product information

Ascend

GRF Product Family

Conventional routers no longer can meet the dynamic demands of the Internet. The GRF, with its unsurpassed packet forwarding rate, sets the standard for high-performance networking.

Carriers ▾ Internet Service Providers ▾ On-line Service Providers
Points of Presence ▾ Backbone Networking

The GRF™ family of high-performance IP switches lets carriers and Internet Service Providers cost-effectively provide network access and backbone services. The GRF's unique architecture combines its Layer-3 switch with intelligent IP Forwarding Media Cards to deliver scalable performance up to 10 million packets per second. The GRF products are equipped to handle the high-bandwidth requirements of demanding networking environments. The GRF 400 supports up to four media cards for up to 4 Gb/s bandwidth while the GRF 1600 supports up to 16 media cards for up to 16 Gb/s of bandwidth.

The GRF easily integrates into existing networks using industry-standard media types such as HSSI, 10/100Base-T, ATM OC-3c, IP SONET OC-3c with Frame Relay and PPP framing, OC-12c, FDDI and CDDI. Network designers can place the GRF into their backbone network, NAP or MegaPOP™ to consolidate equipment, increase port density and reduce the cost of ownership. With the scalable GRF, users have everything needed to grow their network into the next generation of high-performance networking.

ASCEND

Networking Solutions For Carriers, ISPs and On-Line Service Providers

Conventional routers were designed for simple, stable network environments. All packets must wait for access to the router's bus before they can be forwarded to the next network "hop." If the next hop is not in the route-table cache, the packet must wait further in a buffer until the next hop is located by performing a software "lookup" of the entire route table. If the route table is large, the delay can be substantial. Bus contention and route table caching lead to poor performance and lost packets when conventional routers are placed in large, dynamic networks such as the Internet.

The GRF consistently delivers high performance, regardless of the size of the route table or degree of route flapping. The GRF 400 features a 4 Gb/s non-blocking cross-point switch capable of processing 2.8 million packets per second. Whereas the GRF 1600 includes a 16 Gb/s non-blocking cross-point switch that processes up to 10 million packets per second.

IP Forwarding Media Cards perform Layer-3 packet forwarding in the GRF's distributed architecture. Each card has a 1 Gb/s bandwidth connection to the switch that is dedicated on a per card basis. As a high-performance media card is added, so is its full forwarding performance capacity, resulting in linear scalable performance.

The GRF supports a route table of up to 150,000 routes. This is large enough to accommodate the predicted Internet address space growth. Hardware-assisted, full route table lookups significantly improve performance over cache-based architectures. These features enable the GRF to perform Layer-3 decisions at switching speeds, with no degradation in performance even in complex dynamic routing environments.

GRF Applications

NAP

A Network Access Point (NAP) requires a robust solution so that service providers can interconnect and efficiently exchange traffic without delays or dropped packets. The GRF is ideal for colocation with other network devices in a NAP. It supports a large suite of routing protocols including RIP1, RIP2, BGP4, OSPF and IS-IS. The GRF also supports up to 64 logical peering sessions without decreasing packet-forwarding rates.

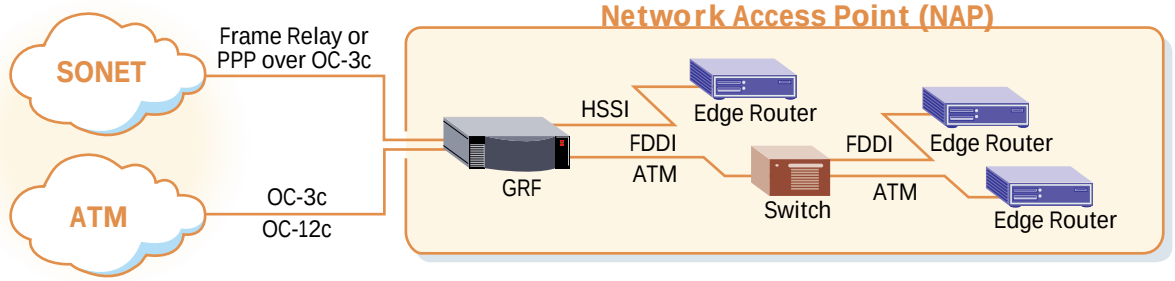
Peering sessions can be implemented over HSSI/DS3, OC-3c (PPP over SONET or ATM), Fast Ethernet, FDDI and HIPPI media. The GRF is compatible with current NAP environments and easily fits into existing topologies. It accepts a variety of media types, supports industry-standard protocols and requires no additional hardware or software. The GRF offers simpler and more cost-effective network design options for meeting the future needs of an expanding network.

