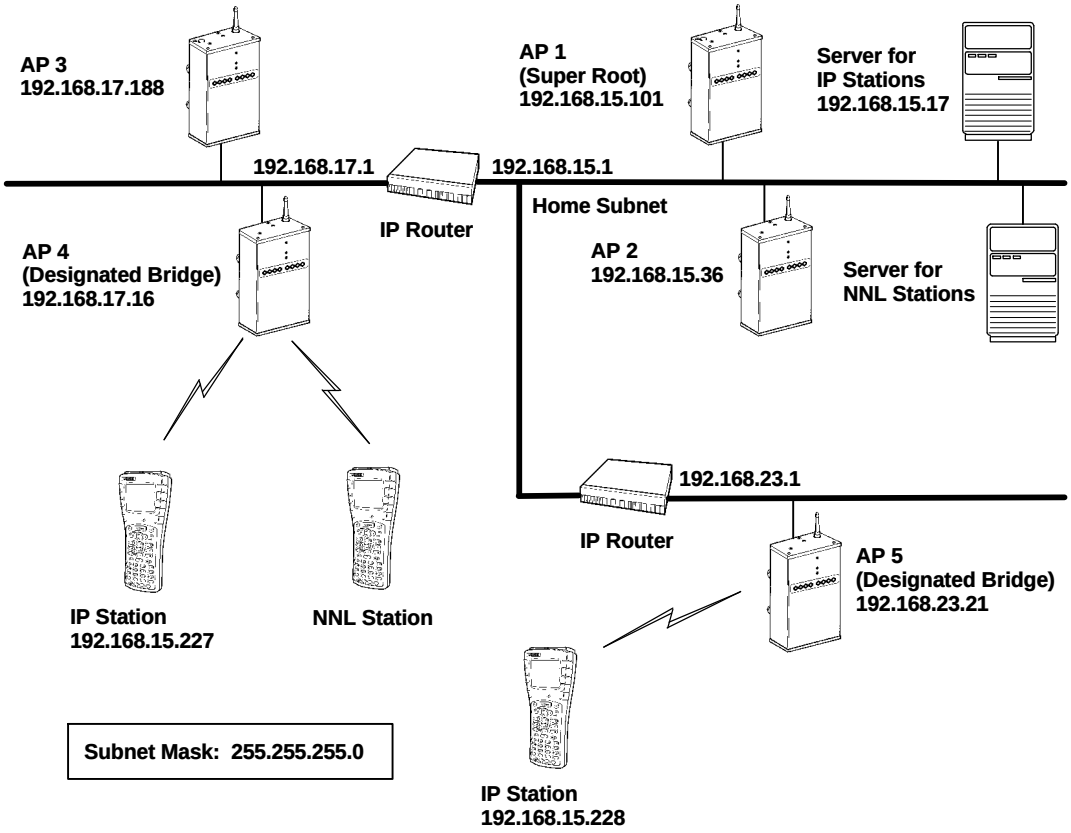


Figure E-3
Example Class C Configuration

Step 1

- Access points are assigned IP addresses for the appropriate subnets.
- Subnet 192.168.15.0 is designated as the home subnet, since it contains the servers used by wireless stations.
- Wireless stations that require IP connectivity are given IP addresses on this subnet.
- Access point (AP) 1 is selected as the primary super root and assigned root priority 3.
- AP 2 is selected as the fallback super root and assigned root priority 1.
- All other access points are configured to root priority 0.

Step 2

- AP 4 is selected as the designated bridge for subnet 192.168.17.0 and configured with bridge priority 2.
- AP 3 is configured as the fallback designated bridge for that subnet, and configured with bridge priority 1.
- Other access points on the subnet are configured with bridge priority 0.
- AP 5 is chosen as the designated bridge for subnet 192.168.23.21.

Step 3

The two super root candidates are configured to originate tunnels. Two options are available: unicast addressing and directed broadcast.

Option A: Unicast Addressing

In this example, unicast IP addresses are entered in the table for each designated bridge. The two designated bridges on subnet 192.168.17.0 negotiate which access point serves as the designated bridge for that subnet.

AP 4 has the highest bridge priority, so AP 3 becomes the designated bridge only if AP 4 fails or loses its network connection. AP 5 is the only access point on subnet 192.168.23.0, so no fallback is available.

Following is the IP Addresses Table for this option:

	Type	Address
1	<Unicast>	192.168.17.16
2	<Unicast>	192.168.17.188
3	<Unicast>	192.168.23.21
4	<Unicast>	0.0.0.0
5	<Unicast>	0.0.0.0
6	<Unicast>	0.0.0.0
7	<Unicast>	0.0.0.0
8	<Unicast>	0.0.0.0

Option B: Directed Broadcast

In this example, a directed broadcast address is used for each subnet. The broadcast to subnet 192.168.17.0 is received by all access points. The access point with the highest bridge priority provides the remote termination of the OWL/IP tunnel. A broadcast MAC address is used.

Following is the IP Addresses Table for this option:

	Type	Address
1	<Broadcast>	192.168.17.255
2	<Broadcast>	192.168.23.255
3	<Unicast>	0.0.0.0
4	<Unicast>	0.0.0.0
5	<Unicast>	0.0.0.0
6	<Unicast>	0.0.0.0
7	<Unicast>	0.0.0.0
8	<Unicast>	0.0.0.0

Step 4: Set TX Filters

Support for both NNL and IP stations is required. This example assumes DIX Ethernet is supported, but 802.3 and SNAP are not required. NNL is enabled by the default settings. Following is the [Frame Types] screen:

	Action	Scope
DIX-IP-Other Protocols	<Drop>	<Unlisted>

Following is the [SubTypes 1] screen:

	Action	SubType	Value
NNL	<Pass>	<DIX-EtherType>	87 5b

The default settings for IP protocols enable ARP and ICMP. TCP and UDP are disabled by default. Applications running over TCP or UDP can be enabled by changing the DIX TCP and DIX UDP ports to pass all frames. Following is the [Frame Types] screen:

	Action	Scope
DIX-IP-TCP Ports	<Pass>	<All>
DIX-IP-UDP Ports	<Pass>	<All>

Alternatively, if a limited set of known applications is to be supported, filters may be set to selectively pass listed Port numbers. Following is the [Frame Types] screen:

	Action	Scope
DIX-IP-TCP Ports	<Drop>	<Unlisted>
DIX-IP-UDP Ports	<Drop>	<Unlisted>

For example, to support FTP (data and control) and Telnet, enable protocol ports 20, 21, and 23, respectively.

The above IP port numbers are specified as decimal values. These can be input directly by following the entry with a decimal point; for example, "20." Values are displayed in the table as hexadecimal values: 14, 15, and 17.

Following is the [SubTypes 1] screen:

	Action	SubType	Value
DIX-ARP	<Pass>	<DIX-EtherType>	08 06
SNAP-ARP	<Drop>	<SNAP-EtherType>	08 06
802.2-IPX-RIP	<Drop>	<802.2-IPX-Socket>	04 51
802.2-IPX-SAP	<Drop>	<802.2-IPX-Socket>	04 53
NNL	<Pass>	<DIX-EtherType>	87 5b
NETBIOS	<Drop>	<802.2-SAP>	f0 f0
1	<Pass>	<DIX-IP-Protocol>	00 01
2	<Pass>	<DIX-IP-TCP-Port>	00 14
3	<Pass>	<DIX-IP-TCP-Port>	00 15
4	<Pass>	<DIX-IP-TCP-Port>	00 17
.			
.			
16	<Drop>	<DIX-IP-TCP-Port>	00 00

Example 2: Class B IP Address Using Subnetting

The example in Figure E-4 uses the Class B address of 172.16.0.0 and a subnet mask of 255.255.248.0. This provides 30 subnets of 2046 hosts each. Subnet addressing for this network is described under "IP Subnet Mask" in Section 4, "Configuration."

In this example, each subnet has about 10 access points. The home subnet contains the address range of 172.16.16.1 through 172.16.23.254.

Step 1

- Access points are assigned IP addresses for the appropriate subnets.
- Subnet 172.16.16.0 is designated as the home subnet, since it contains the servers used by wireless stations.
- Wireless stations that require IP connectivity are given IP addresses on this subnet.
- AP 1 is selected as the primary super root, and given root priority 3.
- AP 2 is selected as the fallback super root and assigned root priority 1.
- All other access points are configured to root priority 0.

Step 2

- AP 11 is selected as the designated bridge for subnet 192.16.24.0 and configured with bridge priority 2.
- AP 12 is configured as the fallback designated bridge for that subnet, and configured with bridge priority 1.
- Other access points on the subnet are configured with bridge priority 0.
- AP 21 and AP 22, AP 31 and AP 32, etc. are configured as designated bridge candidates for their respective subnets.

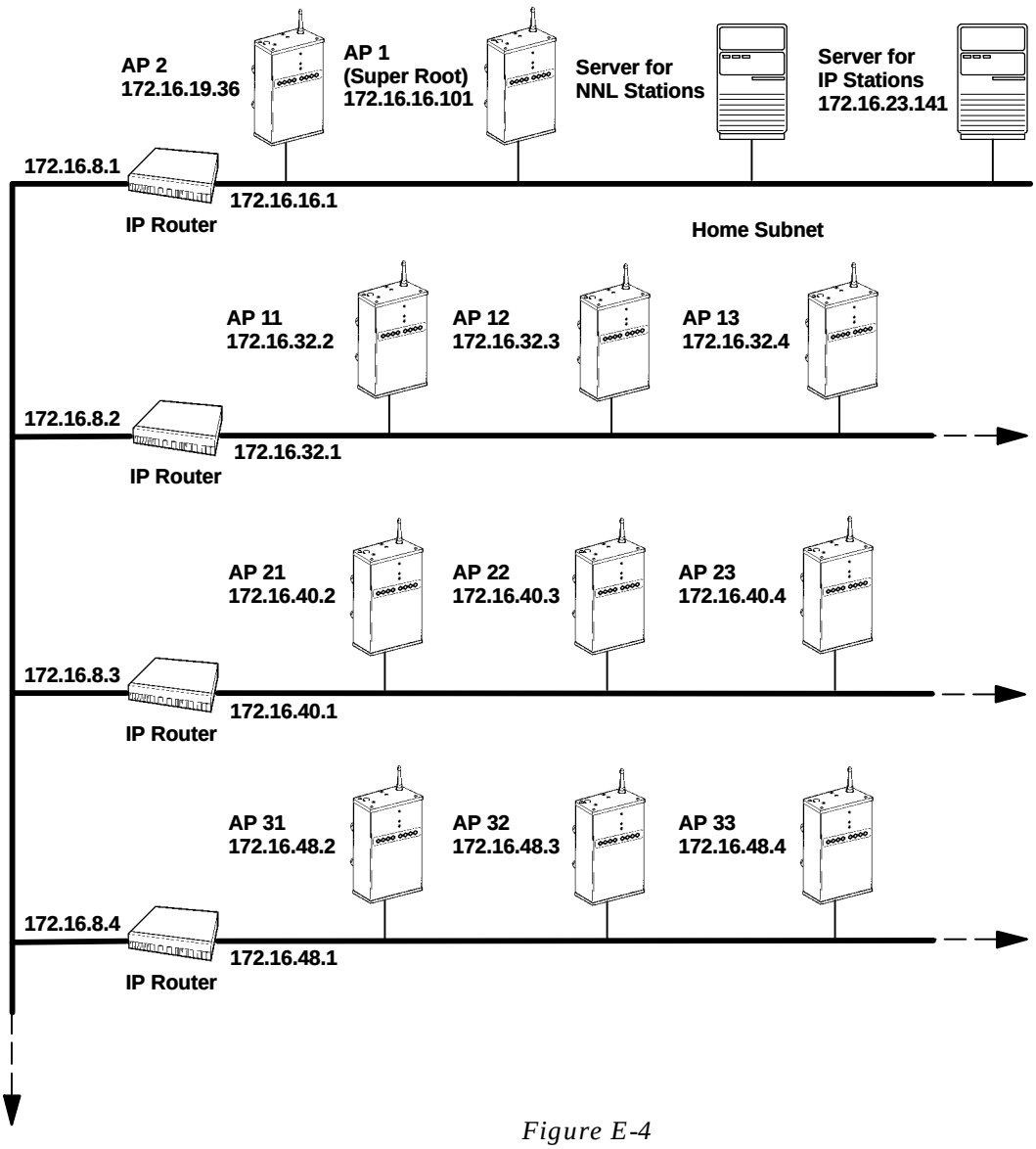


Figure E-4
Example Class B Configuration

Step 3

The two super root candidates are configured to originate tunnels.

Option A: Unicast Addressing

In this example, unicast IP addresses are entered in the table for each designated bridge. The two designated bridges on each subnet will negotiate which access point serves as the designated bridge for that subnet.

