Distributed 5000 Hubs

Simplifies Network Connectivity

Provides Efficient Bandwidth Allocation

Enhances Manageability

Delivers Bullet-Proof Reliability and Maximizes Network Availability

Protects Network Investments

Bay Networks Distributed 5000™ hub family delivers a highly flexible solution for Ethernet networks, combining the convenience and performance of modular hubs with the value and simplicity of stackable solutions. A system of eight Distributed 5000 hubs supports up to 288 ports and up to 27 Ethernet segments, providing a superior path for growth.

Distributed 5000 hubs provide a high-performance solution for growing structured networking environments by extending proven Bay Networks System 5000™ features to high-density wiring closets and mid-sized network backbones. Distributed 5000 hubs are also powerful platforms for integrating high-performance switching as needed, delivering key capabilities defined in the Bay Networks Switched Internetworking Services (BaySIS™) architecture.

Distributed 5000 hubs, featuring a unique blend of modular and stackable hub capabilities, are available in two sizes: a two-slot hub that supports up to 24 Ethernet ports, and a three-slot hub that supports up to 36 Ethernet ports. Both versions feature complete manageability,

full redundancy, support for multiple segments, per-port configuration switching, efficient scalability, and bullet-proof reliability, delivering superior performance in a compact and cost-effective package.

The hubs also support hot-swappable Ethernet host and management modules. The host modules offer flexible, mix-and-match connectivity options for supporting standards-based Ethernet over copper, fiber, and coaxial cabling. In addition, the three-slot hub supports a network management module that provides complete SNMP and RMON management for up to eight hubs in a single stack, making efficient use of a single investment. Three levels of embedded management are available, offering increasingly powerful and sophisticated capabilities for monitoring and controlling a Distributed 5000-based network from a central management station.

Bay Networks

Benefits

Simplifies Network Connectivity
Distributed 5000 hubs combine the simplicity and cost-effective scalability of stackable solutions with the power and flexibility of modular hubs, delivering a wide range of media options and superior scalability without the complexity of fully modular solutions.

Provides Efficient Bandwidth Allocation
The Distributed 5000's multisegment design improves network performance through microsegmentation — dividing the system into segments with smaller user populations to relieve network congestion and reduce bandwidth contention. Configuration switching on every port enables resources to be software-assigned to one of 27 different segments, enabling users to microsegment the network quickly and easily without ever visiting the wiring closet. With the addition of a Model 28200 Modular Ethernet Switch, the Distributed 5000 offers one of the industry's most powerful multisegment solutions.

Enhances Manageability
The Distributed 5000 hub includes embedded management capabilities that deliver superior network monitoring and control using Bay Networks Optivity® network management system. Leveraging a single management module across an entire eight-hub stack, the Distributed 5000 extends full SNMP management to all hub ports and segments, providing both comprehensive management and significant cost savings. Optional Data Collection Modules (DCMs) provide full RMON statistics and data for advanced remote management operations. DCMs can be dedicated to a single hub segment or used across all segments, further enhancing management and leveraging investments.

Delivers Bullet-Proof Reliability and Maximizes Network Availability
The Distributed 5000 brings a new level of reliability to the wiring closet by including redundant system clocks, redundant fans, redundant configuration storage, and redundant fiber links. Additionally, optional redundant power supplies and redundant management modules are supported. Host modules and network management modules are hot-swappable to maximize network uptime.

Protects Network Investments
Working with 28000 Series™ Ethernet switches and/or Access Stack Node (ASN™) routers, the Distributed 5000 hub's multisegment architecture ensures that bandwidth is available to support both today's and tomorrow's demanding applications. As the network grows and performance requirements increase, the Distributed 5000 hubs can be segmented to maintain network response quality.

The Distributed 5000 also embodies Bay Networks BaySIS architecture, an open, standards-based framework that defines a strategic evolution to the switched internetworks of the future, ensuring compatibility with future Bay Networks products and solutions.