Backbone

The GRF is well-suited for providing backbone services over high-speed media because of its high-aggregate packet-forwarding rates and support for multiple media types. The GRF complements or replaces existing Frame Relay switches. Network designers can use the GRF to build new high-speed backbones that are well-positioned for the future.

The GRF's high-aggregate bandwidth provides a single solution for interconnecting specialized Autonomous Systems (AS) such as Virtual Private Networks (VPNs), Virtual Access Networks (VANs) and private backbones. By consolidating functionality into one system, network architects can better manage transit traffic and simplify network design.

NAP—New Options with the GRF



The GRF is the ideal solution for growing a NAP environment. It fits easily into existing topologies and offers cost-effective design options for expanding the network. Support for new media types such as OC-12c, Frame Relay or PPP over SONET OC-3c provides new options for NAP designs.

MegaPOP

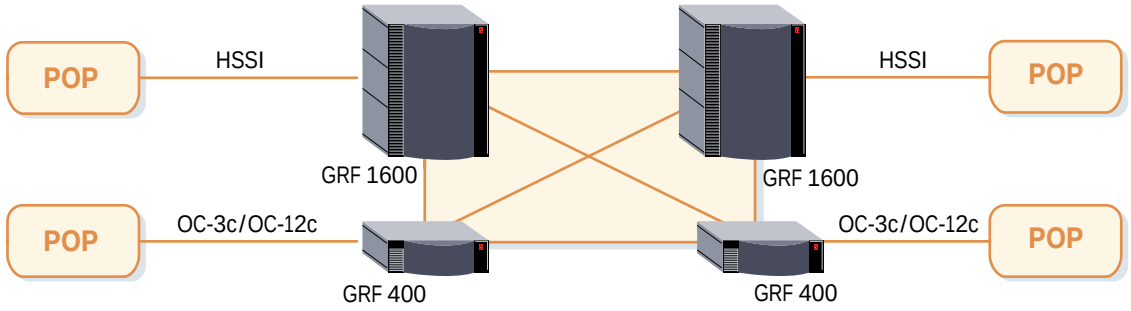
Combined with the MAX TNT™, the GRF gives ISPs and carriers unprecedented packet aggregation services. This powerful solution supports hundreds of thousands of users in under eight feet of rack space.

A single GRF easily handles the high-volume traffic delivered from a fully-configured MAX TNT. This combination is simpler and more cost-effective than designing a POP environment that uses multiple switches and routers. A MegaPOP™ solution includes a GRF and a MAX TNT, dramatically reducing rack space requirements and driving down costs to the lowest price per port available.

Additional applications

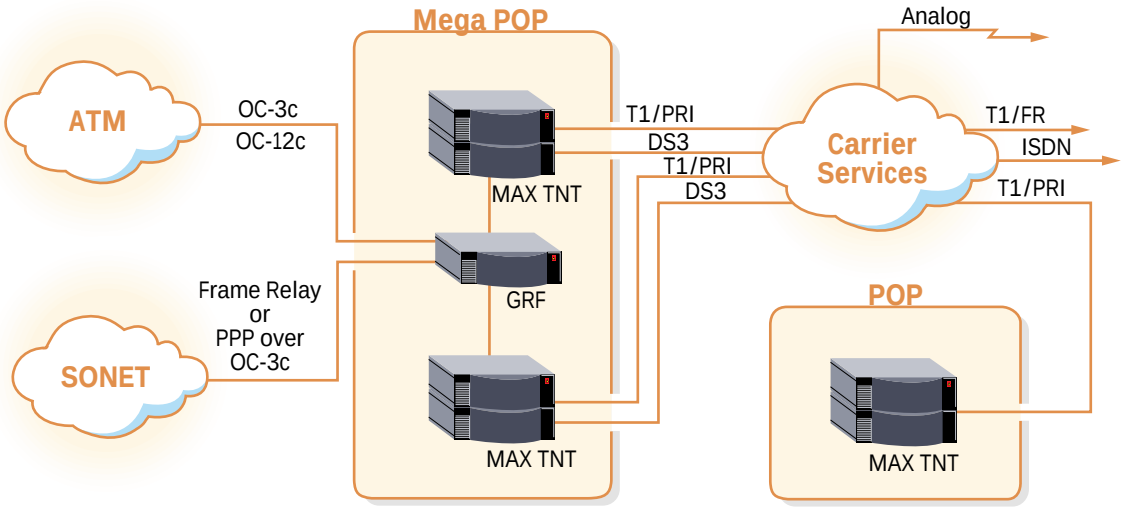
The GRF can be colocated with content servers on high-speed lines while maintaining access to the backbone and providing aggregation services. It easily fits into an ISP's current network topology with support for high-speed media such as OC-3c, OC-12c and even HIPPI using standard routing protocols.