Use of two designated bridge candidates on each subnet restricts the number of subnets that can be supported to four. To increase the size of the wireless network, it is necessary to eliminate redundant designated bridges or use broadcast addressing.

	Type	Address
1	<Unicast>	172.16.24.2
2	<Unicast>	172.16.24.3
3	<Unicast>	172.16.32.2
4	<Unicast>	172.16.32.3
5	<Unicast>	172.16.40.2
6	<Unicast>	172.16.40.3
7	<Unicast>	172.16.48.2
8	<Unicast>	172.16.48.3

Option B: Directed Broadcast

In this example, a directed broadcast address is used for each subnet. The broadcast to address 172.16.23.255 is received by all access points on subnet 172.16.16.0. The access point with the highest bridge priority provides the remote termination of the OWL/IP tunnel for each subnet. A broadcast MAC address is used. This option supports primary and fallback access points on up to eight subnets.

	Type	Address
1	<Broadcast>	172.16.23.255
2	<Broadcast>	172.16.31.255
3	<Broadcast>	172.16.39.255
4	<Broadcast>	172.16.47.255
5	<Unicast>	0.0.0.0
6	<Unicast>	0.0.0.0
7	<Unicast>	0.0.0.0
8	<Unicast>	0.0.0.0

Option C: All Subnets Broadcast

In this example, an All Subnets broadcast address is used. This broadcast is forwarded throughout the network and received by designated bridges on all subnets. See ***Comments*** on the next page before using the All Subnets broadcast. Directed broadcast is the preferred implementation for larger system installations.

	Type	Address
1	<Broadcast>	172.16.248.255
2	<Unicast>	0.0.0.0
3	<Unicast>	0.0.0.0
4	<Unicast>	0.0.0.0
5	<Unicast>	0.0.0.0
6	<Unicast>	0.0.0.0
7	<Unicast>	0.0.0.0
8	<Unicast>	0.0.0.0

Comments:

- The All Subnets broadcast generates traffic to all subnets, including those that do not contain access points.
- Some IP routers do not support All Subnets, or may require specific configuration.
- There are practical limits on the number of tunnels a super root can establish and support. These limits depend on factors unique to each installation, such as network traffic. The eight tunnel addresses specified in the menu are a conservative limit for large networks.
- Generally, installations that require roaming over multiple subnets can be partitioned in other ways. Consult your Sales Representative or Technical Support for more information.

Step 4

TX filter set up is identical to Example 1 (page E-13).

Appendix F

Port and Cable Pin-Outs

This appendix lists pin-outs for the 6710 Access Point's DIAG and AUI ports, and the standard null modem cable.

DIAG Port Pin-Outs

The following chart defines the signals present on the pins for the DIAG port. Pin numbering is from left to right and top to bottom. For example, pin 1 is on the top left of the connector, and the last pin is on the bottom right.

Pin Number	Signal Name	Signal Level
1	Not used	
2	TXD	RS-232
3	RXD	RS-232
4	DTR	RS-232
5	GND	
6	DSR	RS-232
7	Not used	
8	Not used	
9	Not used	

AUI Port Pin-Outs

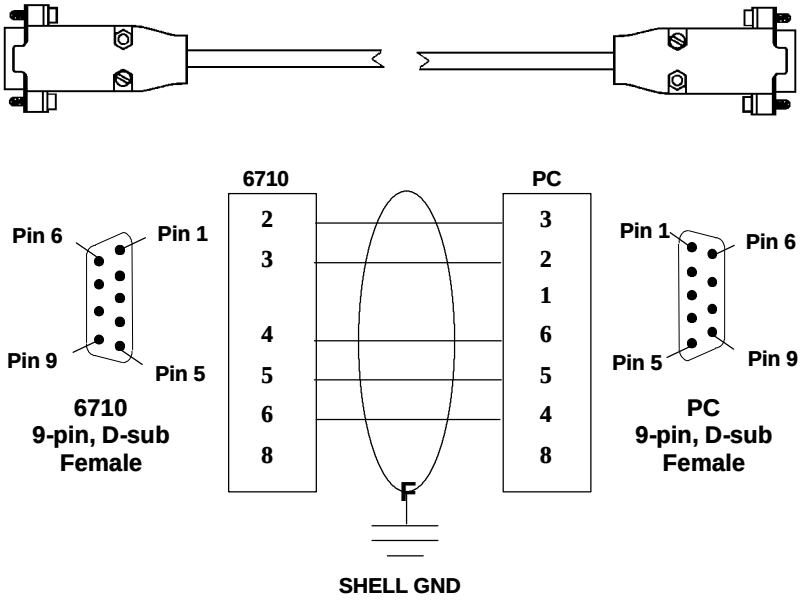
The following chart defines the signals present on the pins for the AUI port. Pin numbering is from left to right and top to bottom. For example, pin 1 is on the top left of the connector, and the last pin is on the bottom right.

Pin Number	Signal Name
1	GND
2	Data
3	Data
4	Not used
5	Data
6	GND
7	Not used
8	Not used
9	Data
10	Data
11	Not used
12	Data
13	12 V dc
14	Not used
15	Not used

DIAG Port Cable

DIAG Port
to 9-pin Male PC Port
(Standard Null Modem Cable)

Part Number: 226-106-001 (6 feet)



Appendix G

MIB

Product Contents

The 6710 Access Point MIB is on disk part number 215-894-001. Order the MIB through your Sales Representative.

The following products are available for management of the open wireless LAN/INCA LAN:

- HP OpenView for Windows
- OWLView for HP OpenView for UNIX
- OWLView for HP OpenView for Windows

About This Product

The 6710 Access Point MIB is packaged to provide basic network management capability for the open wireless LAN. The access point maintains the following management objects, which are specific to its operation:

- **6710MIB.MIB** — contains all of the Intermec management objects supported on the 6710 Access Point.
- **RFC1213.MIB** — is the standard MIB-II.
- **RFC1398.MIB** — is the standard Ethernet MIB.

These MIBs are on the 6710 Access Point's MIB disk. You need to load the MIBs onto your management platform to query the access point for these management objects.

Getting Started

Install the MIBs onto your management platform in this order:

1. **RFC1213.MIB**
2. **RFC1398.MIB**
3. **6710MIB.MIB**

" **NOTE:** *If you are using HP OpenView for Windows, use the OpenView Control/SNMP Manager/Manage Database menu items to add the previous listed MIBs to the HP OpenView MIB database. If you are* ***not*** *using HP OpenView for Windows, consult your network management station user's guide for instructions on adding MIBs.*

MIB-II Information

MIB-II is for use with network management protocols in TCP/IP-based internets. The 6710 Access Point supports most of MIB-II. Table G-1 contains the major groups.

Table G-1
MIB-II Information

MIB Family	OID	Purpose	Groups
System	1.3.6.1.2.1.1	Model and device type	
Interfaces	1.3.6.1.2.1.2	I/O ports	
AT	1.3.6.1.2.1.3	Table of IP to MAC/DLC address	
IP	1.3.6.1.2.1.4	IP process	
ICMP	1.3.6.1.2.1.5	ICMP process	
TCP	1.3.6.1.2.1.6	TCP process	
UDP	1.3.6.1.2.1.7	UDP process	
EGP *	1.3.6.1.2.1.8	EGP process	
CMOT *	1.3.6.1.2.1.9	Historical inclusion for OSI support	
Transmission	1.3.6.1.2.1.10	Allows for data based on I/O port type	dot3 (Ethernet)
SNMP	1.3.6.1.2.1.11	Allows data to be collected about SNMP devices	

* *The 6710 Access Point does not support EGP and CMOT.*

6710 Access Point MIB Information

Intermec has structured its proprietary management information similar to MIB-II. In addition to MIB-II, the 6710 Access Point supports information specific to its operation.

EXAMPLE: Device system information is found under `nSystem`, similar to MIB-II System. The OID for the nSystem group ends in "1," just as the OID for MIB-II system ends in "1."

Table G-2 shows access point MIB information.

Table G-2
MIB Information

MIB Family	OID	Purpose	Groups
nSystem	1.3.6.1.4.1.469.1000.2.1	Model, device type, software, file system	hw, file, fsinfo, segment, dir, sysErrors, criticalErrors
nInterfaces	1.3.6.1.4.1.469.1000.2.2	I/O ports	nifx, portState, portStats, ptxq, pmsg
nSNMP	1.3.6.1.4.1.469.1000.2.11	SNMP	community, trapTarget
nBridge	1.3.6.1.4.1.469.1000.2.17	Bridging	rt, brg, addr, brgState, bridgeStats
nControl	1.3.6.1.4.1.469.1000.2.105	Device control	powerUp, softwareDownLoad

Access to Management Information

Access to Intermec management information is obtained with the proper COMMUNITY name. Intermec provides three levels of access. This table outlines the levels with the required community name.

" **NOTE:** *Community strings are case-sensitive.*

Community String	Access Type	Description of Access Type
public	READ-ONLY	May read MIB objects, but not write or change values. **EXCLUSIONS:** Will not be able to read or write the Community Table.
CR52401	READ-WRITE	May read MIB objects. May write to MIB objects that have read-write access. **EXCLUSIONS:** Will not be able to read or write the Community Table.
secret	SUPER-USER	May read MIB objects. May write to MIB objects that have read-write access. Can read and write the Community Table.

The names of the community strings for each community or access group are stored in (norand.manage.norandNet.nSNMP.v1Config.communityTable). These three records may be viewed and modified if used with the SUPER-USER community. There is a maximum, allowing for three levels of access.

Records may be added or deleted via setting the communityStatus object to enable, disable, or delete. The first row in the CommunityTable is reserved for the SUPER-USER community definition. This record is not removable. This is a fixed record to ensure read-write access to the MIBs on the 6710 Access Point. Note the communityName for the first record can be changed to ensure end-user control of security for the 6710 Access Point.

MIB-II Notes

System Group	Three fields in the MIB-II system group are writable. Those fields are: sysContact, sysName, and sysLocation. It is important that these values be preserved in case the 6710 Access Point is powered (off and on) or rebooted. The following lists the number of characters for each field that will be preserved in the event of a power (off and on) or reboot. sysContact: 31 characters sysName: 31 characters sysLocation: 39 characters
Interfaces Group	The ifTable.ifAdminStatus object is read-write accessible. However, this functionality has not been enabled.
IP Forwarding	IP Forwarding is disabled for this release of the 6710 Access Point. Therefore, the MIB-II ipForwarding object is not changeable.

MIB Directory

The following pages describe the various groups the 6710 Access Point supports. Table G-3 lists groups, their meaning, and page numbers where each group's table summary and definitions appear.

Table G-3
MIB Directory

Group	Meaning	Group Summary	MIB Definition
Product OIDs			
products	INTERMEC® Products	G-8	G-24
System Information			
hw	Hardware Information	G-9	G-24
fsinfo	File System Information	G-10	G-25
segment	File Segment Information	G-10	G-26
dir	Software Directory Listing	G-11	G-28
criticalErrors	Critical Errors Information	G-11	G-30
Interface Information			
nifx	Norand Extensions to Interfaces Table	G-12	G-32
portState	Port State Information	G-13	G-36
portStats	Port Statistics	G-14	G-41
ptxq	Port Transmit Queue	G-15	G-46
pmsg	Pending Message Services	G-16	G-49
SNMP Version 1 Configuration			
community	Community Table	G-17	G-52
trapTarget	Trap Target Table	G-17	G-55
Bridging Parameters			
rt	Route Table	G-18	G-56
brg	Bridge Table	G-19	G-61
addr	Address Table	G-20	G-63
brgState	Bridge State Information	G-20	G-64
bridgeStats	Bridge Statistics	G-22	G-69
Control Groups			
powerUp	Power Up Objects	G-23	G-72
softwareDownLoad	Software Download	G-23	G-72

MIB Outline

Product OIDs

This group contains an Object IDentification (OID) for each INTERMEC device.

Table G-4
products GROUP

Device Products
norand.manage.products.x
(1.3.6.1.4.1.469.1000.1.x)

OID	Object Name	Object Type	Access
1	ap6710	OBJECT ID	Not Applicable (N/A)
2	gw4030	OBJECT ID	(N/A)
3	wnas	OBJECT ID	(N/A)
4	ts6950	OBJECT ID	(N/A)
5	gwap6910	OBJECT ID	(N/A)
6	uap2100	OBJECT ID	(N/A)
7	msd6710	OBJECT ID	(N/A)

System Information

The following groups contain system level objects describing hardware and file system configuration properties. The groups also contain information about critical errors.