Features

The Distributed 5000 family combines the power of modular chassis with the simplicity of stackable hubs to provide a scalable, cost-effective connectivity solution for distributed enterprise networks. Based on Bay Networks leading System 5000 technology, Distributed 5000 hubs are ideal for supporting both high-density wiring closets and mid-sized network centers in dynamic and growing environments. Working with the 28000 Series Ethernet/Fast Ethernet switches and the ASN routers, the Distributed 5000 fills a critical role in the Bay Networks strategy for supporting high-performance, multisegment Ethernet networks.

Distributed 5000 Description
The Distributed 5000 delivers a flexible and scalable solution for starting and growing Ethernet networks. The Distributed 5000 family includes two hub models: the two-slot Distributed 5000 hub, which supports up to 24 ports (see Figure 1), and the three-slot Distributed 5000 hub, which supports a maximum of 36 Ethernet ports (see Figure 2). In both models, the hub slots accept any combination of Distributed 5000 Ethernet host modules, delivering a level of flexibility that allows users to selectively configure the hubs to meet specific connectivity requirements. The three-slot hubs can also accommodate a Distributed 5000 network management module (NMM), which provides full management capabilities for the chassis.

As the network grows, multiple Distributed 5000 hubs can be stacked to support additional users. Up to eight hubs can be linked as a common system, communicating across a common System Management Bus (SMB). The stack acts as a single hub and repeater, simplifying management and Ethernet network configuration. In a stacked configuration, a single Distributed 5000 NMM in a three-slot hub provides complete management for the entire system, including all attached hubs and associated ports, optimizing network management investments.

Each Distributed 5000 hub also supports a total of six independent segments — three local and three "cascade," which are shared by all hubs in a common stack. This multisegment capability provides tremendous configuration flexibility for moderately segmented wiring closet environments.
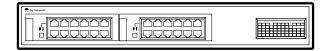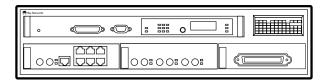
Figure 1   **Two-Slot Distributed 5000 Hub**

Figure 2   **Three-Slot Distributed 5000 Hub**

Distributed 5000 Architecture

The Distributed 5000's advanced architecture features a number of capabilities and benefits, including comprehensive manageability, per-port configuration switching, scalability, cascade expandability, and mission-critical reliability. Together, these features combine to provide a versatile, easily customized networking solution.

Comprehensive Manageability Onboard microprocessors provide monitoring, control, and supervisory functionality for the hub, all modules and ports, and associated repeaters. The microprocessor communicates with the optional NMM over the SMB. Distributed 5000 hubs simplify management by providing a single point for desktop connections that can be remotely monitored and reconfigured through the Optivity Enterprise™ and/or Optivity Campus™ network management systems.

Scalability Up to eight Distributed 5000 hubs can be stacked as a single system, enabling networks to grow incrementally as needed. Each hub features a Cascade Up and Cascade Down connector, allowing new units to be added anywhere in the stack to meet specific site requirements. In a maximum configuration, a Distributed 5000 system can support up to 288 Ethernet connections across 27 segments — three local segments per hub, plus the three cascade segments shared by all hubs in the stack.

Per-Port Configuration Switching Each port on a Distributed 5000 hub can be selectively assigned to any of the three local hub segments or three cascade segments. This feature provides full virtual LAN (VLAN) support for all ports with the three cascade segments.

Mission-Critical Reliability All Distributed 5000 hubs have redundant power supply connections. One optional redundant power supply provides a backup power source for up to four hubs; two redundant power supplies can provide backup power for up to eight hubs. If the onboard power supply fails, the hub will automatically switch to the warm-standby dc source and generate an alert to the network management station.

Each hub has one ac line input, and each redundant power supply has two ac line inputs. The ac line input can be connected to different ac line sources for a triple redundant ac configuration. This provides a greater level of redundancy and power protection for even higher network availability.