GRF in the Backbone—Unsurpassed Aggregate Performance



The GRF allows ISPs and carriers to offer access to backbone services over a variety of media types such as OC-3c/OC-12c, ATM, PPP or Frame Relay. The GRF offers high-aggregate bandwidth for interconnecting both public and private backbones.

MegaPOP



When combined with the MAX TNT, the GRF allows ISPs and carriers to offer high-aggregate service to their users. With this combination, they can support an entire city in under eight feet of rack space.

Specially Designed for the Growing Internet

Layer-3 switching increases performance and maximizes network capacity

The GRF has an advanced IP switching technology that delivers a low-latency, high-bandwidth path for Layer-3 packet forwarding up to 10 million packets per second. The GRF forwards IP packets at full line speeds while simultaneously maintaining a route table of 150,000 routes.

- Scalable IP Forwarding Media Cards:
  - Built-in intelligence for Layer-3 decisions
  - Each port has 1 Gb/s dedicated bandwidth per card
- Either a 4 Gb/s (GRF 400) or 16 Gb/s (GRF 1600) non-blocking crosspoint switch
- IP packets forwarded as packets (not cells)
- Does not require additional proprietary software
- Uses existing network nodes without modifications

Consolidation drives down the cost of ownership

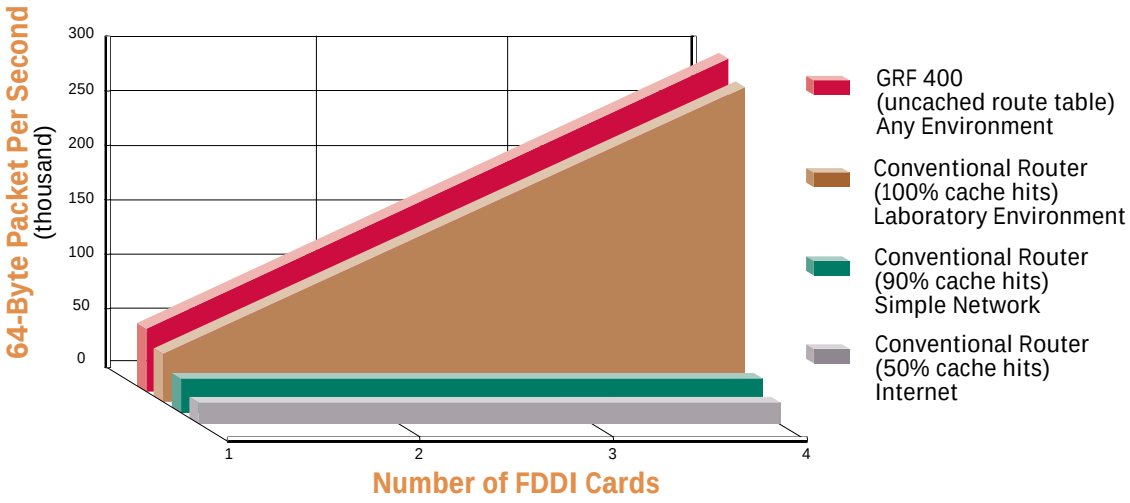
The chassis on the GRF is specially sized for the space constraints that typify the POP or backbone networking environment. It can hold up to four (GRF 400) or 16 (GRF 1600) IP Forwarding Media Cards providing support for multiple, high-speed media types in a single solution. Carriers and service providers can use a fully-loaded GRF to its fullest capacity without experiencing any degradation in performance. By consolidating equipment into a single system, the GRF alleviates equipment room build-out and drives down cost to the lowest price per port available.