" **NOTE:** *The MIB definition for each group starts on the page given below.*

- hw Hardware Information (page G-24)
- fsinfo File System Information (page G-25)
- segment File Segment Information (page G-26)
- dir Software Directory Listing (page G-28)
- criticalErrors Critical Errors Information (page G-30)

Table G-5
hw GROUP

Device Hardware Information
norand.manage.norandNet.nSystem.hw.x
(1.3.6.1.4.1.469.1000.2.1.1.x)

OID	Object Name	Object Type	Access
1	hwPartNo	INTEGER	read
2	hwDescription	DisplayString	read
3	hwRevision	INTEGER	read
4	hwSerialNo	INTEGER	read
5	hwID	INTEGER	read

Table G-6
fsinfo GROUP

Device File System Information
norand.manage.norandNet.nSystem.file.fsinfo.x
(1.3.6.1.4.1.469.1000.2.1.3.1.x)

OID	Object Name	Object Type	Access
1	fsEnabled	INTEGER	read
2	fsMaxSectors	INTEGER	read
3	fsSectorSize	INTEGER	read
4	fsNumSegments	INTEGER	read
5	fsNumFiles	Gauge	read
6	fsBootSegment	INTEGER	read
7	fsDataSegment	INTEGER	read

Table G-7
segment GROUP

Device File Segment Information
norand.manage.norandNet.nSystem.file.segment.x
(1.3.6.1.4.1.469.1000.2.1.3.2.x)

OID	Object Name	Object Type	Access
2.1.1	segID	INTEGER	read
2.1.2	segFirstSector	INTEGER	read
2.1.3	segLastSector	INTEGER	read
2.1.4	segStatus	INTEGER	read
2.1.5	segSize	INTEGER	read
2.1.6	segFree	INTEGER	read

Table G-8
dir GROUP

Device Software Directory Listing
norand.manage.norandNet.nSystem.file.dir.x
(1.3.6.1.4.1.469.1000.2.1.3.3.x)

OID	Object Name	Object Type	Access
2.1.1	dirIndex	INTEGER	read
2.1.2	dirName	DisplayString	read
2.1.3	dirSegment	INTEGER	read
2.1.4	dirType	INTEGER	read
2.1.5	dirSize	INTEGER	read
2.1.6	dirDate	DisplayString	read
2.1.7	dirTime	DisplayString	read
2.1.8	dirVersion	DisplayString	read

Table G-9
criticalErrors GROUP

Device Critical Errors Information
norand.manage.norandNet.nSystem.sysErrors.criticalErrors.x
(1.3.6.1.4.1.469.1000.2.1.4.1.x)

OID	Object Name	Object Type	Access
1	ceEnabled	INTEGER	read
2	ceOverflow	INTEGER	read
3	ceReset	INTEGER	write
4.1.1	ceLogErrorCode	INTEGER	read
4.1.2	ceLogErrorCount	Counter	read

Interface Information

The following groups relate information about Norand interfaces, port state, port statistics, port transmit queue, and pending message services.

" NOTE: *The MIB definition for each group starts on the page given below.*

- nifx Norand Extensions to Interfaces Table (page G-32)
- portState Port State Information (page G-36)
- portStats Port Statistics (page G-41)
- ptxq Port Transmit Queue (page G-46)
- pmsg Pending Message Services (page G-49)

Table G-10
nifx GROUP

Norand Extensions to MIB-II Interfaces Table
norand.manage.norandNet.nInterfaces.nifx.x
(1.3.6.1.4.1.469.1000.2.2.2.x)

OID	Object Name	Object Type	Access
4.1.1	nifxIndex	INTEGER	read
4.1.2	nifxType	INTEGER	read
4.1.3	nifxInDisabledDiscards	Counter	read
4.1.4	nifxInOverruns	Counter	read
4.1.5	nifxInHWOverruns	Counter	read
4.1.6	nifxInUcastDPkts	Counter	read
4.1.7	nifxInNUcastDPkts	Counter	read
4.1.8	nifxInLenErrors	Counter	read
4.1.9	nifxExcessiveDeferrals	Counter	read
4.1.10	nifxInNetIDDiscards	Counter	read
4.1.11	nifxInFragDiscards	Counter	read
4.1.12	nifxInUFilterDiscards	Counter	read
4.1.13	nifxInNUFilterDiscards	Counter	read
4.1.14	nifxInQFullDiscards	Counter	read

Table G-11
portState GROUP

Device Port State Information
norand.manage.norandNet.nInterfaces.portState.x
(1.3.6.1.4.1.469.1000.2.2.3.x)

OID	Object Name	Object Type	Access
4.1.1	psPort	INTEGER	read
4.1.2	psIfIndex	INTEGER	read
4.1.3	psAddress	PhysAddress	read
4.1.4	psType	INTEGER	read
4.1.5	psState	INTEGER	read
4.1.6	psCost	INTEGER	read
4.1.7	psHelloPeriod	INTEGER	read
4.1.8	psHelloCount	Counter	read
4.1.9	psMacdWindow	INTEGER	read
4.1.10	psMacdQSize	Gauge	read
4.1.11	psMacdTimeouts	Counter	read
4.1.12	psIsPrimary	INTEGER	read
4.1.13	psIsSecondary	INTEGER	read
4.1.14	psIsSecondaryCandidate	INTEGER	read
4.1.15	psSecondaryUniFlooding	INTEGER	read
4.1.16	psSecondaryMultiFlooding	INTEGER	read
4.1.17	psIsRadio	INTEGER	read
4.1.18	psPendEnabled	INTEGER	read

Table G-12
portStats GROUP

Device Port Statistics
norand.manage.norandNet.nInterfaces.portStats.x
(1.3.6.1.4.1.469.1000.2.2.4.x)

OID	Object Name	Object Type	Access
4.1.1	pstcPort	INTEGER	read
4.1.2	pstcInOWLPkts	Counter	read
4.1.3	pstcInUcastOWLDataPkts	Counter	read
4.1.4	pstcInNUcastOWLDataPkts	Counter	read
4.1.5	pstcInOWLErrors	Counter	read
4.1.6	pstcOutOWLPkts	Counter	read
4.1.7	pstcOutUcastOWLDataPkts	Counter	read
4.1.8	pstcOutNUcastOWLDataPkts	Counter	read
4.1.9	pstcOutOWLErrors	Counter	read
4.1.10	pstcParentLinkErrors	Counter	read
4.1.11	pstcAlertLinkErrors	Counter	read
4.1.12	pstcInUcastRelayPkts	Counter	read
4.1.13	pstcInNUcastRelayPkts	Counter	read
4.1.14	pstcOutUcastRelayPkts	Counter	read
4.1.15	pstcOutNUcastRelayPkts	Counter	read
4.1.16	pstcInUcastInbound	Counter	read
4.1.17	pstcInUcastOutbound	Counter	read
4.1.18	pstcInUcastSec	Counter	read
4.1.19	pstcInUcastFlood	Counter	read
4.1.20	pstcUcastDiscards	Counter	read
4.1.21	pstcInNUcastDiscards	Counter	read
4.1.22	pstcInUcastToIFC	Counter	read
4.1.23	pstcInNUcastToIFC	Counter	read
4.1.24	pstcOutDelayDiscards	Counter	read

Table G-13
ptxq GROUP

Device Port Transmit Queue
norand.manage.norandNet.nInterfaces.ptxq.x
(1.3.6.1.4.1.469.1000.2.2.5.x)

OID	Object Name	Object Type	Access
1.1.1	ptxqPort	INTEGER	read
1.1.2	ptxqRegQSize	Gauge	read
1.1.3	ptxqRegQMax	INTEGER	read
1.1.4	ptxqExpQSize	Gauge	read
1.1.5	ptxqExpQMax	INTEGER	read
1.1.6	ptxqQHpCount	Counter	read
1.1.7	ptxqQExpCount	Counter	read
1.1.8	ptxqQRegCount	Counter	read
1.1.9	ptxqQHpDiscards	Counter	read
1.1.10	ptxqQExpDiscards	Counter	read
1.1.11	ptxqQRegDiscards	Counter	read
1.1.12	ptxqMultiQSize	Gauge	read
1.1.13	ptxqMultiQMax	INTEGER	read
1.1.14	ptxqMultiQDiscards	Counter	read

Table G-14
pmsg GROUP

Device Pending Message Service
norand.manage.norandNet.nInterfaces.pmsg.x
(1.3.6.1.4.1.469.1000.2.2.6.x)

OID	Object Name	Object Type	Access
1.1.1	pmsgPort	INTEGER	read
1.1.2	pmsgPendRecCurrent	Gauge	read
1.1.3	pmsgPendRecMax	INTEGER	read
1.1.4	pmsgPendMsgCurrent	Gauge	read
1.1.5	pmsgPendMsgMax	INTEGER	read
1.1.6	pmsgPendMsgTotal	Counter	read
1.1.7	pmsgPendMsgDiscards	Counter	read
1.1.8	pmsgPendRecOverflowErrors	Counter	read
1.1.9	pmsgPendMsgOverflowErrors	Counter	read
1.1.10	pmsgPendAgedRecCount	Counter	read
1.1.11	pmsgPendAgedMsgCount	Counter	read

SNMP Version 1 Configuration Group

This group contains objects that configure the version 1 Simple Network Management Protocol (SNMP) agent.

" NOTE: *The MIB definition for each group starts on the page given below.*

- community Community Table (page G-52)
- trapTarget Trap Target Table (page G-55)

Table G-15
community TABLE

Device SNMP v1 Configurations
norand.manage.norandNet.nSNMP.v1Config.x
(1.3.6.1.4.1.469.1000.2.11.1.x)

OID	Object Name	Object Type	Access
2.1.1	communityIndex	INTEGER	read
2.1.2	communityStatus	INTEGER	write
2.1.3	communityName	DisplayString	write
2.1.4	communityPrivileges	INTEGER	write

Table G-16
trapTarget TABLE

Device SNMP v1 Configurations
norand.manage.norandNet.nSNMP.v1Config.x
(1.3.6.1.4.1.469.1000.2.11.1.x)

OID	Object Name	Object Type	Access
3.1.1	trapTargetIndex	INTEGER	read
3.1.2	trapTargetStatus	INTEGER	write
3.1.3	trapTargetName	DisplayString	write
3.1.4	trapTargetIpAddress	IpAddress	write

Bridging Parameters

The following groups contain objects relating to the wireless transparent bridging operation.

" NOTE: *The MIB definition for each group starts on the page given below.*

- rt Route Table (page G-56)
- brg Bridge Table (page G-61)
- addr Address Table (page G-63)
- brgState Bridge State Information (page G-64)
- bridgeStats Bridge Statistics (page G-69)

Table G-17
rt GROUP

Device Route Table
norand.manage.norandNet.nBridge.rt.x
(1.3.6.1.4.1.469.1000.2.17.2.x)

OID	Object Name	Object Type	Access
2.1.1	rtDestination	PhysAddress	read
2.1.2	rtPort	INTEGER	read
2.1.3	rtAge	INTEGER	read
2.1.4	rtNodeId	INTEGER	read
2.1.5	rtAttachId	INTEGER	read
2.1.6	rtAttachTime	TimeTicks	read
2.1.7	rtApEaddr	PhysAddress	read
2.1.8	rtHopAddrLen	INTEGER	read
2.1.9	rtHopAddr16	INTEGER	read

Table G-17 (Continued)
rt GROUP

Device Route Table
norand.manage.norandNet.nBridge.rt.x
(1.3.6.1.4.1.469.1000.2.17.2.x)

OID	Object Name	Object Type	Access
2.1.10	rtHopEaddr	PhysAddress	read
2.1.11	rtIsBound	INTEGER	read
2.1.12	rtIsRemote	INTEGER	read
2.1.13	rtIsChild	INTEGER	read
2.1.14	rtIsAp	INTEGER	read
2.1.15	rtIsDistributed	INTEGER	read
2.1.16	rtIsRemoteLan	INTEGER	read
2.1.17	rtNS	INTEGER	read
2.1.18	rtNR	INTEGER	read

Table G-18
brg GROUP

Device Bridge Table
norand.manage.norandNet.nBridge.brg.x
(1.3.6.1.4.1.469.1000.2.17.3.x)

OID	Object Name	Object Type	Access
2.1.1	brgDestination	PhysAddress	read
2.1.2	brgPort	INTEGER	read
2.1.3	brgAge	INTEGER	read
2.1.4	brgType	INTEGER	read
2.1.5	brgIsPermanent	INTEGER	read
2.1.6	brgTimestamp	TimeTicks	read

Table G-19
addr GROUP

Address Table
norand.manage.norandNet.nBridge.addr.x
(1.3.6.1.4.1.469.1000.2.17.4.x)

OID	Object Name	Object Type	Access
2.1.1	addrDestination	PhysAddress	read
2.1.2	addrAge	INTEGER	read
2.1.3	addrNodeId	INTEGER	read
2.1.4	addrAlias	DisplayString	read
2.1.5	addrDeviceId	INTEGER	read
2.1.6	addrIpAddress	IPAddress	read

Table G-20
brgState GROUP

Bridge State Information
norand.manage.norandNet.nBridge.brgState.x
(1.3.6.1.4.1.469.1000.2.17.6.x)

