

# x320 Series

## Gigabit Layer 3 PoE++/PoE Pass-through Switches



### Overview

The Allied Telesis x320 Series of Gigabit Layer 3 PoE++/PoE pass-through switches offer an impressive set of features in a compact design. Flexible Power over Ethernet capabilities make them ideal for IoT device connectivity in smart buildings and business environments.

The x320-10GH can provide up to 90 Watts of PoE power on all ports, while the x320-11GPT can be powered by PoE<sup>1</sup>, and also pass PoE power through to connected end points. Each switch offers 8 x 10M/100M/1 Gigabit ports and flexible Gigabit uplinks.

### Flexible PoE

The x320 Series support today's commonly used PoE standards, providing 15.4 Watts of PoE (802.3af), and 30 Watts of PoE+ (802.3at). In addition, the x320-10GH also supports providing 60 or 90 Watts of PoE++ (802.3bt).

### Continuous PoE

Continuous PoE allows the x320 Series switches to be restarted without affecting the supply of power to connected devices. Smart lighting, security cameras, and other PoE devices will continue to operate during a software upgrade on the switch.

### Network Management

Vista Manager™ EX bundled with Allied Telesis Autonomous Management Framework™ Plus (AMF Plus)) meets the increasing management requirements of modern networks. While AMF Plus allows an entire network to be securely and easily managed as a single virtual device, Vista Manager EX provides an intuitive and powerful graphical tool for monitoring and managing AMF Plus wired, Autonomous Wave Control (AWC) wireless, and third party (SNMP) devices.

### Cybersecurity

The x320 series acting as an AMF Plus member is compatible with our AMF-Security solution, which enables a self-defending network. The AMF-Sec controller responds immediately to any internal malware threats by instructing the x320 to isolate the affected part of the network, and quarantine the suspect device. Vista Manager EX alerts networks administrators of threats that have been dealt with.

### Network resiliency

Allied Telesis Ethernet Protection Switched Ring (EPSRing™), and the standards-based G.8032 Ethernet Ring Protection, ensure that distributed network segments have high-speed, resilient access to online resources and applications.

### Secure

A secure network environment is guaranteed. The x320 Series offers powerful control over network traffic types, secure management options, loop guard to protect against cabling mistakes, and tri-authentication for comprehensive access control.

Security from malicious network attacks is provided by a comprehensive range of features such as DHCP snooping, STP root guard, BPDU protection, and access control lists. Each of these can be configured to perform a variety of actions upon detection of a suspected attack or a malfunction.

### Environmentally friendly

The x320 Series supports Energy Efficient Ethernet (EEE), automatically reducing the power consumed by the switch whenever there is no traffic on a port. This

### Key Features

- AlliedWare Plus Enterprise-class operating system
- Allied Telesis Autonomous Management Framework™ Plus (AMF Plus)
- Vista Manager EX compatible
- AMF-Security compatible
- Full 30 Watts of PoE+
- Up to 90 Watts of PoE++ (x320-10GH only)
- PoE pass-through (x320-11GPT only)
- Continuous PoE
- EPSRing™ and G.8032 for resilient rings
- EPSR Master
- Energy Efficient Ethernet saves power
- Active Fiber Monitoring
- Enhanced Transmission Selection (ETS)
- Static and dynamic routing
- Fanless design for silent operation
- Flexible deployment
- Wide operating temperature range
- Multicast Source Discovery Protocol (MSDP)
- Link Monitoring
- Upstream Forwarding Only (UFO)
- NETCONF/RESTCONF with YANG data modelling
- IPFIX (IP Flow Information Export)

sophisticated feature can significantly reduce operating costs by reducing the power requirements of the switch and any associated cooling equipment.

The x320 models are fan-less, providing silent operation, which makes them ideal for desktop or work area deployment.

<sup>1</sup> The x320-11GPT uses PD port 11 to receive PoE power, but cannot be powered by PoE if the AC adapter is connected

# KEY FEATURES

## Autonomous Management Framework™ Plus (AMF Plus)

AMF Plus is a sophisticated suite of management tools that provide a simplified approach to network management. Common tasks are automated or made so simple that the every-day running of a network can be achieved without the need for highly-trained, and expensive, network engineers. Powerful features like centralized management, auto-backup, auto-upgrade, auto-provisioning and auto-recovery enable plug-and-play networking and zero-touch management.