- GRF 400 holds up to four IP Forwarding Media cards
- GRF 1600 holds up to 16 IP Forwarding Media cards
- If fully configured with any single media type:
  - The GRF 400 supports: 8 HSSI ports, 32 Ethernet, 8 ATM OC-3c, 4 IP/SONET OC-3c, 16 FDDI, 16 CDDI, 4 OC-12c
  - The GRF 1600 supports: 32 HSSI, 128 Ethernet, 32 OC-3c, 16 IP/SONET OC-3c, 64 FDDI, 64 CDDI, 16 OC-12c
- Added cards contribute their full port and forwarding capacity
- 3U rack-mount chassis fits into the restricted space at the POP

Full suite of routing protocols ensures interoperability

The GRF includes a robust suite of routing protocols providing the flexibility and interoperability required for complex network topologies. Support for industry-standard routing protocols lets carriers and service providers offer access to a broad range of backbone network services.

The GRF 400 Delivers Scalable Performance



Conventional router performance degrades rapidly when placed in networks that route traffic to a large number of IP addresses. In these networks, routers using caches treat most IP addresses as new addresses, forcing them to perform a software-based, full route table lookup. Even with 50 percent cache hits, a conventional router's aggregate packet-per-second performance plummets to less than 4 percent of a fully-configured GRF 400.

- Supports multicast
- BGP4 protocol support includes:
  - Route reflections
  - MEDs
  - Communities
  - DPAs
  - Flat route dampening
  - Weighted route dampening
  - Confederations
  - NextHop-Self
  - Static routing as an IGP
- OSPF, IS-IS, RIP v1/v2, EGP

Standards-based architecture provides migration path to new technologies

The GRF easily fits into an existing network environment, protecting the current investment in hardware and software. As the network grows, the media-neutral GRF allows carriers and service providers to migrate to the latest network technologies simply by adding a card. With GRF, users are not limited to just ATM. The GRF supports the following media types:

- HSSI
- 10/100Base-T
- ATM OC-3c/STM-3
- IP/SONET OC-3c with Frame Relay and PPP framing
- FDDI
- CDDI
- HIPPI
- ATM OC-12c/STM-12 (1 port per card)
- Frame Relay switching (over NNI and UNI with bandwidth enforcement)

Reliable hardware and software design assures system availability

Because downtime is not an option for your network, the GRF is designed for continuous operation. The GRF offers a full range of features that enable network administrators to upgrade and maintain the system without interrupting user operations.

- Redundant, load-balancing power supplies
- Hot-swappable power supplies
- Redundant, load-balancing fans (GRF 1600)
- Hot-swappable fan drawer (GRF 1600)
- Hot-swappable IP Forwarding Media Cards can be removed or added while the system is on-line
- Remote access and reboot

Industry-standard features fit easily into current management strategy

Support for industry-standard features allows administrators to monitor the network with their existing management tools. The GRF supports standard and proprietary MIBs for puts, gets and traps. It works with standard SNMP management packages such as HP OpenView and SunNet Manager.

- Accessible from SNMP management packages
- Command-line configuration tools
- Administrative authentication using RADIUS
- Administrative authentication using Secure ID

GRF Product Family

Distributed Functions Provide Superior System Performance and Packet Throughput

The GRF 400 includes an IP Switch Control Board and supports up to four IP Forwarding Media Cards. The GRF 1600 includes an IP Switch Board as well as a Control Board and supports up to 16 IP Forwarding Media Cards.