OID	Object Name	Object Type	Access
3	bsAddress	PhysAddress	read
4	bsLanId	INTEGER	read
5	bsCostToRoot	INTEGER	read
6	bsIsRoot	INTEGER	read
7	bsIsAttached	INTEGER	read
8	bsAttachId	INTEGER	read
9	bsMyRootPriority	INTEGER	read
10	bsRootPort	INTEGER	read

Table G-20 (Continued)
brgState GROUP

Bridge State Information
norand.manage.norandNet.nBridge.brgState.x
(1.3.6.1.4.1.469.1000.2.17.6.x)

OID	Object Name	Object Type	Access
11	bsDesignatedRootAddress	PhysAddress	read
12	bsDesignatedRootPriority	INTEGER	read
13	bsDesignatedRootSequence	INTEGER	read
14	bsParentAddress	PhysAddress	read
15	bsPortCount	INTEGER	read
16	bsNodeId	INTEGER	read
17	bsRootChangedCount	Counter	read
18	bsRootCount	Counter	read
19	bsAttachCount	Counter	read
20	bsDetachReason	INTEGER	read
21	bsNetworkTime	TimeTicks	read
22	bsUniFloodLevel	INTEGER	read
23	bsMultiFloodLevel	INTEGER	read
24	bsIsPrimaryBridge	INTEGER	read
25	bsIsSecondaryBridge	INTEGER	read
26	bsUniFilterExpr	INTEGER	read
27	bsMultiFilterExpr	INTEGER	read

Table G-21
bridgeStats GROUP

Bridge Statistics
norand.manage.norandNet.nBridge.bridgeStats.x
(1.3.6.1.4.1.469.1000.2.17.7.x)

OID	Object Name	Object Type	Access
3	bstcRouteCount	Gauge	read
4	bstcChildCount	Gauge	read
5	bstcChildApCount	Gauge	read
6	bstcRemoteCount	Gauge	read
7	bstcPrimaryCount	Gauge	read
8	bstcInboundCount	Gauge	read
9	bstcSecondaryCount	Gauge	read
10	bstcRemoteLanCount	Gauge	read
11	bstcRouteGetErrors	Counter	read
12	bstcEntryGetErrors	Counter	read
13	bstcRmtLanGetErrors	Counter	read
14	bstcRouteSeqErrors	Counter	read
15	bstcDeleteSeqErrors	Counter	read
16	bstcEntrySeqErrors	Counter	read
17	bstcInvalidUpdateErrors	Counter	read

Control Groups

Objects in the following groups exert control over the 6710 Access Point. Present functions include rebooting and scheduling software downloads.

" **NOTE:** *The MIB definition for each group starts on the page given below.*

- powerUp Power Up Objects (page G-72)
- softwareDownLoad Software Download (page G-72)

Table G-22
powerUp GROUP

Device Power Up Objects
norand.manage.norandNet.nControl.powerUp.x
(1.3.6.1.4.1.469.1000.2.105.1.x)

OID	Object Name	Object Type	Access
1	pwrPowerUpCount	Counter	read
2	pwrNextPowerUpTime	TimeTicks	write

Table G-23
softwareDownLoad GROUP

Device Software Download
norand.manage.norandNet.nControl.softwareDownLoad.x
(1.3.6.1.4.1.469.1000.2.105.2.x)

OID	Object Name	Object Type	Access
1	sdStartTime	TimeTicks	write
2	sdServerIpAddress	IpAddress	write
3	sdScriptFilename	DisplayString	write
4	sdStatus	INTEGER	read
5	sdErrorString	DisplayString	read
6	sdCheckPoint	INTEGER	write
7	sdSetActivePointers	INTEGER	write
8	sdTerminate	INTEGER	write