AMF Plus secure mode encrypts all AMF traffic, provides unit and user authorization, and monitors network access to greatly enhance network security.

From AW+ 5.5.2-2 onwards, an AMF Plus license operating in the network provides all standard AMF network management and automation features, and also enables the AMF Plus intent-based networking features in Vista Manager EX (from version 3.10.1 onwards).

## Power over Ethernet (PoE+, PoE++, and PoE pass-through)

The x320-10GH supports providing up to 90 Watts (PoE++) on all ports. This enables powering high power devices such as high resolution PTZ cameras with heater/blowers for outdoor applications, enhanced infrared lighting and lighting controllers, remote Point of Sale (POS) kiosks, and more.

The x320-11GPT can supply up to 30 Watts (PoE+) to connected devices. It can be powered by an AC power adapter, or by PoE. When deployed together, the x320-11GPT can be powered by the x320-10GH, while PoE pass-through enables power from the x320-10GH to pass through the x320-11GPT to power connected end points.

## PWR300 (External Power Supply)

This PWR300 is the external Power Supply Unit (PSU) for x320-10GH. One PWR300 will power the switch and provide PoE power. Up to three PWR300 PSUs can be used to increase the available PoE power, and enable power supply redundancy.

## Flexible deployment

The x320 Series can operate from -10 to +55 degrees Celsius, and with a fanless design, and using the PoE passthrough feature, are ideally suited for flexible deployment in the ceiling of smart buildings and any other areas of the business premises.

## Continuous PoE

Continuous PoE allows the switch to be restarted without affecting the supply of power to connected devices. Smart lighting, security cameras, and other PoE devices will continue to operate during a software upgrade on the switch.

## Ethernet Protection Switched Ring (EPSRing™)

EPSRing allows several x320 switches to form a high-speed protected ring, capable of recovery within as little as 50ms. This feature is perfect for high performance and high availability in enterprise networks. x320 Series switches can act as the EPSR Master.

Super-Loop Protection (SLP) enables a link between two EPSR nodes to be in separate EPSR domains, improving redundancy and network fault resiliency.

## G.8032 Ethernet Ring Protection

G.8032 provides standards-based high-speed ring protection, that can be deployed stand-alone, or interoperate with Allied Telesis EPSR.

Ethernet Connectivity Fault Monitoring (CFM) proactively monitors links and VLANs, and provides alerts when a fault is detected.

## NETCONF/RESTCONF

NETCONF/RESTCONF with YANG data modeling provides a standardized way to represent data and securely configure devices.

## Industry-leading Quality of Service (QoS)

Comprehensive low-latency wire speed QoS provides flow-based traffic management with full classification, prioritization, traffic shaping and min/max bandwidth profiles. Boosted network performance and guaranteed delivery of business-critical Ethernet services and applications are provided. Time-critical services such as voice and video take precedence over non-essential services such as file downloads, maintaining responsiveness of Enterprise applications

## Voice VLAN

Voice VLAN automatically separates voice and data traffic into two different VLANs. This places delay-sensitive traffic into a voice-dedicated VLAN, which simplifies QoS configurations.

## Open Shortest Path First (OSPFv2, OSPFv3)

OSPF is a scalable and adaptive routing protocol for IP networks. The addition of OSPFv3 provides support for IPv6 and further strength for next generation networking.

## IPFIX (IP Flow Information Export)

IPFIX enables exporting IP flow data in a network for analysis. This provides network administrators with information for accounting, billing, capacity planning, and performance optimization.

## sFlow

sFlow monitors switched networks, and provides visibility to enable performance optimization, usage accounting/billing, and defense against security threats. Sampled packets sent to a collector provide a real-time view of network traffic.

## Active Fiber Monitoring (AFM)

Active Fiber Monitoring prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent. Active Fiber Monitoring is supported on fiber data and fiber stacking links.

## Tri-authentication

Authentication options on the x320 Series also include alternatives to IEEE 802.1x port-based authentication, such as web authentication to enable guest access and MAC authentication for endpoints that do not have an IEEE 802.1x supplicant. All three authentication methods—IEEE 802.1x, MAC-based and Web-based—can be enabled simultaneously on the same port for tri-authentication.