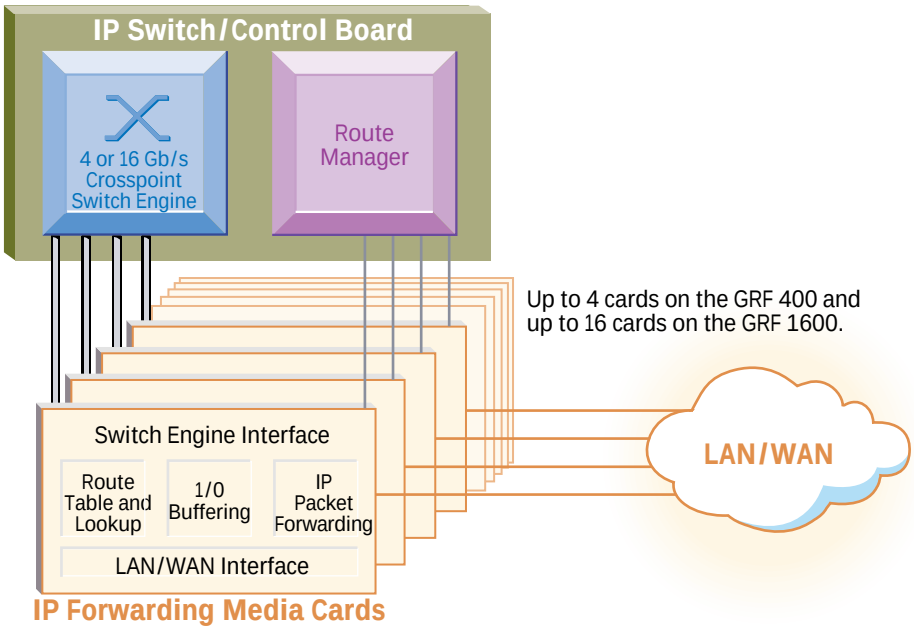
The IP Forwarding Media cards contain an intelligent IP packet forwarding engine including an on-board full route table, CPUs and memory. Each card contains 8 MB of buffering—4 MB for transmit and 4 MB for receive. The buffers permit forwarding between media cards that have different speeds.

Several high-speed processors run embedded software to perform dedicated tasks including buffer management and Layer-3 forwarding. Each card has separate memory that contains a full route table of up to 150,000 routes. The card can perform a hardware lookup of the route table to locate the next "hop." This lookup is performed in less than 2.5 microseconds even when the route table contains as many as 150,000 routes. For most networks, the next hop is found in less than 1 microsecond. This is 100 times faster than software-driven route table lookups.

On the GRF 400, the IP Switch Control Board provides dynamic route management processing and houses a 4 Gb/s crosspoint switch. On the GRF 1600, the Control Board provides dynamic route management processing and the IP Switch Board houses a 16 Gb/s crosspoint switch. The high-speed, non-blocking nature of the crosspoint switch fabric permits multiple data paths to operate simultaneously.

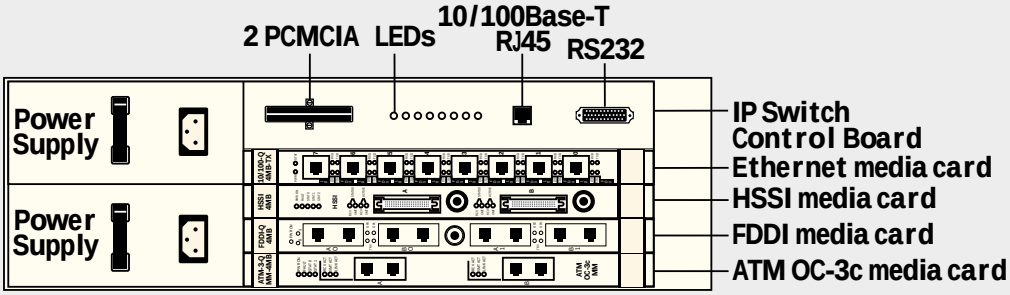
The Route Manager runs a full suite of routing protocols using Ascend's embedded operating system. A 166 MHz Pentium processor performs dynamic routing, allowing the media cards to forward packets without interruption.