MIB Definitions

Following are the MIB definitions for the 6710 Access Point.

```
-- ****************************************************************
-- *
-- *                    6710MIB.MIB Version 1.32
-- *
-- ****************************************************************
OWL DEFINITIONS ::= BEGIN

      IMPORTS
          enterprises, IpAddress, Counter, Gauge, TimeTicks
              FROM RFC1155-SMI
          PhysAddress, DisplayString
              FROM RFC1213-MIB
          OBJECT-TYPE
              FROM RFC-1212;
      --  This MIB module uses the extended OBJECT-TYPE macro as
      --  defined in RFC-1212;


norand                          OBJECT IDENTIFIER ::= { enterprises 469 }
    manage                      OBJECT IDENTIFIER ::= { norand 1000 }
        products                OBJECT IDENTIFIER ::= { manage 1 }
            ap6710              OBJECT IDENTIFIER ::= { products 1 }
            gw4030              OBJECT IDENTIFIER ::= { products 2 }
            wnas                OBJECT IDENTIFIER ::= { products 3 }
            ts6950              OBJECT IDENTIFIER ::= { products 4 }
            gwap6910            OBJECT IDENTIFIER ::= { products 5 }
            uap2100             OBJECT IDENTIFIER ::= { products 6 }
            msd6710             OBJECT IDENTIFIER ::= { products 7 }
        norandNET               OBJECT IDENTIFIER ::= { manage 2 }
            nSystem             OBJECT IDENTIFIER ::= { norandNET 1 }
                hw              OBJECT IDENTIFIER ::= { nSystem 1 }
                    -- The Hardware Parameters Group
                    hwPartNo      OBJECT-TYPE
                     SYNTAX INTEGER (0..2147483647)
                     ACCESS read-only
                     STATUS mandatory
                     DESCRIPTION
                     "The Norand part number of the hardware device."
                     ::= { hw 1 }
                    hwDescription OBJECT-TYPE
                     SYNTAX DisplayString (SIZE (0..40))
                     ACCESS read-only
                     STATUS mandatory
                     DESCRIPTION
                     "The description of the hardware device."
                     ::= { hw 2 }
```

```
    hwRevision    OBJECT-TYPE
     SYNTAX INTEGER (0..2147483647)
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The revision level of the hardware device."
     ::= { hw 3 }

    hwSerialNo    OBJECT-TYPE
     SYNTAX INTEGER (0..2147483647)
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The serial number of the hardware device."
     ::= { hw 4 }

    hwID          OBJECT-TYPE
     SYNTAX INTEGER (0..2147483647)
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The device identifier of the hardware device.
     Values = 3250, 4000, 4020, 4030, 4033, 3240, 1000,
     1100, 1700, 5940, 4650, 100 (ACE process), 200
     (DOSNMS), 300 (Norand Proxy Agent), 6710 (Access
     Point)."
     ::= { hw 5 }

file              OBJECT IDENTIFIER ::= { nSystem 3 }

    fsinfo        OBJECT IDENTIFIER ::= { file 1 }

        -- The FileSystem Information Table

        fsEnabled     OBJECT-TYPE
          SYNTAX INTEGER { true(1), false(2) }
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "TRUE, if the file system is enabled"
          ::= { fsinfo 1 }

        fsMaxSectors  OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The number of physical sectors.  A file
          segment consists of one or more adjacent
          physical sectors."
          ::= { fsinfo 2 }
```

```
        fsSectorSize  OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The size of a physical sector in bytes."
          ::= { fsinfo 3 }
        fsNumSegments OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The number of logical file segments
          (0-MAX_SECTORS)"
          ::= { fsinfo 4 }
        fsNumFiles    OBJECT-TYPE
          SYNTAX Gauge
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The number of files (0-25)"
          ::= { fsinfo 5 }
        fsBootSegment OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The index of the current boot segment.  If the
          index is non-zero and the first file in the
          associated segment is executable, then control
          is passed to that file during the power-up
          sequence."
          ::= { fsinfo 6 }
        fsDataSegment OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The index of the active data segment.  Files
          stored in this segment will be accessible to an
          executing application."
          ::= { fsinfo 7 }
segment         OBJECT IDENTIFIER ::= { file 2 }
-- The File Segment Table
        -- Table Definition
```

```
segTable       OBJECT-TYPE
 SYNTAX SEQUENCE OF SEGEntry
 ACCESS not-accessible
 STATUS mandatory
 DESCRIPTION
 ""
 ::= { segment 2 }

-- Row Definition

segEntry       OBJECT-TYPE
 SYNTAX SEGEntry
 ACCESS not-accessible
 STATUS mandatory
 INDEX { segID }
 ::= { segTable 1 }

-- Columnar Object Definitions

SEGEntry ::=
 SEQUENCE {
   segID          INTEGER,
   segFirstSector INTEGER,
   segLastSector  INTEGER,
   segStatus      INTEGER,
   segSize        INTEGER,
   segFree        INTEGER
}

segID          OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The segment ID (1 - (NUM_SEGMENTS+1)).  A
  non-zero number which uniquely identifies a
  segment."
  ::= { segEntry 1 }

segFirstSector OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The first physical sector in the segment
  (1 - (MAX_SECTORS + 1))"
  ::= { segEntry 2 }
```

```
    segLastSector  OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The last physical sector in the segment
      (FIRST_SECTOR - (MAX_SECTORS + 1))"
      ::= { segEntry 3 }

    segStatus      OBJECT-TYPE
      SYNTAX INTEGER  {   valid(1),
                          invalid(2) }
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The segment status:
         valid   = 1,
         invalid = 2 "
      ::= { segEntry 4 }

    segSize        OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The segment size in bytes"
      ::= { segEntry 5 }

    segFree        OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The number of available bytes in the segment
      which are not currently allocated to a file."
      ::= { segEntry 6 }

dir           OBJECT IDENTIFIER ::= { file 3 }

-- The File Directory Table

    -- Table Definition

    dirTable   OBJECT-TYPE
     SYNTAX SEQUENCE OF DIREntry
     ACCESS not-accessible
     STATUS mandatory
     DESCRIPTION
     "The FileSystem Directory"
     ::= { dir 2 }

    -- Row Definition
```

```
dirEntry   OBJECT-TYPE
 SYNTAX DIREntry
 ACCESS not-accessible
 STATUS mandatory
 INDEX { dirIndex }
 ::= { dirTable 1 }

-- Columnar Object Definitions

DIREntry ::=
 SEQUENCE {
   dirIndex   INTEGER,
   dirName    DisplayString,
   dirSegment INTEGER,
   dirType    INTEGER,
   dirSize    INTEGER,
   dirDate    DisplayString,
   dirTime    DisplayString,
   dirVersion DisplayString
}

dirIndex   OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Directory Index"
  ::= { dirEntry 1 }

dirName    OBJECT-TYPE
  SYNTAX DisplayString (SIZE (0..14))
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "File name"
  ::= { dirEntry 2 }

dirSegment OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "File segment (1 - (NUM_SEGMENTS + 1)).
  The segment ID which identifies the segment
  containing the file."
  ::= { dirEntry 3 }
```

```
            dirType    OBJECT-TYPE
              SYNTAX INTEGER { executable(1),
                               data(2),
                             invalid(3) }
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "File type:
                 executable = 1,
                 data       = 2,
                 invalid    = 3 "
              ::= { dirEntry 4 }

            dirSize    OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "The file size in bytes"
              ::= { dirEntry 5 }

            dirDate    OBJECT-TYPE
              SYNTAX DisplayString (SIZE (0..12))
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "The file date in MM-DD-YYYY display format."
              ::= { dirEntry 6 }

            dirTime    OBJECT-TYPE
              SYNTAX DisplayString (SIZE (0..10))
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "The file time in HH:MM:SS display format."
              ::= { dirEntry 7 }

            dirVersion OBJECT-TYPE
              SYNTAX DisplayString (SIZE (0..8))
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "The file version in v99.99 display format."
              ::= { dirEntry 8 }

        sysErrors          OBJECT IDENTIFIER ::= { nSystem 4 }

            criticalErrors OBJECT IDENTIFIER ::= { sysErrors 1 }
```

```
ceEnabled       OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "A value of true(1) signifies that the critical
  error log was successfully initialized as part
  of the power-up sequence.  Any errors in that
  initialization process result in a value of
  false(2)."
  ::= { criticalErrors 1 }

ceOverflow      OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Overflow error code.  If the overflow code is
  non-zero, it indicates that the log has
  overflowed and the overflow code contains the
  last displaced value."
  ::= { criticalErrors 2 }

ceReset         OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-write
  STATUS mandatory
  DESCRIPTION
  "A user can reset the critical error log by
  setting ceReset to true(1).  Valid values are
  true(1) or false(2)."
  ::= { criticalErrors 3 }

ceLogTable      OBJECT-TYPE
  SYNTAX SEQUENCE OF CELogEntry
  ACCESS not-accessible
  STATUS mandatory
  DESCRIPTION
  "Critical Error Log Table"
  ::= { criticalErrors 4 }

ceLogEntry      OBJECT-TYPE
  SYNTAX CELogEntry
  ACCESS not-accessible
  STATUS mandatory
  INDEX { ceLogErrorCode }
  ::= { ceLogTable 1 }
```

```
            CELogEntry ::=
              SEQUENCE {
                ceLogErrorCode  INTEGER,
                ceLogErrorCount Counter
              }

            ceLogErrorCode  OBJECT-TYPE
              SYNTAX INTEGER
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "Critical error code.  A 16-bit value which
              uniquely indentifies a system software error.
              The error codes are intended for internal
              Norand use."
              ::= { ceLogEntry 1 }

            ceLogErrorCount OBJECT-TYPE
              SYNTAX Counter
              ACCESS read-only
              STATUS mandatory
              DESCRIPTION
              "Error count for the associated ceLogErrorCode"
              ::= { ceLogEntry 2 }

nInterfaces          OBJECT IDENTIFIER ::= { norandNET 2 }

   nifx              OBJECT IDENTIFIER ::= { nInterfaces 2 }

-- The Norand Extended Interfaces Table

        nifxTable             OBJECT-TYPE
         SYNTAX SEQUENCE OF NIFXEntry
         ACCESS not-accessible
         STATUS mandatory
         DESCRIPTION
         "Norand Extended Interface Table"
         ::= { nifx 4 }

        nifxEntry             OBJECT-TYPE
         SYNTAX NIFXEntry
         ACCESS not-accessible
         STATUS mandatory
         INDEX { nifxIndex }
         ::= { nifxTable 1 }
```

```
NIFXEntry ::=
  SEQUENCE {
    nifxIndex                INTEGER,
    nifxType                 INTEGER,
    nifxInDisabledDiscards   Counter,
    nifxInOverruns           Counter,
    nifxInHWOverruns         Counter,
    nifxInUcastDPkts         Counter,
    nifxInNUcastDPkts        Counter,
    nifxInLenErrors          Counter,
    nifxExcessiveDeferrals   Counter,
    nifxInNetIDDiscards      Counter,
    nifxInFragDiscards       Counter,
    nifxInUFilterDiscards    Counter,
    nifxInNUFilterDiscards   Counter,
    nifxInQFullDiscards      Counter
}

nifxIndex              OBJECT-TYPE
 SYNTAX INTEGER
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Interface index"
 ::={ nifxEntry 1 }

nifxType               OBJECT-TYPE
 SYNTAX INTEGER {       ether(4),
                       bb485(33),
                       owlIP(66),
                   proxim24(132),
                      nor24(195),
                  falcon902(197),
                        uhf(198)
                }
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Norand Interface Type"
 ::={ nifxEntry 2 }
```

```
nifxInDisabledDiscards OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received unicast frames which do
 not require forwarding.  Unicast ethernet frames are
 discarded if ether-to-radio flooding is disabled
 and the destination is unknown; otherwise, unicast
 frames are discarded if the bridge has learned that
 the destination port is the same as the source port"
 ::={ nifxEntry 3 }

nifxInOverruns         OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received frames discarded because the
 frame could not be queued for the MAC-D task"
 ::={ nifxEntry 4 }

nifxInHWOverruns       OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received frames discarded due to
 hardware overruns."
 ::={ nifxEntry 5 }

nifxInUcastDPkts       OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received unicast frames successfully
 delivered to the MAC-D task"
 ::={ nifxEntry 6 }

nifxInNUcastDPkts      OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received multicast frames
 successfully delivered to the MAC-D task"
 ::={ nifxEntry 7 }
```

```
nifxInLenErrors        OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number received frames with length errors"
 ::={ nifxEntry 8 }

nifxExcessiveDeferrals OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of aborted transmissions due to
 excessive deferrals"
 ::={ nifxEntry 9 }

nifxInNetIDDiscards    OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received frames discarded because the
 LAN ID did not match"
 ::={ nifxEntry 10 }

nifxInFragDiscards     OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of received frame fragments discarded
 because a fragmented frame could not be
 re-assembled"
 ::={ nifxEntry 11 }

nifxInUFilterDiscards  OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of enabled received unicast frames
 discarded due to a unicast filter expression"
 ::={ nifxEntry 12 }
```

```
    nifxInNUFilterDiscards OBJECT-TYPE
     SYNTAX Counter
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The number of enabled received multicast frames
     discarded due to a multicast filter expression"
     ::={ nifxEntry 13 }

    nifxInQFullDiscards    OBJECT-TYPE
     SYNTAX Counter
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The number of received frames discarded because the
     frame could not be queued for the MAC-R task"
     ::={ nifxEntry 14 }

portState          OBJECT IDENTIFIER ::= { nInterfaces 3 }

  -- The Port State Table

    psTable                  OBJECT-TYPE
     SYNTAX SEQUENCE OF PSEntry
     ACCESS not-accessible
     STATUS mandatory
     DESCRIPTION
     "MAC-R port state variables"
     ::= { portState 4 }

    psEntry                  OBJECT-TYPE
     SYNTAX PSEntry
     ACCESS not-accessible
     STATUS mandatory
     INDEX { psPort }
     ::= { psTable 1 }
```

```
PSEntry ::=
  SEQUENCE {
    psPort                    INTEGER,
    psIfIndex                 INTEGER,
    psAddress                 PhysAddress,
    psType                    INTEGER,
    psState                   INTEGER,
    psCost                    INTEGER,
    psHelloPeriod             INTEGER,
    psHelloCount              Counter,
    psMacdWindow              INTEGER,
    psMacdQSize               Gauge,
    psMacdTimeouts            Counter,
    psIsPrimary               INTEGER,
    psIsSecondary             INTEGER,
    psIsSecondaryCandidate    INTEGER,
    psSecondaryUniFlooding    INTEGER,
    psSecondaryMultiFlooding INTEGER,
    psIsRadio                 INTEGER,
    psPendEnabled             INTEGER
}

psPort                    OBJECT-TYPE
  SYNTAX INTEGER (1..4)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-R port ID (1-4).  A number which uniquely
  identifies the port."
  ::= { psEntry  1 }

psIfIndex                 OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-D interface index.  The index matches the
  interface index of the associated row in the mib-II
  interface table."
  ::= { psEntry  2 }

psAddress                 OBJECT-TYPE
  SYNTAX PhysAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "802 address of the port"
  ::= { psEntry  3 }
```

```
psType                    OBJECT-TYPE
  SYNTAX INTEGER {       ether(4),
                        bb485(33),
                        owlIP(66),
                     proxim24(132),
                        nor24(195),
                    falcon902(197),
                         uhf(198)
                 }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Norand port type:
    ether  = 4,
    Proxim = 196,
    Falcon = 197,
    UHF    = 198"
  ::= { psEntry  4 }

psState                   OBJECT-TYPE
  SYNTAX INTEGER { disabled(0),
                       idle(1),
                       open(2),
                    receive(3),
                   transmit(4) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Port state:
   disabled = 0,
   idle     = 1,
   open     = 2,
   receive  = 3,
   transmit = 4 "
  ::= { psEntry  5 }

psCost                    OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Incremental path cost of the port.
   Default values:
   ether  = 20,
   Falcon = 100,
   UHF    = 255 "
  ::= { psEntry  6 }
```

```
psHelloPeriod            OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Inter-HELLO time (.01 secs.)"
  ::= { psEntry  7 }

psHelloCount             OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "HELLO transmit count"
  ::= { psEntry  8 }

psMacdWindow             OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Max. number of active MAC-D transmit requests"
  ::= { psEntry  9 }

psMacdQSize              OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Current number of active MAC-D transmit requests"
  ::= { psEntry  10 }

psMacdTimeouts           OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-D transmit timeout errors"
  ::= { psEntry 11 }

psIsPrimary              OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, for primary bridge ports"
  ::= { psEntry 12 }
```

```
psIsSecondary            OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, for secondary bridge ports"
  ::= { psEntry 13 }

psIsSecondaryCandidate   OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, if secondary bridge port candidates"
  ::= { psEntry 14 }