## TACACS+ Command Authorization

TACACS+ Command Authorization offers centralized control over which commands may be issued by each specific AlliedWare Plus device user. It complements authentication and accounting services for a complete AAA solution.

## Premium Software License

The x320 Series feature set can be elevated by applying the premium software license, which adds dynamic routing protocols and Layer 3 multicasting capabilities.

## VLAN Access Control List (ACLs)

ACLs simplify access and traffic control across entire segments of the network. They can be applied to a VLAN as well as a specific port.

## Loop Protection

Thrash limiting, also known as rapid MAC movement, detects and resolves network loops. It is highly user-configurable—from the rate of looping traffic to the type of action the switch should take when it detects a loop.

With thrash limiting, the switch only detects a loop when a storm has occurred, which can potentially cause disruption to the network. To avoid this, loop detection works in conjunction with thrash limiting to send special Loop Detection Frame (LDF) packets that the switch listens for. If a port receives an LDF packet, you can choose to disable the port, disable the link, or send an SNMP trap. This feature can help to detect loops before a network storm occurs, avoiding the risk and inconvenience of traffic disruption.

## Multicast Source Discovery Protocol (MSDP)

MSDP enables two or more PIM-SM (Sparse Mode) domains to share information on active multicast sources, for more efficient forwarding of multicast traffic.

## Link Monitoring (Linkmon)

Linkmon enables network health monitoring by regularly sending probes over key links to gather metrics comprising latency, jitter, and probe loss. This supports pro-active network management, and can also be used with triggers to automate a change to device or network configuration in response to the declining health of a monitored link.

## VLAN Mirroring (RSPAN)

VLAN mirroring allows traffic from a port on a remote switch to be analyzed locally. Traffic being transmitted or received on the port is duplicated and sent across the network on a special VLAN.

## Upstream Forwarding Only (UFO)

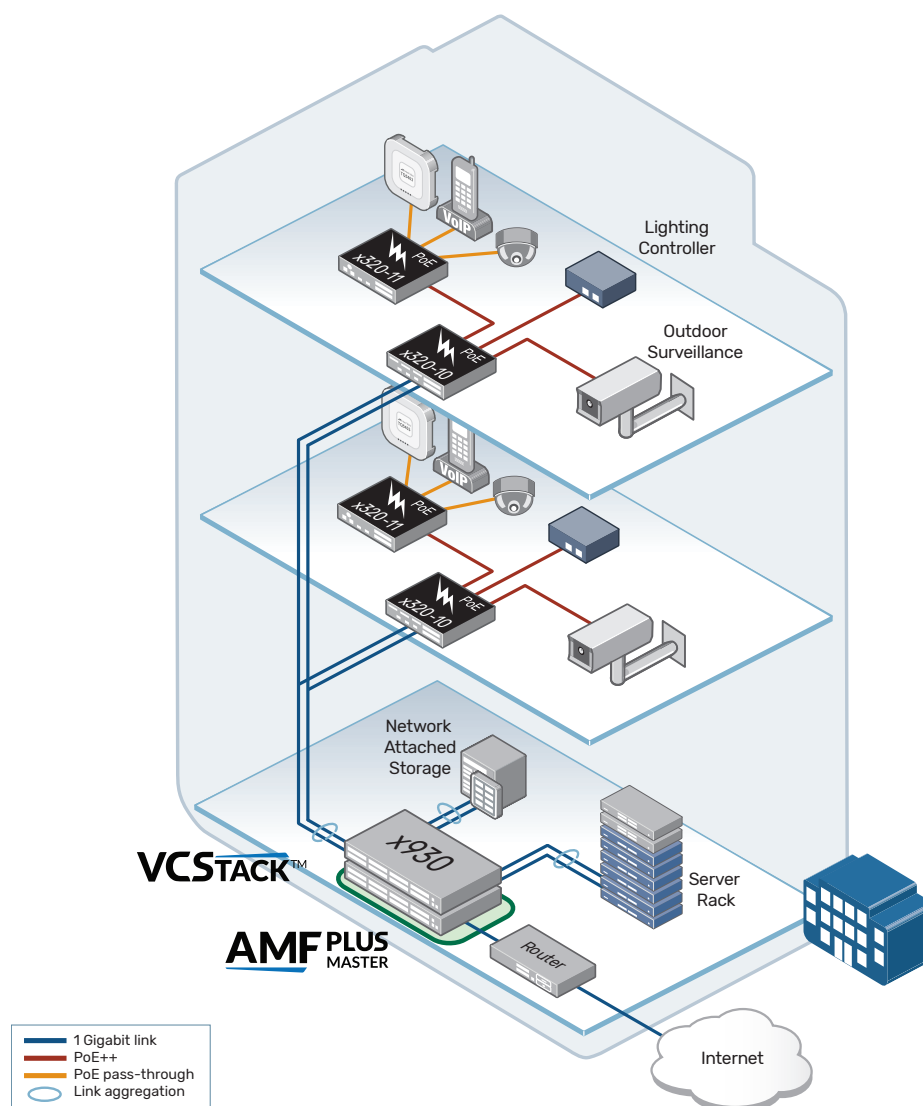
UFO lets you manage which ports in a VLAN can communicate with each other, and which only have upstream access to services, for secure multi-user deployment.