Additionally, each hub is equipped with dual fans, redundant clocks, and a redundant link capability to ensure trouble-free operation. The dual fan unit provides a backup cooling source should the primary fan fail. Redundant clocks enable each hub to drive the common cascade clock in the event of a primary clock failure. In a cascade configuration, one hub provides a common clock for the stack; if that clock fails, a second clock in another hub will take over. The redundant link capability provides a backup connection to critical devices or between hubs to ensure uninterrupted connectivity should a primary link fail.

Redundant configuration storage is provided by installing an NMM in the stack. Each Distributed 5000 hub stores host module configuration information in nonvolatile memory. This same configuration data is backed up in nonvolatile memory on the NMM. If a module or

hub is replaced, the new component will learn its configuration from the redundant configuration store on the NMM, maintaining previous options. Redundant management is supported by installing a second NMM in another hub. Only one NMM is active at a time; the second NMM remains in warm standby mode and is activated only upon the failure of the primary NMM.

Distributed 5000 Host Modules
Distributed 5000 host modules provide Ethernet shared access connectivity for end users or shared network resources such as servers or printers. The modules are fully compatible with the IEEE 802.3 Ethernet standard, including 10BASE-T, 10BASE-FL, and 10BASE2 specifications. The modules also support a number of other features that enhance performance and flexibility, including:

• BaySecure™ LAN Access, a unique Bay Networks feature that improves network security by converting Ethernet's traditional "party line" into a direct person-to-person link, eliminating the threat of electronic eavesdropping and other forms of unapproved access.
• Hot-swapping, which allows modules to be added to or removed from a powered hub without affecting the operation of the rest of the system.
• Distributed repeating architecture, which allows independent repeater functionality per port for flexible expansion to meet evolving network needs.

• Per-port autopartitioning, which automatically disconnects ports experiencing excessive or lengthy collisions, ensuring high performance.
• Per-port automatic polarity detection/correction, which detects and automatically corrects receive data pair signal inversions, ensuring uninterrupted network performance.
• Segment selection switch, which allows all ports on a host module to be preassigned to one of the six segments (three local, three cascade) within the hub as a default setting. Administration of the per-port configuration switching feature overrides this setting.

The Distributed 5000 host module family includes 10BASE-T, 10BASE-FL, and 10BASE2 models, as well as mixed-media modules supporting various combinations of fiber, unshielded twisted pair, and coaxial cabling.

10BASE-T Host Module The Distributed 5000 10BASE-T Host Module provides 12 RJ-45 ports for 10BASE-T connectivity to Ethernet networks over Category 3, Category 4, and Category 5 unshielded twisted pair cabling. One port can be configured as either MDI or MDI-X, enabling it to support connections to other hubs with straight-through unshielded twisted pair patch cables, eliminating the need for a crossover cable.

10BASE-T Host Module with BaySecure LAN Access The Distributed 5000 10BASE-T Host Module with BaySecure LAN Access is identical to the 10BASE-T Host Module, with the addition of BaySecure LAN Access technology to ensure the security of private and confidential data.

10BASE-T Telco Host Module The Distributed 5000 10BASE-T Telco Host Module provides one Telco-style 50-pin connector with 12 ports for 10BASE-T connectivity to Ethernet networks. The ports support connections over Category 3, Category 4, and Category 5 unshielded twisted pair cabling. One RJ-45 MDI-X/MDI port is provided to support connections to other hubs using straight-through unshielded twisted pair patch cables.

10BASE-T Telco Host Module with BaySecure LAN Access The Distributed 5000 10BASE-T Telco Host Module with BaySecure LAN Access is identical to the 10BASE-T Telco Host Module, with the addition of BaySecure LAN Access technology to ensure the security of private and confidential data.

10BASE-FL Host Module The 10BASE-FL Host Module provides three ST multimode fiber connectors for 10BASE-FL connectivity to Ethernet networks over 50/125 and 62.5/125 μm multimode fiber optic cabling.