psSecondaryUniFlooding   OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, for secondary bridge ports which require
  unicast flooding"
  ::= { psEntry 15 }

psSecondaryMultiFlooding OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, for secondary bridge ports which require
  multicast flooding"
  ::= { psEntry 16 }

psIsRadio                OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, for radio ports"
  ::= { psEntry 17 }

psPendEnabled            OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, if the port supports pending messages"
  ::= { psEntry 18 }
```

```
portStats          OBJECT IDENTIFIER ::= { nInterfaces 4 }

     pstcTable                OBJECT-TYPE
      SYNTAX SEQUENCE OF PSTCEntry
      ACCESS not-accessible
      STATUS mandatory
      DESCRIPTION
      "MAC-R port state variables"
      ::= { portStats 4 }

     pstcEntry                OBJECT-TYPE
      SYNTAX PSTCEntry
      ACCESS not-accessible
      STATUS mandatory
      INDEX { pstcPort }
      ::= { pstcTable 1 }

     PSTCEntry ::=
       SEQUENCE {
         pstcPort                 INTEGER,
         pstcInOWLPkts            Counter,
         pstcInUcastOWLDataPkts   Counter,
         pstcInNUcastOWLDataPkts  Counter,
         pstcInOWLErrors          Counter,
         pstcOutOWLPkts           Counter,
         pstcOutUcastOWLDataPkts  Counter,
         pstcOutNUcastOWLDataPkts Counter,
         pstcOutOWLErrors         Counter,
         pstcParentLinkErrors     Counter,
         pstcAlertLinkErrors      Counter,
         pstcInUcastRelayPkts     Counter,
         pstcInNUcastRelayPkts    Counter,
         pstcOutUcastRelayPkts    Counter,
         pstcOutNUcastRelayPkts   Counter,
         pstcInUcastInbound       Counter,
         pstcInUcastOutbound      Counter,
         pstcInUcastSec           Counter,
         pstcInUcastFlood         Counter,
         pstcInUcastDiscards      Counter,
         pstcInNUcastDiscards     Counter,
         pstcInUcastToIFC         Counter,
         pstcInNUcastToIFC        Counter,
         pstcOutDelayDiscards     Counter
     }
```

```
pstcPort                OBJECT-TYPE
  SYNTAX INTEGER (1..4)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-R port ID (1-4).  A number which uniquely
  identifies the port."
  ::= { pstcEntry 1 }

pstcInOWLPkts           OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total received OWL packets"
  ::= { pstcEntry 2 }

pstcInUcastOWLDataPkts  OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received OWL unicast data packets"
  ::= { pstcEntry 3 }

pstcInNUcastOWLDataPkts OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received multicast OWL data packets"
  ::= { pstcEntry 4 }

pstcInOWLErrors         OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received OWL packets with errors"
  ::= { pstcEntry 5 }

pstcOutOWLPkts          OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total OWL packets sent"
  ::= { pstcEntry 6 }
```

```
pstcOutUcastOWLDataPkts  OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total unicast OWL data packets sent"
  ::= { pstcEntry 7 }

pstcOutNUcastOWLDataPkts OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total multicast OWL data packets sent"
  ::= { pstcEntry 8 }

pstcOutOWLErrors         OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "OWL packet send errors"
  ::= { pstcEntry 9 }

pstcParentLinkErrors     OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Root port send link errors"
  ::= { pstcEntry  10 }

pstcAlertLinkErrors      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Link errors which generated an ALERT"
  ::= { pstcEntry 11 }

pstcInUcastRelayPkts     OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast relay packets"
  ::= { pstcEntry 12 }
```

```
pstcInNUcastRelayPkts    OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received multicast relay packets"
  ::= { pstcEntry 13 }

pstcOutUcastRelayPkts    OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total unicast relay packets sent"
  ::= { pstcEntry 14 }

pstcOutNUcastRelayPkts   OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total multicast relay packets sent"
  ::= { pstcEntry 15 }

pstcInUcastInbound       OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast data packets routed inbound or
  relayed onto the distribution LAN"
  ::= { pstcEntry 16 }

pstcInUcastOutbound      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast data packets routed outbound"
  ::= { pstcEntry 17 }

pstcInUcastSec           OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast data packets relayed to a
  secondary LAN"
  ::= { pstcEntry 18 }
```

```
pstcInUcastFlood          OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast data packets with an unknown
  destination"
  ::= { pstcEntry 19 }

pstcInUcastDiscards       OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast data packets discarded"
  ::= { pstcEntry 20 }

pstcInNUcastDiscards      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received multicast data packets discarded"
  ::= { pstcEntry 21 }

pstcInUcastToIFC          OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received unicast packets passed to
  the data link interface"
  ::= { pstcEntry 22 }

pstcInNUcastToIFC         OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Received multicast packets passed to
  the data link interface"
  ::= { pstcEntry 23 }

pstcOutDelayDiscards      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Send packets discarded due to excessive delay"
  ::= { pstcEntry 24 }
```

```
ptxq            OBJECT IDENTIFIER ::= { nInterfaces 5 }

    ptxqTable           OBJECT-TYPE
      SYNTAX SEQUENCE OF PTXQEntry
      ACCESS not-accessible
      STATUS mandatory
      DESCRIPTION
      "The Port Transmit Queue Table"
      ::= { ptxq 1 }

    ptxqEntry           OBJECT-TYPE
      SYNTAX PTXQEntry
      ACCESS not-accessible
      STATUS mandatory
      INDEX { ptxqPort }
      ::= { ptxqTable 1 }

    PTXQEntry ::=
      SEQUENCE {
        ptxqPort            INTEGER,
        ptxqRegQSize        Gauge,
        ptxqRegQMax         INTEGER,
        ptxqExpQSize        Gauge,
        ptxqExpQMax         INTEGER,
        ptxqQHpCount        Counter,
        ptxqQRegCount       Counter,
        ptxqQExpCount       Counter,
        ptxqQHpDiscards     Counter,
        ptxqQRegDiscards    Counter,
        ptxqQExpDiscards    Counter,
        ptxqMultiQSize      Gauge,
        ptxqMultiQMax       INTEGER,
        ptxqMultiQDiscards Counter
      }

    ptxqPort            OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "MAC-R port ID (1-4).
       A number which uniquely indentifies the port."
      ::= { ptxqEntry 1 }
```

```
ptxqRegQSize       OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Current regular queue size (0-REG_Q_MAX).
  The number of regular priority packets which are
  currently queued for transmission on the port."
  ::= { ptxqEntry 2 }

ptxqRegQMax        OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The maximum number of regular priority packets
  which can be queued for transmission on the port."
  ::= { ptxqEntry 3 }

ptxqExpQSize       OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Current expedited queue size (0..EXP_Q_MAX).  The
  number of expedited packets which are currently
  queued for transmission on the port."
  ::= { ptxqEntry 4 }

ptxqExpQMax        OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The maximum number of expedited packets which can
  be queued for transmission on the port."
  ::= { ptxqEntry 5 }

ptxqQHpCount       OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of attempts to queue a high priority
  packet for transmission"
  ::= { ptxqEntry 6 }
```

```
ptxqQExpCount      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of attempts to queue an expedited
  priority packet for transmission"
  ::= { ptxqEntry 7 }

ptxqQRegCount      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of attempts to queue a regular priority
  packet for transmission"
  ::= { ptxqEntry 8 }

ptxqQHpDiscards    OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of failed attemts to queue a high
  priority packet"
  ::= { ptxqEntry 9 }

ptxqQExpDiscards   OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of failed attemts to queue an
  expedited priority packet"
  ::= { ptxqEntry 10 }

ptxqQRegDiscards   OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of failed attemts to queue a
  regular priority packet"
  ::= { ptxqEntry 11 }
```

```
    ptxqMultiQSize     OBJECT-TYPE
      SYNTAX Gauge
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "Current multicast queue size.  The number of
      multicast packets which are queued for transmission
      on the (radio) port.  Multicast packets are
      transmitted after HELLO packets on OWL radio
      ports."
      ::= { ptxqEntry 12 }

    ptxqMultiQMax      OBJECT-TYPE
      SYNTAX INTEGER
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The maximum number of multicast packets which will
      be queued for transmission on the (radio) port."
      ::= { ptxqEntry 13 }

    ptxqMultiQDiscards OBJECT-TYPE
      SYNTAX Counter
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "The number of failed attempts to queue a
      Multicast packet"
      ::= { ptxqEntry 14 }

pmsg          OBJECT IDENTIFIER ::= { nInterfaces 6 }

    pmsgTable                OBJECT-TYPE
      SYNTAX SEQUENCE OF PmsgEntry
      ACCESS not-accessible
      STATUS mandatory
      DESCRIPTION
      "Pending Message Table"
      ::= { pmsg 1 }

    pmsgEntry                OBJECT-TYPE
      SYNTAX PmsgEntry
      ACCESS not-accessible
      STATUS mandatory
      INDEX { pmsgPort }
      ::= { pmsgTable 1 }
```

```
PmsgEntry ::=
  SEQUENCE {
    pmsgPort                  INTEGER,
    pmsgPendRecCurrent        Gauge,
    pmsgPendRecMax            INTEGER,
    pmsgPendMsgCurrent        Gauge,
    pmsgPendMsgMax            INTEGER,
    pmsgPendMsgTotal          Counter,
    pmsgPendMsgDiscards       Counter,
    pmsgPendRecOverflowErrors Counter,
    pmsgPendMsgOverflowErrors Counter,
    pmsgPendAgedRecCount      Counter,
    pmsgPendAgedMsgCount      Counter
  }

pmsgPort                  OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-R port ID (1-4).
  A number which uniquely indentifies the port."
  ::= { pmsgEntry 1 }

pmsgPendRecCurrent        OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Current terminal record count"
  ::= { pmsgEntry 2 }

pmsgPendRecMax            OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Maximum terminal record count"
  ::= { pmsgEntry 3 }

pmsgPendMsgCurrent        OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Current pending message count"
  ::= { pmsgEntry 4 }
```

```
pmsgPendMsgMax            OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Maximum pending message count"
  ::= { pmsgEntry 5 }

pmsgPendMsgTotal          OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Total pending message count"
  ::= { pmsgEntry 6 }

pmsgPendMsgDiscards       OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of pending messages in-queue which were
  discarded before they could be delivered because
  the terminal's queue was full."
  ::= { pmsgEntry 7 }

pmsgPendRecOverflowErrors OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of times that a terminal requested
  pending message services when no pending message
  records were available."
  ::= { pmsgEntry 8 }

pmsgPendMsgOverflowErrors OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "The number of times when the maximum number of
  stored messages, per platform, was exceeded."
  ::= { pmsgEntry 9 }
```

```
        pmsgPendAgedRecCount      OBJECT-TYPE
          SYNTAX Counter
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The number of terminal records discarded due to
          maximum age (12 minutes)"
          ::= { pmsgEntry 10 }
        pmsgPendAgedMsgCount      OBJECT-TYPE
          SYNTAX Counter
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "The number of pending messages which were
          discarded due to maximum age. (default = 5
          seconds)"
          ::= { pmsgEntry 11 }
nSNMP                 OBJECT IDENTIFIER ::= { norandNET 11 }
    v1Config          OBJECT IDENTIFIER ::= { nSNMP 1 }
      --Norand Community table defines the accepted community
      --strings and their access privileges
       -- The Community Table
```

```
communityTable          OBJECT-TYPE
  SYNTAX  SEQUENCE OF CommunityEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
  "The community table is used to define communities
  and their access privileges.  Norand's
  implementation of the community table has some
  special considerations:

  1) GETs and SETs to the community table can only be
  accomplished using the SUPER-USER community
  string which Norand has defined;
  2) This SUPER-USER community string, or password,
  is defined in the first row of the community table.
  The communityName contained in the first row of the
  community table is always the SUPER-USER community
  string.  This community string (communityName) may
  be modified.
  3) All rows of the community table are modifiable
  (SET) when using the SUPER-USER community string.
  However, for the first row of the community table,
  only the communityName object is modifiable.
  This ensures that the SUPER-USER will always have
  maximum access to the MIB data.  All other rows in
  the community Table are accessible as defined in
  the MIB definition.
  4) The SUPER-USER and other default community
  string values can be found in Norand's User's
  Guide."
  ::= { v1Config 2 }

-- Row Definition

communityEntry          OBJECT-TYPE
  SYNTAX  CommunityEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
  "Each entry relates to a specific community
  & associates to it access privileges."
  INDEX   { communityIndex }
  ::= {communityTable 1 }

-- Columnar Object Definition
```

```
CommunityEntry ::=
  SEQUENCE {
    communityIndex          INTEGER,
    communityStatus         INTEGER,
    communityName           DisplayString,
    communityPrivileges     INTEGER
}

-- Leaf Definition

communityIndex        OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
  "Identifies the community row"
  ::= { communityEntry 1 }

communityStatus       OBJECT-TYPE
  SYNTAX  INTEGER {  enabled(1),
                    disabled(2),
                     deleted(3) }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
  "Status of a community record.
  Alterations to the table may only be performed by
  a manager using the SUPER-USER community name.
  Status types:
         Enabled = Community record active
         Disabled = Community record not active
         Deleted = Disables and nulls objects in
         record"
  ::= { communityEntry 2 }

communityName         OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..15))
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
  "The authoritative name for the community.  Unless
  the Norand SUPER-USER community name is employed, a
  GET from this column yields an access violation."
  ::= { communityEntry 3 }
```

```
communityPrivileges   OBJECT-TYPE
  SYNTAX  INTEGER {    get-only(1),
                   set-and-get(3) }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
  "SET and GET privileges of community."
  ::= { communityEntry 4 }

-- Norand trap table defines all trap target IP addresses

   -- Table Definition

   trapTargetTable     OBJECT-TYPE
     SYNTAX  SEQUENCE OF TrapTargetEntry
     ACCESS  not-accessible
     STATUS  mandatory
     DESCRIPTION
     "The trap target table specifies
     the IP address of SNMPv1 managers
     that expect trap notifications."
     ::= { v1Config 3 }

   -- Row Definition

   trapTargetEntry     OBJECT-TYPE
     SYNTAX  TrapTargetEntry
     ACCESS  not-accessible
     STATUS  mandatory
     DESCRIPTION
     "Each entry relates to a specific named manager
     at a given IP address & belonging to given
     community."
     INDEX   { trapTargetIndex }
     ::= {trapTargetTable 1 }

   -- Columnar Object Definition

   TrapTargetEntry ::=
     SEQUENCE {
       trapTargetIndex     INTEGER,
       trapTargetStatus    INTEGER,
       trapTargetName      DisplayString,
       trapTargetIpAddress IpAddress
   }

   -- Leaf Definition
```

```
        trapTargetIndex     OBJECT-TYPE
          SYNTAX INTEGER
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "Identifies the trapTarget row"
          ::= { trapTargetEntry 1 }

        trapTargetStatus    OBJECT-TYPE
          SYNTAX  INTEGER {  enabled(1),
                             disabled(2),
                              deleted(3) }
          ACCESS  read-write
          STATUS  mandatory
          DESCRIPTION
          "Status of a trapTarget record."
          ::= { trapTargetEntry 2 }

        trapTargetName      OBJECT-TYPE
          SYNTAX  DisplayString (SIZE (0..16))
          ACCESS  read-write
          STATUS  mandatory
          DESCRIPTION
          "The authoritative name for the trapTarget."
          ::= { trapTargetEntry 3 }

        trapTargetIpAddress OBJECT-TYPE
          SYNTAX  IpAddress
          ACCESS  read-write
          STATUS  mandatory
          DESCRIPTION
          "IP Address of manager (which is assumed to be
          bound to & listening on port 162)."
          ::= { trapTargetEntry 4 }

nBridge               OBJECT IDENTIFIER ::= { norandNET 17 }

    rt                OBJECT IDENTIFIER ::= { nBridge 2 }

        -- The RT Table

        -- Table Definition

        rtTable           OBJECT-TYPE
          SYNTAX SEQUENCE OF RTEntry
          ACCESS not-accessible
          STATUS mandatory
          DESCRIPTION
          "Each entry in this table provides routing
          information for child nodes which are reachable via
          a route."
          ::= { rt 2 }
```

```
-- Row Definition

rtEntry            OBJECT-TYPE
  SYNTAX RTEntry
  ACCESS not-accessible
  STATUS mandatory
  INDEX { rtDestination }
  ::= { rtTable 1 }

-- Columnar Object Definition

RTEntry ::=
SEQUENCE {
    rtDestination   PhysAddress,
    rtPort          INTEGER,
    rtAge           INTEGER,
    rtNodeId        INTEGER,
    rtAttachId      INTEGER,
    rtAttachTime    TimeTicks,
    rtApEaddr       PhysAddress,
    rtHopAddrLen    INTEGER,
    rtHopAddr16     INTEGER,
    rtHopEaddr      PhysAddress,
    rtIsBound       INTEGER,
    rtIsRemote      INTEGER,
    rtIsChild       INTEGER,
    rtIsAp          INTEGER,
    rtIsDistributed INTEGER,