## Quality of Service

Enhanced Transmission Selection (ETS) provides quality of service by allocating bandwidth to important traffic classes, with the flexibility to share remaining bandwidth to maximize traffic throughput and performance.

## KEY SOLUTIONS

# Enable Today's Smart Buildings with Flexible PoE



More than ever, PoE powered devices are converging on the Enterprise network to enable smooth business operation, with central management of building security and systems, as well as online user connectivity. The x320 Series are ideal for these modern business networks, with flexible PoE provision to connect and power a wide range of network and IoT devices.

The x320-10GH provides up to 90 Watts of PoE power per port, and as shown in the diagram can support high-power devices such as high resolution outdoor

PTZ cameras with heater/blowers, advanced LED lighting controllers and more.

The x320-11GPT can supply up to 30 Watts of PoE power to connected devices, and can itself be powered by PoE or an AC adapter.

As shown in the diagram, the x320-10GH can use PoE to power the x320-11GPT, and also pass PoE power through it to connected devices such as IP phones, wireless access points and so on.

With their fanless design for silent operation, and supporting a wide temperature range, the x320 series offer very flexible deployment options. They can be DIN rail mounted in ceiling and other building spaces, and when powered by PoE the x320-11GPT doesn't require a separate power connection to operate. Used alongside PoE pass-through to connect and power end points, the x320 Series are an ideal solution for today's smart buildings and converged business networks.

# SPECIFICATIONS

## Performance

- Supports 10KB L2 jumbo frames
- Wire speed multicasting
- 4094 configurable VLANs
- Up to 16K MAC addresses
- Up to 2K multicast entries
- 512MB DDR3 SDRAM, 128MB NAND flash memory
- Packet buffer memory: 1.5MB

## Reliability

- Modular AlliedWare Plus operating system
- Full environmental monitoring of PSU, fans, temperature and internal voltages. SNMP traps alert network managers in case of any failure
- MTBF: Mean Time Between Failures)
  - x320-10GH: 400,000 hours
  - x320-11GPT: 240,000 hours
  - PWR300: 2,370,000 hours

## Expandability

- Versatile licensing options for additional features

## Flexibility and Compatibility

- 1G-SFP ports on x320 will support any combination of Allied Telesis 100Mbps and 1000Mbps SFP modules listed in this document under Ordering Information
- Port speed and duplex configuration can be set manually or by auto-negotiation

## Diagnostic Tools

- Active Fiber Monitoring detects tampering on optical links
- Built-In Self Test (BIST)
- Cable fault locator (TDR)
- Connectivity Fault Management (CFM) - Continuity Check Protocol (CCP) for use with G.8032 ERPS
- Find-me device locator
- Automatic link flap detection and port shutdown
- Optical Digital Diagnostic Monitoring (DDM)
- Ping polling for IPv4 and IPv6
- Port mirroring
- Trace Route for IPv4 and IPv6
- Uni-Directional Link Detection (UDLD)
- Port mirroring
- No limit on mirrored ports
- 1 mirror (analyzer) port
- VLAN mirroring (RSPAN)