GRF Switch Architecture

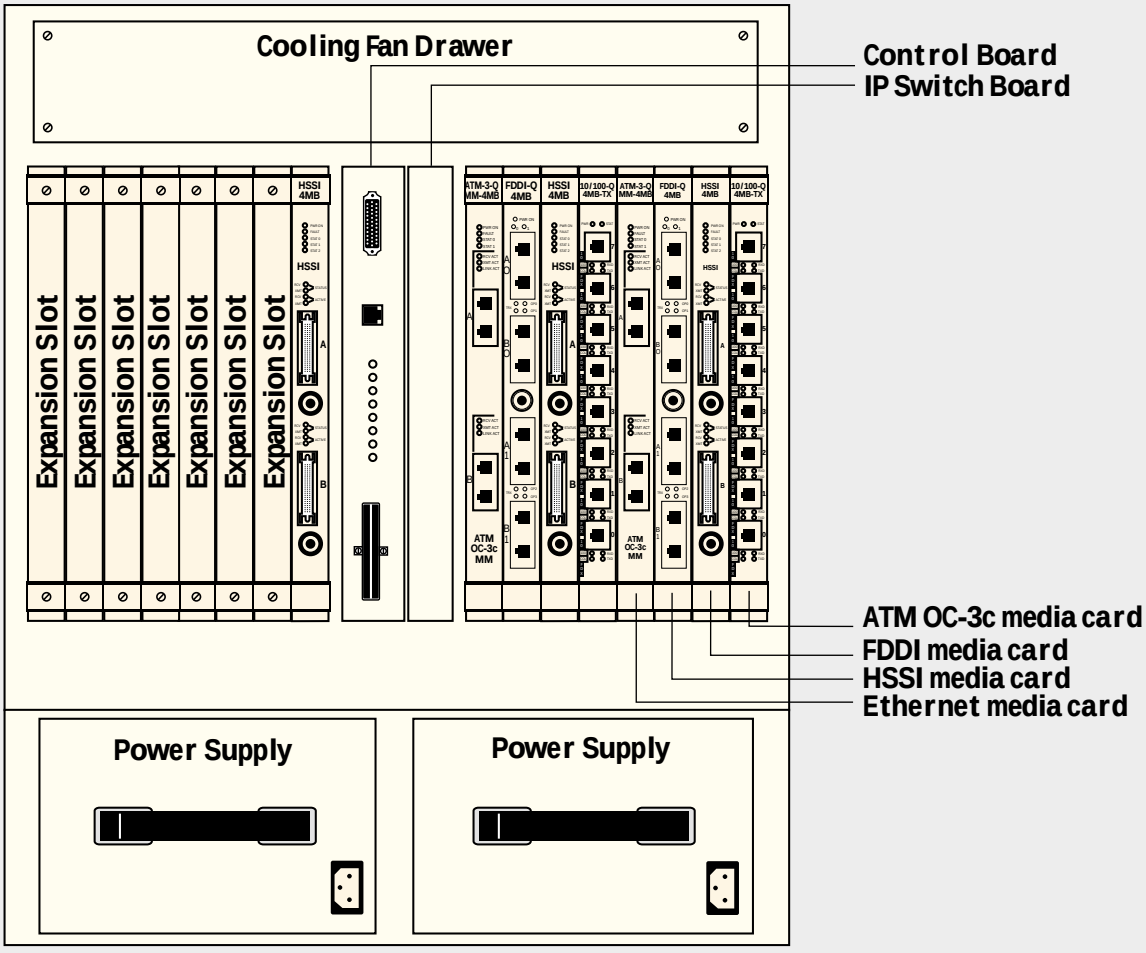


The GRF is the only product that combines high-speed switching, route management and distributed IP forwarding.

GRF 400 Back Panel



GRF 1600 Back Panel



Software Features

Routing Protocols

EGP, OSPF, BGP 3/4, RIP v1 and v2
BGP4 Mods Route Reflection, MEDs, Communities, DPAs, Flat Route Dampening, Weighted Route, Dampening, Confederations, NextHop-Self
Static Routing as an IGP
OSPF Multicast
IP Multicast (DVMRP)
Integrated IS-IS

Other Features

Filtering Packet header logging
Inbound IP packet filtering
Outbound IP packet filtering
Into-me packet filtering
SNMP v1
RADIUS Administrative authentication
Secure ID Administrative authentication

Hardware Specifications

System Chassis

IP Forwarding Media Cards: GRF 400: 1-4 per chassis, GRF 1600: 1-16 per chassis multiple media types supported simultaneously
PCMCIA Slots: 2
Serial Adapters: 1
10/100Base-T: 1 autosensing
Dimensions: GRF 400: 5.25 in x 19 in x 19 in [13.34 cm 48.26 x cm 48.26 x cm]
GRF 1600: 21 in x 19 in x 19 in [48.26 cm x 48.26 cm x 48.26 cm]
Weight: GRF 400: 26.5 lbs [11.93 kg]
GRF 1600: 100 lbs [45 kg]
AC Voltage: 85 to 264 VAC, 60/50 Hz. 10 A maximum
Wall Receptacle: Standard US 3-prong plug, 115 V grounded receptacle, international options available

Power

Consumption: GRF 400: 500 W
GRF 1600: 1200 W
Altitude: 0-10,000 feet [0-3048 meters]
Relative Humidity: 10%-90% (non-condensing)
Temperature: 32-104°F [0-40°C]