    rtIsRemoteLan   INTEGER,
    rtNS            INTEGER,
    rtNR            INTEGER
}

-- Leaf Definition

rtDestination      OBJECT-TYPE
SYNTAX PhysAddress
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The 802 address of the destination."
::= { rtEntry 1 }

rtPort             OBJECT-TYPE
SYNTAX INTEGER (1..4)
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The MAC-R port ID (1-4).  A number which uniquely
identifies the port."
::= { rtEntry 2 }
```

```
rtAge              OBJECT-TYPE
SYNTAX INTEGER
ACCESS read-only
STATUS mandatory
DESCRIPTION
"The time (in minutes) since the route was updated."
::= { rtEntry 3 }

rtNodeId           OBJECT-TYPE
SYNTAX INTEGER (0..65535)
ACCESS read-only
STATUS mandatory
DESCRIPTION
"16-bit node ID of the destination.  A 16-bit
identifier which uniquely identifies an OWL node in
an OWL LAN."
::= { rtEntry 4 }

rtAttachId         OBJECT-TYPE
SYNTAX INTEGER (0..65535)
ACCESS read-only
STATUS mandatory
DESCRIPTION
"Attach sequence number.  The sequence number is
copied from an OWL ATTACH request PDU.  The sequence
number is not valid for 'remote' nodes."
::= { rtEntry 5 }

rtAttachTime       OBJECT-TYPE
SYNTAX TimeTicks
ACCESS read-only
STATUS mandatory
DESCRIPTION
"Last attach time (.01 secs.)"
::= { rtEntry 6 }

rtApEaddr          OBJECT-TYPE
SYNTAX PhysAddress
ACCESS read-only
STATUS mandatory
DESCRIPTION
"802 address of AP which is the first hop on
the path to the destination"
::= { rtEntry 7 }
```

```
rtHopAddrLen        OBJECT-TYPE
SYNTAX INTEGER { twoByte(2),
                 sixByte(6) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"MAC-D address length (2 or 6). A MAC-D entity may
use either 16-bit locally assigned addresses or
48-bit 802 addresses."
::= { rtEntry 8 }

rtHopAddr16         OBJECT-TYPE
SYNTAX INTEGER (0..65535)
ACCESS read-only
STATUS mandatory
DESCRIPTION
"16-bit MAC-D address (if rtHopAddrLen is
twoByte(2))"
::= { rtEntry 9 }

rtHopEaddr          OBJECT-TYPE
SYNTAX PhysAddress
ACCESS read-only
STATUS mandatory
DESCRIPTION
"48-bit MAC-D address (if rtHopAddrLen is
sixByte(6))"
::= { rtEntry 10 }

rtIsBound           OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the destination is fully attached and the
path can be used to forward data."
::= { rtEntry 11 }

rtIsRemote          OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the destination is a non-OWL node"
::= { rtEntry 12 }
```

```
rtIsChild          OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the destination is a child node"
::= { rtEntry 13 }

rtIsAp             OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the destination is an AP"
::= { rtEntry 14 }

rtIsDistributed    OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the path is through a distributed AP
(root node only)"
::= { rtEntry 15 }

rtIsRemoteLan      OBJECT-TYPE
SYNTAX INTEGER { true(1), false(2) }
ACCESS read-only
STATUS mandatory
DESCRIPTION
"True if the destination is a remote LAN"
::= { rtEntry 16 }

rtNS               OBJECT-TYPE
SYNTAX INTEGER (0..65535)
ACCESS read-only
STATUS mandatory
DESCRIPTION
"MAC-R send sequence number for terminal nodes.  The
16-bit (0-65535) sequence number of the last OWL data
request PDU sent to the destination"
::= { rtEntry 17 }
```

```
    rtNR                OBJECT-TYPE
    SYNTAX INTEGER (0..65535)
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
    "MAC-R receive sequence number for terminal nodes.
    The 16-bit (0-65535) sequence number of the last OWL
    data request PDU received from the destination"
    ::= { rtEntry 18 }

brg                 OBJECT IDENTIFIER ::= { nBridge 3 }

    -- The BRG Table

    -- Table Definition

    brgTable            OBJECT-TYPE
     SYNTAX SEQUENCE OF BRGEntry
     ACCESS not-accessible
     STATUS mandatory
     DESCRIPTION
     "Each entry in this table provides bridge
     information for child nodes which are reachable via
     a bridge."
     ::= { brg 2 }

    -- Row Definition

    brgEntry            OBJECT-TYPE
     SYNTAX BRGEntry
     ACCESS not-accessible
     STATUS mandatory
     INDEX { brgDestination }
     ::= { brgTable 1 }

    -- Columnar Object Definition

    BRGEntry ::=
     SEQUENCE {
       brgDestination PhysAddress,
       brgPort        INTEGER,
       brgAge         INTEGER,
       brgType        INTEGER,
       brgIsPermanent INTEGER,
       brgTimestamp   TimeTicks
    }

    -- Leaf Definition
```

```
brgDestination     OBJECT-TYPE
 SYNTAX PhysAddress
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The 802 address of the destination."
 ::= { brgEntry 1 }

brgPort            OBJECT-TYPE
 SYNTAX INTEGER (1..4)
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "MAC-R port ID (1-4).  A number which uniquely
 identifies the port."
 ::= { brgEntry 2 }

brgAge             OBJECT-TYPE
 SYNTAX INTEGER
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Time (in minutes) since the entry was updated."
 ::= { brgEntry 3 }

brgType            OBJECT-TYPE
 SYNTAX INTEGER {   primary(1),
                   secondary(2),
                    outbound(3),
                     inbound(4) }
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Entry Type:
   primary   = 1,
   secondary = 2,
   outbound  = 3,
   inbound   = 4 "
 ::= { brgEntry 4 }

brgIsPermanent     OBJECT-TYPE
 SYNTAX INTEGER { true(1), false(2) }
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "TRUE, if the entry is permanent."
 ::= { brgEntry 5 }
```

```
    brgTimestamp        OBJECT-TYPE
     SYNTAX TimeTicks
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The time when the primary or inbound entry was
     added or the time when the secondary entry was added
     or re-attached."
     ::= { brgEntry 6 }

addr                OBJECT IDENTIFIER ::= { nBridge 4 }

    -- The Addr Table

    -- Table Definition

    addrTable           OBJECT-TYPE
     SYNTAX SEQUENCE OF AddrEntry
     ACCESS not-accessible
     STATUS mandatory
     DESCRIPTION
     "Each entry in this table provides address
     information for all OWL nodes in the network.  This
     table exists only at the root node."
     ::= { addr 2 }

    -- Row Definition

    addrEntry           OBJECT-TYPE
     SYNTAX AddrEntry
     ACCESS not-accessible
     STATUS mandatory
     INDEX { addrDestination }
     ::= { addrTable 1 }

    -- Columnar Object Definition

    AddrEntry ::=
     SEQUENCE {
       addrDestination PhysAddress,
       addrAge         INTEGER,
       addrNodeId      INTEGER,
       addrAlias       DisplayString,
       addrDeviceId    INTEGER,
       addrIpAddress   IpAddress
    }

    -- Leaf Definition
```

```
    addrDestination    OBJECT-TYPE
     SYNTAX PhysAddress
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The 802 address of the registered port."
     ::= { addrEntry 1 }
    addrAge            OBJECT-TYPE
     SYNTAX INTEGER
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "The time (in minutes) since the entry was updated."
     ::= { addrEntry 2 }
    addrNodeId         OBJECT-TYPE
     SYNTAX INTEGER (0..65535)
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "16-bit (0-65535) node/port ID"
     ::= { addrEntry 3 }
    addrAlias          OBJECT-TYPE
     SYNTAX DisplayString (SIZE (0..16))
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "An alias for the 802 address"
     ::= { addrEntry 4 }
    addrDeviceId       OBJECT-TYPE
     SYNTAX INTEGER (0..65535)
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "Device ID (0-65535).  An OWL node can, optionally,
     set a device ID in a registration request PDU."
     ::= { addrEntry 5 }
    addrIpAddress      OBJECT-TYPE
     SYNTAX IpAddress
     ACCESS read-only
     STATUS mandatory
     DESCRIPTION
     "32-bit IP address for IP nodes (e.g. APs)"
     ::= { addrEntry 6 }
brgState           OBJECT IDENTIFIER ::= { nBridge 6 }
    -- The Bridge State Group
```

```
bsAddress                OBJECT-TYPE
  SYNTAX PhysAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "802 address of the AP"
  ::= { brgState 3 }

bsLanId                  OBJECT-TYPE
  SYNTAX INTEGER (0..254)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "OWL LAN ID (0-254)"
  ::= { brgState 4 }

bsCostToRoot             OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Path cost to the root"
  ::= { brgState 5 }

bsIsRoot                 OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, if the AP is the root"
  ::= { brgState 6 }

bsIsAttached             OBJECT-TYPE
  SYNTAX INTEGER { true(1), false(2) }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "TRUE, if the AP is attached"
  ::= { brgState 7 }

bsAttachId               OBJECT-TYPE
  SYNTAX INTEGER (0..65535)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "16-bit (0-65535) ATTACH sequence number.  This
  number is incremented each time the AP sends an
  ATTACH request."
  ::= { brgState 8 }
```

```
bsMyRootPriority         OBJECT-TYPE
  SYNTAX INTEGER (0..7)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Root priority of the AP (0-7).  An AP with a root
  priority of 0 can not become the root node.  The AP
  with the highest priority will become the root in
  an OWL LAN"
  ::= { brgState 9 }

bsRootPort               OBJECT-TYPE
  SYNTAX INTEGER (1..4)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "MAC-R root port number. The port number (1-4) of
  the port used to communicate with the parent node."
  ::= { brgState 10 }

bsDesignatedRootAddress  OBJECT-TYPE
  SYNTAX PhysAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "802 address of the current root"
  ::= { brgState 11 }

bsDesignatedRootPriority OBJECT-TYPE
  SYNTAX INTEGER (1..7)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Root priority of the current root (1-7)"
  ::= { brgState 12 }

bsDesignatedRootSequence OBJECT-TYPE
  SYNTAX INTEGER (0..255)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Root sequence of the current root (0-255).  The
  sequence number identifies a single instance of the
  root."
  ::= { brgState 13 }
```

```
bsParentAddress          OBJECT-TYPE
  SYNTAX PhysAddress
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "802 address of the parent AP"
  ::= { brgState 14 }

bsPortCount              OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of MAC-R ports"
  ::= { brgState 15 }

bsNodeId                 OBJECT-TYPE
  SYNTAX INTEGER (0..65535)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "16-bit node ID (0-65535).  The node ID uniquely
  identifies the node in an OWL LAN."
  ::= { brgState 16 }

bsRootChangedCount       OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of times that the root has changed."
  ::= { brgState 17 }

bsRootCount              OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of times that the AP became the root"
  ::= { brgState 18 }

bsAttachCount            OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of times that the AP has changed from an
  unattached state to an attached state."
  ::= { brgState 19 }
```

```
bsDetachReason          OBJECT-TYPE
  SYNTAX INTEGER
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Last detach reason code.  The code indicates the
  reason that the AP became unattached for the last
  occurrence.
  0 - Initial Value,
  1 - A new root node was detected,
  2 - The network inactivity timer expired,
  4 - A better path to the root was detected,
  5 - The node's parent became unattached,
  7 - The node was in a detach list in a HELLO PDU,
  8 - The node was functioning as the root and
  relinquished the root status,
  9 - The maximum number of attache retries was
  exceeded without receiving an ATTACH response PDU,
  900-90F - A MAC-D link error occurred while sending
  a PDU to the parent node."
  ::= { brgState 20 }

bsNetworkTime           OBJECT-TYPE
  SYNTAX TimeTicks
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Distributed network time (.01 sec)"
  ::= { brgState 21 }

bsUniFloodLevel         OBJECT-TYPE
  SYNTAX INTEGER (1..2)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Flooding level for unicast frames (1-2)"
  ::= { brgState 22 }

bsMultiFloodLevel       OBJECT-TYPE
  SYNTAX INTEGER (0..3)
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Flooding level for multicast frames (0-3)"
  ::= { brgState 23 }
```

```
    bsIsPrimaryBridge        OBJECT-TYPE
      SYNTAX INTEGER { true(1), false(2) }
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "TRUE, if the AP bridges to the distribution LAN"
      ::= { brgState 24 }

    bsIsSecondaryBridge      OBJECT-TYPE
      SYNTAX INTEGER { true(1), false(2) }
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "TRUE, if the AP is the designated bridge for
      a secondary LAN"
      ::= { brgState 25 }

    bsUniFilterExpr          OBJECT-TYPE
      SYNTAX INTEGER (0..255)
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "Unicast ethernet filter ID (0-255).  If the ID is
      non-zero, it points to a user defined expression
      which is used to filter unicast frames on the
      ethernet port."
      ::= { brgState 26 }

    bsMultiFilterExpr        OBJECT-TYPE
      SYNTAX INTEGER (0..255)
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "Multicast ethernet filter ID (0-255). If the ID is
      non-zero, it points to a user defined expression
      which is used to filter multicast frames on the
      ethernet port."
      ::= { brgState 27 }

bridgeStats        OBJECT IDENTIFIER ::= { nBridge 7 }

    bstcRouteCount           OBJECT-TYPE
      SYNTAX Gauge
      ACCESS read-only
      STATUS mandatory
      DESCRIPTION
      "Total route table entries"
      ::= { bridgeStats 3 }
```

```
bstcChildCount          OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of attached children"
  ::= { bridgeStats 4 }

bstcChildApCount        OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Number of attached AP children"
  ::= { bridgeStats 5 }

bstcRemoteCount         OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Non-OWL bridge table entries"
  ::= { bridgeStats 6 }

bstcPrimaryCount        OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Distribution LAN bridge table entries"
  ::= { bridgeStats 7 }

bstcInboundCount        OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Inbound bridge table entries"
  ::= { bridgeStats 8 }

bstcSecondaryCount      OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Secondary LAN bridge table entries"
  ::= { bridgeStats 9 }
```

```
bstcRemoteLanCount      OBJECT-TYPE
  SYNTAX Gauge
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Route entries for remote LANs"
  ::= { bridgeStats 10 }

bstcRouteGetErrors      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Route table overflow errors"
  ::= { bridgeStats 11 }

bstcEntryGetErrors      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Bridge table overflow errors"
  ::= { bridgeStats 12 }

bstcRmtLanGetErrors     OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Remote LAN overflow errors"
  ::= { bridgeStats 13 }

bstcRouteSeqErrors      OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Out-of-sequence route update errors"
  ::= { bridgeStats 14 }

bstcDeleteSeqErrors     OBJECT-TYPE
  SYNTAX Counter
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
  "Out-of-sequence route delete errors"
  ::= { bridgeStats 15 }
```

```
        bstcEntrySeqErrors      OBJECT-TYPE
          SYNTAX Counter
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "Out-of-sequence bridge entry update errors"
          ::= { bridgeStats 16 }

        bstcInvalidUpdateErrors OBJECT-TYPE
          SYNTAX Counter
          ACCESS read-only
          STATUS mandatory
          DESCRIPTION
          "Invalid route update errors"
          ::= { bridgeStats 17 }

nControl              OBJECT IDENTIFIER ::= { norandNET 105 }

    powerUp            OBJECT IDENTIFIER ::= { nControl 1 }

        pwrPowerUpCount    OBJECT-TYPE
         SYNTAX Counter
         ACCESS read-only
         STATUS mandatory
         DESCRIPTION
         "power-up count"
         ::= { powerUp 1 }

        pwrNextPowerUpTime OBJECT-TYPE
         SYNTAX TimeTicks
         ACCESS read-write
         STATUS mandatory
         DESCRIPTION
         "Next power-up time (Used to reboot the device)"
         ::= { powerUp 2 }

    softwareDownLoad   OBJECT IDENTIFIER ::= { nControl 2 }

        sdStartTime         OBJECT-TYPE
         SYNTAX TimeTicks
         ACCESS read-write
         STATUS mandatory
         DESCRIPTION
         "The amount of time to delay before beginning the
         software download"
         ::= { softwareDownLoad 1 }
```

```
sdServerIpAddress   OBJECT-TYPE
 SYNTAX IpAddress
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION
 "TFTP server IP address"
 ::= { softwareDownLoad 2 }

sdScriptFilename    OBJECT-TYPE
 SYNTAX DisplayString (SIZE (0..80))
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION
 "Download script filename (May include path)"
 ::= { softwareDownLoad 3 }

sdStatus            OBJECT-TYPE
 SYNTAX INTEGER {
                      sdPending(1),
                    sdSTStopped(2),
                    sdInProcess(3),
                   sdTerminated(4),
                      sdSuccess(5),
                        sdError(6),
                        pwrNPUT(7),
                      tftpError(8)
                }
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Status of the current software download"
 ::= { softwareDownLoad 4 }

sdErrorString       OBJECT-TYPE
 SYNTAX DisplayString (SIZE (0..40))
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "Description of sdStatus field"
 ::= { softwareDownLoad 5 }
```

```
sdCheckPoint        OBJECT-TYPE
 SYNTAX INTEGER
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION
 "An application variable intended to contain a
 number relating the progress of the current software
 download"
 ::= { softwareDownLoad 6 }

sdSetActivePointers OBJECT-TYPE
 SYNTAX INTEGER {
                   none(1),
                   boot(2),
                   data(3),
                   both(4)
                 }
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION
 "If the device reboots due to the expiration of the
 pwrNextPwrUpTime timer, this value specifies which
 active pointers will be toggled prior to rebooting"
 ::= { softwareDownLoad 7 }

sdTerminate         OBJECT-TYPE
 SYNTAX INTEGER {
                  true(1),
                  false(2)
                 }
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION
 "Terminate the current software download"
 ::= { softwareDownLoad 8 }

END
```