10BASE2 Host Module The Distributed 5000 10BASE2 Host Module offers four BNC connectors for supporting 10BASE2 Ethernet connections over thin coaxial cabling, or ThinNet.

Mixed-Media Host Modules The Distributed 5000 mixed-media host modules offer multiple connectivity options for supporting Ethernet in mixed cabling environments. Three mixed-media host modules are available.

- **10BASE-T/10BASE-FL Host Module** This module offers six RJ-45 MDI-X modular receptacles for supporting 10BASE-T host connections over unshielded twisted pair cabling, and one dual ST-type connector for supporting 10BASE-FL host connections over 50/125 and 62.5/125 μm multi-mode fiber optic cabling. The fiber port can also support a 10BASE-FL downlink to a Model 5000 hub in the network center. The port also provides automatic support for Bay Networks remote signaling, matching the port at the remote end of the link. LEDs verify both transmit and receive connections. One additional RJ-45 MDI port is provided to support connections to other hubs using straight-through unshielded twisted pair patch cables, eliminating the need for a crossover cable when connecting to another hub.
- **10BASE-T/Single-Mode Fiber Host Module** Identical to the 10BASE-T/10BASE-FL Host Module, with the exception of one dual ST-type connector for supporting host connections over 8.5/125 μm single-mode fiber optic cabling. Single-mode fiber supports links up to 10 kilometers for widely dispersed network environments.

- **10BASE-T/AUI Mixed-Media Host Module** Offers six RJ-45 MDI-X modular receptacles for supporting 10BASE-T over unshielded twisted pair cabling, and one attachment unit interface (AUI) connector for supporting an 802.3 Ethernet downlink to centralized resources such a Model 5000 hub in the network center. One additional RJ-45 MDI port is provided to support connections to other hubs using straight-through unshielded twisted pair patch cables, eliminating the need for a crossover cable when connecting to another hub.

Distributed 5000 Network Management Modules

Distributed 5000 network management modules (NMMs), installed in a three-slot hub, deliver high-performance embedded management capabilities for an entire eight-hub stack.

Using the Distributed 5000's SMB, which spans all hubs in a stack, the NMMs provide comprehensive, simultaneous advanced management and statistics collection for all 27 segments. Additionally, the NMMs support Bay Networks Autotopology™ dynamic mapping feature, which provides a variety of system-generated views of the network topology, for all 27 segments in a stack. SNMP management operations are performed through an independent, hardware-configurable nonpromiscuous NIC interface. The interface is also configurable via the NMM service port so that it can be attached to one of the three cascaded segments.

All Distributed 5000 NMMs feature a 32-bit CPU with 2 megabytes of DRAM. Two NMM versions are available, providing increasingly powerful embedded management features for the Distributed 5000 network.

Advanced NMM The Distributed 5000 Advanced NMM comes preconfigured with the Bay Networks Advanced management agent, which provides comprehensive core-level SNMP management for the network. Using the System 5000's distributed management architecture, the Advanced Agent offloads statistics capture to the host modules, easing the burden on centralized management resources.

The Advanced Agent delivers complete fault and diagnostic management capabilities for the Distributed 5000 network, including Find Nodes, Show Nodes, Allowed Nodes, and Autotopology dynamic mapping. Agent software and configuration information is stored in onboard flash EEPROM and NVRAM. By supporting the Advanced Agent, the Advanced NMM provides enhanced management functionality such as:

- Support for Bay Networks EZ Install™ feature, which automatically assigns an IP address to an unconfigured hub to facilitate easy "ship to site" hub installation.
- The agent, boot image, and host unit firmware can be upgraded using BootP/TFTP.
- Full support for MIB II (RFC 1213).
- Support for RMON (RFC 1757) Alarms and Events groups, which, in conjunction with a Bay Networks action group, provides SuperRMON thresholds on any MIB object.
- Find Nodes and Show Nodes features for all 27 Distributed 5000 segments.
- BaySecure LAN Access for all 27 segments, including intrusion control, eavesdrop protection, and Allowed Nodes Plus security.