IP Switch/Control Board

Processor: Intel Pentium 166 MHz
Processor
L2 Cache: 512 KB Fast SRAM
DRAM: 64 MB 256 MB SECDED memory (8 SIMM sockets for 32 MB SIMMS)
FLASH Memory: 85 MB
Switch: 16 Gb/s Triquent TQ8017
Software: Ascend embedded OS

Supported Standards (Chassis and IP Switch Control Board)

Internet

RFC 768 User Datagram Protocol
RFC 791 Internet Protocol
RFC 792 Internet Control Message Protocol
RFC 793 Transmission Control Protocol
RFC 854 Telnet Protocol Specification
RFC 855 Telnet Option Specifications
RFC 857 Telnet Echo Option
RFC 858 Telnet Suppress Go Ahead Option
RFC 860 Telnet Timing Mark Option
RFC 862 Echo Protocol
RFC 863 Discard Protocol
RFC 864 Character Generator Protocol
RFC 867 Daytime Protocol
RFC 868 Time Protocol
RFC 894 Standard for the Transmission of IP Datagrams Over Ethernet Networks
RFC 959 File Transfer Protocol
RFC 1034 Domain Names-Concepts and Facilities
RFC 1035 Domain Names - Implementation and Specification
RFC 1058 Routing Information Protocol
RFC 1073 Telnet Window Size Option
RFC 1079 Telnet Terminal Speed Option
RFC 1112 Host Extensions for IP Multicasting
RFC 1155 Structure and Identification of Management Information for TCP/IP-based Internets
RFC 1157 A Simple Network Management Protocol (SNMP)
RFC 1184 Telnet Linemode Option
RFC 1191 Path MTU Discovery
RFC 1212 Concise MIB Definitions
RFC 1213 Management Information Base for Network Management of TCP/IP based Internets: MIB-II
RFC 1215 A Convention for Defining Traps for Use with the SNMP
RFC 1227 SNMP MUX Protocol and MIB
RFC 1267 A Border Gateway Protocol 3 (BGP-3)
RFC 1305 Network Time Protocol (v3)
RFC 1350 The TFTP Protocol (Revision 2)
RFC 1397 Default Route Advertisement in BGP2 and BGP3 Versions of the Border Gateway Protocol
RFC 1403 BGP OSPF Interaction
RFC 1471 The Definitions of Managed Objects for the Link Control Protocol of the Point-to-Point Protocol
RFC 1473 The Definitions of Managed Objects for the IP Network Control Protocol of the Point-to-Point Protocol
RFC 1512 FDDI Management Information Base
RFC 1583 OSPF Version 2
RFC 1643 Definitions of Managed Objects for the Ethernet-like Interface Types
RFC 1722 RIP Version 2 Protocol Applicability Statement
RFC 1723 RIP Version 2 Carrying Additional Information
RFC 1771 A Border Gateway Protocol 4 (BGP-4)
RFC 1901 Introduction to Community-Based SNMP v2
RFC 1902 Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMP v2)
RFC 1903 Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMP v2)
RFC 1904 Conformance Statements for Version 2 of the Simple Network Management Protocol (SNMP v2)
RFC 1905 Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMP v2)
RFC 1906 Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMP v2)
RFC 1907 Management Information Base for Version 2 of the Simple Network Management Protocol (SNMP v2)

Note: See individual media card specification sheets for media-specific RFCs.

Planned* Agency Certification

Safety

UL-ANSI/UL 1950*
CU -CAN/CSA-C22.2 No. 950*
TUV-GS-EN 60950*
VCCI Class 1 (industrial environments)*

Emissions

FCC Class A (commercial or industrial environments)*
Canadian DOC, Radio Interference Regulation, Class A*
CE Mark: EN 55022 (Class A emissions), EN50082-2 (heavy industry immunity)*

Telco

NEBS in process*

*Completion planned for product release.

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Ascend Communications, Inc. is a leading, worldwide provider of remote networking solutions for corporate central sites, Internet Service Providers' points of presence, remote offices, mobile workers, and telecommuters. Ascend develops, manufactures, markets, sells and supports products which utilize bandwidth on demand to extend existing corporate networks for applications such as remote LAN access, Internet access, telecommuting, SOHO connectivity and videoconferencing/multimedia access.

Ascend markets the GRF, MAX, Multiband, Pipeline, Netwarp and Security families of products. Ascend products are available in more than 30 countries worldwide.

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Remote Networking
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