Glossary

Access Point

Access points provide the following functions:

- A *wired bridge* is an access point that attaches to the network through an Ethernet link and has bridging enabled (through access point configuration menus). A wired bridge converts wireless LAN frames to Ethernet frames, and Ethernet frames to wireless LAN frames. A wired bridge also forwards wireless LAN frames to wireless LAN nodes.
- A *designated bridge* is an access point that bridges frames to and from a secondary Ethernet LAN. A designated bridge for a secondary Ethernet LAN attaches to the network through a radio port, or through an Enterprise Open Wireless LAN (Enterprise OWL) port when establishing an IP tunnel.
- A *wired access point* is an access point that attaches to the network through an Ethernet link and has bridging disabled (through the configuration menus).
- A *wireless access point* is an access point that attaches to the network through a radio port. A wireless access point provides a wireless store-and-forward operation with frames transmitted over the wireless media to reach their destination.

Bridging

In this manual, *bridging* refers to the translational bridging process of converting open wireless LAN frames to Ethernet frames, and Ethernet frames to open wireless LAN frames.

Broadcast

A *broadcast* is a transmission to all wireless stations at the same time.

Channel

Channel refers to a logical data channel. A port may contain one or more channels. Data for any given wireless station is contiguous on a channel. Each of the remote ports on a controller may contain up to three channels apiece.

Designated Bridge

Access points physically connected to a secondary physical LAN, and within the radio coverage area of an access point on the distribution LAN, are candidates to become the *designated bridge* for the secondary LAN. The designated bridge is a particular access point assigned the role of bridging frames destined for or received from the secondary LAN, providing a wireless connection between two unconnected secondary LAN segments.

DHCP (Dynamic Host Configuration Protocol)

DHCP is an Internet standard stack protocol that allows dynamic distribution of IP address and other configuration information to IP hosts on a network.

Implementation of the DHCP client simplifies installation because the devices automatically receive IP addresses from a DHCP server on the network. (The DHCP client also accepts addresses from a Bootp server.)

Direct Sequence

Direct sequence is a spread spectrum technique by which the transmitted signal is spread over a wide frequency range. In a direct sequence system, the bandwidth is large relative to the data rate.

Distribution (Primary) LAN

A *distribution LAN* is the Ethernet segment to which the super root directly connects. Typically, it is also the segment to which the primary hosts or LAN servers connect.

Ethernet

In this user's guide, *Ethernet* is a general term indicating both 802.3 and DIX Ethernet (also called Ethernet 2.0).

FLASH

FLASH is a special type of EEPROM (Electrically Erasable Programmable Read-Only Memory) that can be erased and reprogrammed.

Forwarding

A frame is *forwarded* by sending it to the next hop on the path to the final destination. All access points (including wireless access points) forward frames.

Frame

A *frame* is a series of bytes of data encapsulated with a header (and trailer). Frame is often used interchangeably with packet, although technically a packet refers to data from the network layer of the protocol stack.

Frequency Agile

The *frequency agile* system software allows access points to be individually configured to operate on one of several pre-programmed frequencies. Wireless stations are programmed with a list of all frequencies used in the installed access points, and change frequencies in order to roam between access points. Access points may be installed with overlapping coverage using different frequencies to increase throughput.

Currently, no provision exists to allow frequency agile operation on a subset of the available frequencies.

Frequency Hopping

Frequency hopping is a spread spectrum technique by which the band is divided into a number of channels and the transmissions hop from channel to channel is in a specified sequence.

Hop

Hop is used in vector distance routing and is equal to one data link. A path to the final destination on a net is a series of hops away from the origin.

Inbound Frames

Frames sent toward the distribution LAN are *inbound*.

IP Subnet

An *IP subnet* is a single member of the collection of hardware networks that compose an IP network. Host addresses on a given subnet share an IP network number with hosts on all other subnets of that IP network, but the local address part is divided into subnet-number and hostnumber fields to indicate which subnet a host is on.

IP Wireless Station

An *IP wireless station* is any PC-compatible computing station running IP. (A PEN*KEY® computer is an IP wireless station if it is running an off-the-shelf IP protocol stack.)

LAN (Local Area Network)

A *LAN* is a group of network devices in which each device can communicate through a wired or wireless link. The wired link may be composed of several segments joined by repeaters and bridges. The LAN is characterized by the relatively short distance it is designed to cover, a high speed of operation, and relatively low error rates. The geographic scope of LANs is limited to thousands of feet or closely-spaced building complexes.

MAC (Media Access Control) Sublayer

The *MAC sublayer* is the lower portion of the Data Link layer of the Open Systems Interconnection (OSI) model.

Mobile IP Wireless Station

In this user's guide, a *mobile IP wireless station* is any IP wireless station that can roam across IP subnet boundaries.

Multicast Address

A *multicast address* is a form of broadcast address through which copies of the frame are delivered to a subset of all possible destinations with a common multicast address.

NNL Wireless Station

An *NNL wireless station* is a terminal emulation station. These stations use an optimized transport protocol for reliable operation in wireless environments.

Octet

An *octet* is a byte composed of eight bits.

Open System

An *open system* comprises protocols and components that meet standards set by industry-accepted governing bodies. The standards ensure that when new protocols and components are introduced into an existing system, the protocols and components will meet the standards and be able to communicate with the existing system. The OSI model is the basis for a system to communicate with any other system. The model is a framework of standards used to create protocol stacks and applications for networking applications.

Open Wireless LAN Node

An *open wireless LAN node* is any access point or wireless station that connects to the network using the 900 MHz or synthesized UHF radio option.

Outbound Frames

Frames moving away from the distribution LAN are *outbound*.

Primary LAN

See *Distribution LAN*.

Radio Network

The *radio network* consists of radio-enabled network devices and communication paths. It is a group of fixed-end devices and wireless stations in which each can communicate with at least one other device through either a radio or wired Ethernet link. Secondary Ethernet LANs are part of the radio network; the distribution LAN is not part of the radio network.

Redundancy

Redundancy is the ability of a duplicate access point to immediately take over the function of another access point that goes offline.

Remote Subnet

The *remote subnet* is an Ethernet segment other than the distribution LAN. For Enterprise OWL, the remote subnet is the Ethernet link of the access point that attaches to the super root through an IP tunnel.

ROM (Read-Only Memory)

ROM contains computer instructions that cannot be reprogrammed by the user. The computer can read instructions out of ROM, but no data can be stored in ROM. The user can change some of the variables within ROM, such as the software, boot segment, data segment, and baud rate.

Root Subnet

The *root subnet* is the Ethernet segment to which the access point super root connects, which is the distribution LAN. For Enterprise OWL, the root subnet is the Ethernet link of the access point that originates an IP tunnel, which is the super root.

Secondary Ethernet LAN

A *secondary Ethernet LAN* is an Ethernet segment that connects to the distribution LAN through a wireless link. A single access point functions as the *designated bridge* for the secondary LAN.

Segment

In LANs, a *segment* is a length of cable from termination to termination. For example, a 10BASE2 cable segment is the length of cable between the 50-Ohm terminators that attach to each end of the cable. For proper network communications, cable segments must meet ANSI/IEEE standard specifications.

Single Frequency

If a wireless station is using a *single frequency*, it operates on the selected frequency in a list of frequencies. The default is the first frequency in the list.

Subnet

A *subnet* is a single member of the collection of hardware networks that compose an IP network. Host addresses on a given subnet share an IP network number with hosts on all other subnets of that IP network.

The local address part is divided into subnet number and hostnumber fields to indicate which subnet a host is on. A particular division of the local address part is not assumed; this could vary from network to network.

Unicast Address

A *unicast address* is a unique Ethernet address assigned to a single station on the network.

Wireless Hops

A *wireless hop* is a wireless connection to an open wireless LAN. For the access point, a wireless hop means connecting to the open wireless LAN spanning tree through its RF port instead of its Ethernet port. The major advantage of using a wireless connection to the LAN is that it reduces, and sometimes even eliminates, the requirements for LAN cabling.

The wireless access point provides a wireless store-and-forward operation (a *hop*) with each frame transmitted twice over the wireless media to reach its destination. Because frames are transmitted twice, the amount of wireless traffic over the radio network doubles.

In general, the throughput of a wireless access point has about half the effective bandwidth of a wired bridge, because all frames received on the radio channel must be forwarded on the same channel. Therefore, using a wireless access point exchanges performance for ease of installation.

Wireless Stations

Wireless stations is an inclusive term that refers to network terminals and wireless computers equipped with wireless NICs. Network terminals include the INTERMEC® RT1100 Radio Terminal, RT1700 Radio Terminal, and RT5900 Radio Terminal, and the TRAKKER ANTARES products. Wireless computers include the INTERMEC JANUS, PEN*KEY 6400 Computer, and PEN*KEY 6550 Computer.

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