- Support for Bay Networks enhanced repeater MIB above that specified in RFC 1516 and RFC 1515, providing simultaneous statistics and address tracking for all segments.
- SNMP trap messages are issued by NMMs whenever a module is inserted or removed, or if any component fails.

Advanced Analyzer NMM The Distributed 5000 Advanced Analyzer™ NMM features all the capabilities of the Advanced NMM and includes a data collection module (DCM) configured with the Bay Networks Advanced Analyzer management agent. An existing Advanced NMM can be easily upgraded to Advanced Analyzer functionality by adding a DCM.

Advanced Analyzer management provides the industry's most powerful embedded agent technology, offering full support for standard RMON (RFC 1757 — all nine groups). Advanced Analyzer also supports Bay Networks exclusive SuperRMON technology, which provides highly sophisticated network troubleshooting and problem resolution capabilities such as port-to-network address mapping, which identifies the precise physical location where a problem occurred.

Advanced Analyzer management features include:

- Support for Advanced Analyzer agent MIB objects used by the Optivity Design & Analysis™ applications for UNIX, as well as by Optivity for Windows.
- Integrated probe-in-a-hub and hub management capabilities, providing SuperRMON port-oriented packet-level information.
- Nine RMON groups, including Packet Capture and Filter, are provided by each DCM.

Data Collection Module (DCM) Each DCM features a dedicated engine to process frames and compute multilayer RMON and SuperRMON statistics at burst rates of full Ethernet line speeds. Additionally, each DCM features 2 MB of shared RAM (upgradable to 32 MB) to store RMON and SuperRMON data, as well as to provide a path for commands and data retrieval by the NMM's SNMP engine. The DCM is designed for multilayer RMON, providing a built-in upgrade path to the emerging RMON II specification.

A single DCM can be selectively moved, via network management, to any of the three Distributed 5000 cascade segments, providing a roving RMON probe that delivers high-end network analysis on an as-needed basis. Conversely, both the Advanced and Advanced Analyzer NMMs are capable of holding up to three DCMs, enabling the modules to provide dedicated Advanced Analyzer management to all three cascade segments simultaneously.

Distributed 5000 Management
The Distributed 5000 is fully integrated with the latest release of the Optivity network management system, including the DOS-based Optivity Campus and the UNIX-based Optivity Enterprise. With Optivity, users can manage their Distributed 5000 network, as well as other switched and shared-media environments, from a single, central location, consolidating and simplifying overall enterprise management.

Optivity also helps users realize the full potential of the Distributed 5000's configuration switching capabilities through the unique LANarchitect™ tool. Through LANarchitect, network managers seated at the management console can assign individual ports to the various local or cascade segments supported by the Distributed 5000 stack. Users and devices can be flexibly deployed to logical workgroups, regardless of their physical location, improving network performance without changing the network's infrastructure or requiring repeated visits to the wiring closet.

Applications

The Distributed 5000 is optimized for two specific applications: high-density wiring closets and mid-sized network backbones.

1. *High-Density Wiring Closet Connectivity*
   The Distributed 5000 provides a flexible, cost-effective Ethernet connectivity solution for high-density wiring closets supporting from 12 to 288 nodes spread over anywhere from three to 27 segments. When connected to System 5000 hubs located in network centers, Distributed 5000 hubs extend System 5000-class features to the wiring closet in traditional structured network environments (see Figure 3). Working with a Model 28200 Modular Ethernet Switch, the Distributed 5000 also supports the creation of high-performance wiring closets featuring high-speed switching among multiple local segments (see Figure 4).
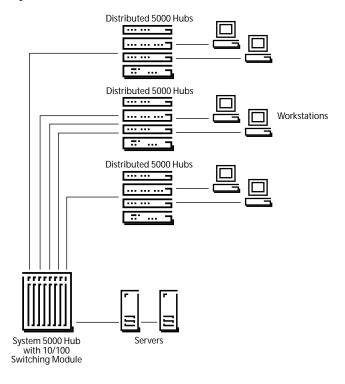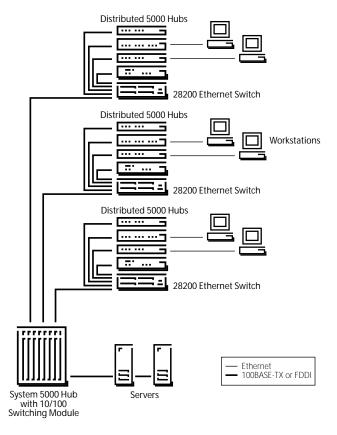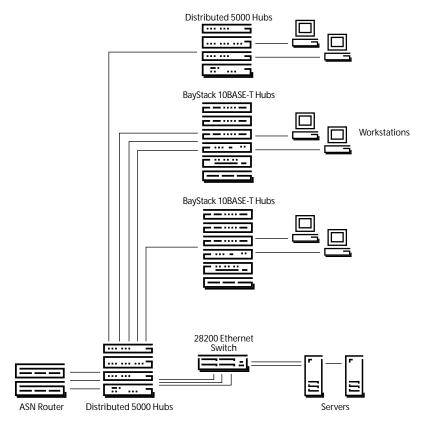
Figure 3 | **Wiring Closet Connectivity**

Distributed 5000 Hubs

Distributed 5000 Hubs

Workstations

Distributed 5000 Hubs

System 5000 Hub
with 10/100
Switching Module

Servers

Figure 4 | **Multisegment Wiring Closets**

Distributed 5000 Hubs

28200 Ethernet Switch

Distributed 5000 Hubs

Workstations

28200 Ethernet Switch

Distributed 5000 Hubs

28200 Ethernet Switch

System 5000 Hub
with 10/100
Switching Module

Servers

Ethernet
100BASE-TX or FDDI

Figure 5 | **Mid-Sized Network Backbones**

Figure 5 — Mid-Sized Network Backbones

2. *Mid-Sized Network Backbones*
The Distributed 5000 delivers System 5000-like features and performance in a smaller form factor and at a lower cost, making it a perfect solution for mid-sized network backbones supporting from 350 to 1,000 nodes. In the network center, where network backbones terminate, the Distributed 5000 provides multiple distributed network segments with direct access to centralized resources such as servers and routers. By centralizing critical resources, this architecture decreases administrative costs, improves network availability, and enhances fault isolation while simplifying management and maintenance through features such as configuration switching, hot-swap capabilities, and redundant power. When deployed with an ASN router and 28000 Series switches, the Distributed 5000 provides a highly reliable and manageable platform for creating mid-sized network backbones (see Figure 5).

Technical Specifications

The physical and electrical attributes of the Distributed 5000 hubs are listed in Table 1.

Table 1 | **Distributed 5000 Hub Technical Specifications**

Data Rate	10 Mbps Manchester encoded IEEE 802.3 CSMA/CD
Electrical Power	
Maximum Input Power	2-slot, 80 W
	3-slot, 160 W
Input Voltage	90-264 V ac at 50-60 Hz
VA Rating	2-slot, 140 VA
	3-slot, 360 VA
Packaging Type	
Rack-Mount	The 2-slot hub occupies 1.5 EIA rack-mount spaces.
	The 3-slot occupies 2.5 EIA rack-mount spaces.
Dimensions	
2-slot	(H) 17.25 in. (43.83 cm) x (W) 17.00 in. (43.13 cm) x (D) 2.46 in. (6.53 cm)
3-slot	(H) 17.25 in. (43.83 cm) x (W) 17.00 in. (43.13 cm) x (D) 4.33 in. (10.99 cm)
Environmental and Regulatory	
Altitude	0 – 8,000 ft (0 – 2400 m)
Humidity	20% – 80% (noncondensing)
Temperature	32° – 104°F (0° – 40°C)
Safety	UL , TUV, CSA
RFI/EMI	FCC Part 15, subparts A and B,
	Class A: EN 55 022 (CISPR 22:1985),
	Class B: VDE 0871, Class B
	VCCI Class 1 ITE

Standards Support

Distributed 5000 hubs support the major industry standards described in Table 2.

Table 2 | **Distributed 5000 IEEE Standards Support**

IEEE 802.3, ISO 8802/3
IEEE 802.3 10BASE-T Signaling
IEEE 10BASE-FL Signaling
IEEE Layer Management for 10 Mbps repeater, clause 19
IEEE Layer Management for 10 Mbps Medium Attachment Units (MAUs; clause 20)
RFC 768 User Datagram Protocol (UDP)
RFC 783 Trivial File Transfer Protocol (TFTP revision 2)
RFC 791 Internet Protocol (IP)
RFC 792 Internet Control Message Protocol (ICMP)
RFC 826 Ethernet Address Resolution Protocol (ARP)
RFC 951 Bootstrap Protocol (BootP)
RFC 1155 Structure and Identification or Management Information for TCP/IP-Based Internets
RFC 1157 Simple Network Management Protocol (SNMP)
RFC 1212 Concise MIB Definitions
RFC 1213 Management Information Base for Network Management of TCP/IP-Based Internets: - System Group - Interfaces Group - Address Translation Group - IP Group - ICMP Group - UDP Group - SNMP Group
RFC 1215 Convention for Defining Traps for Use with the SNMP
RFC 1256 ICMP Router Discovery Messages
RFC 1757 Remote Network Monitoring Management Information Base (RMON): - Statistics Group - History Group - Alarm Group - Host Group - HostTopN Group - Matrix Group - Filter Group - Packet Capture Group - Event Group

Ordering Information

Ordering information for the Distributed 5000 hub family appears in Table 3.

Table 3 | **Distributed 5000 Hubs Ordering Information**

Order Number	Description
Distributed 5000 Hubs	
5DN003	Distributed 5000 3-slot hub (110/220 V)
5DN002	Distributed 5000 2-slot hub (110/220 V)
Host Modules	
5DN308P	Model 5DN308P 10BASE-T host module
AQ1004004	Model 5DN308PS 10BASE-T host module with BaySecure LAN Access
5DN304P	Model 5DN304P 3-port 10BASE-FL host module
AQ1004002	Model 5DN301P 4-port 10BASE2 host module
5DN378P-F	Model 5DN378P-F Mixed-media host module with 10BASE-FL
AQ1004003	Model 5DN378P-SM Mixed-media host module with single-mode fiber
AQ1004001	Model 5DN 378P-A UTP/AUI Mixed-media host module
5DN307P	Model 5DN307P 10BASE-T Telco host module
AQ1004005	Model 5DN307PS 10BASE-T Telco host module with BaySecure LAN Access
Network Management Modules	
AQ1007001	Model 5DN310SA Advanced Analyzer Network Management Module
5DN310	Model 5DN310 Advanced Network Management Module (NMM)
N11	Model N11 Data Collection Module (DCM)
Redundant Power Supply	
RPSU	Redundant Power Supply Unit (RPSU)

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United States

Bay Networks, Inc.
4401 Great America Parkway
Santa Clara, CA 95054
Phone: 1-800-8-BAYNET

Bay Networks, Inc.
8 Federal Street
Billerica, MA 01821-5501
Phone: 1-800-8-BAYNET

Europe, Middle East, and Africa

Bay Networks EMEA, S.A.
Les Cyclades — Immeuble Naxos
25 Allée Pierre Ziller
06560 Valbonne, France
Fax: +33-92-966-996
Phone: +33-92-966-966

Intercontinental

Bay Networks, Inc.
8 Federal Street
Billerica, MA 01821-5501
Fax: 508-670-9323
Phone: 1-800-8-BAYNET

World Wide Web: **http://www.baynetworks.com**