## IPv4 Features

- Black hole routing
- Directed broadcast forwarding
- DNS relay
- Equal Cost Multi Path (ECMP) routing
- Policy-based routing
- Route maps and redistribution (OSPF and RIP)
- Static unicast and multicast routing for IPv4
- UDP broadcast helper (IP helper)

## IPv6 Features

- DHCPv6 client and relay
- DNS client and relay

- IPv4 and IPv6 dual stack
- IPv6 aware storm protection and QoS
- IPv6 hardware ACLs
- Device management over IPv6 networks with SNMP, Telnet and SSH
- NTP client and server
- Static unicast and multicast routing for IPv6
- Log to IPv6 hosts with Syslog
- IPv6 Ready certified

## Management

- Allied Telesis Autonomous Management Framework Plus (AMF Plus) enables powerful centralized management and zero-touch device installation and recovery
- Console management port on the front panel for ease of access
- NETCONF/RESTCONF northbound interface with YANG data modelling
- Eco-friendly mode allows ports and LEDs to be disabled to save power
- Web-based Graphical User Interface (GUI)
- Industry-standard CLI with context-sensitive help
- Powerful CLI scripting engine
- Comprehensive SNMP MIB support for standards-based device management
- Built-in text editor
- Event-based triggers allow user-defined scripts to be executed upon selected system events
- USB interface allows software release files, configurations and other files to be stored for backup and distribution to other devices
- Management stacking allows up to 24 devices to be managed from a single console

## Quality of Service

- 8 priority queues with a hierarchy of high priority queues for real time traffic, and mixed scheduling, for each switch port
- Limit bandwidth per port or per traffic class down to 64kbps
- Wire speed traffic classification with low latency essential for VoIP and real-time streaming media applications
- IPv6 QoS support
- Policy-based QoS based on VLAN, port, MAC and general packet classifiers
- Policy-based storm protection
- Extensive remarking capabilities
- Queue scheduling options for Strict priority, weighted round robin or mixed scheduling
- Type of Services (ToS) IP precedence and DiffServ marking based on layer 2, 3 and 4 headers
- Enhanced Transmission Selection (ETS)

## Resiliency Features

- Control Plane Prioritization (CPP) ensures the CPU always has sufficient bandwidth to process network control traffic
- Dynamic link failover (host attach)
- EPSRing (Ethernet Protection Switched Rings) with Super-Loop Protection (SLP) and enhanced recovery for extra resiliency
- Loop protection: loop detection and thrash limiting
- PVST+ compatibility mode
- STP root guard

## Security Features

- Access Control Lists (ACLs) based on layer 3 and 4 headers
- Configurable auth-fail and guest VLANs
- Dynamic ACLs assigned via port authentication
- ACL Groups enable multiple hosts/ports to be included in a single ACL, reducing configuration
- Configurable ACLs for management traffic
- Authentication, Authorization and Accounting (AAA)
- Bootloader can be password protected for device security
- BPDU protection
- DHCP snooping, IP source guard and Dynamic ARP Inspection (DAI)
- Dynamic VLAN assignment
- DoS attack blocking and virus throttling
- MAC address filtering and MAC address lock-down
- Network Access and Control (NAC) features manage endpoint security
- Learn limits (intrusion detection) for single ports or LAGs
- Private VLANs provide security and port isolation for multiple customers using the same VLAN
- RADIUS group selection per VLAN or port
- Secure Copy (SCP)
- Secure File Transfer (SFTP) client
- Simple Certificate Enrollment Protocol (SCEP) supports secure management
- Strong password security and encryption
- Tri-authentication: MAC-based, web-based and IEEE 802.1x
- Web-based authentication

## Environmental Specifications

- Operating temperature range: -10°C to 55°C (14°F to 131°F)
- Storage temperature range: -25°C to 70°C (-13°F to 158°F)
- Operating relative humidity range: 5% to 90% non-condensing
- Storage relative humidity range: 5% to 95% non-condensing
- Operating altitude: 3,000 meters maximum (9,843 ft)

## Electrical Approvals and Compliances

- EMC: EN55032 class A, FCC class A, VCCI class A, ICES-003 class A
- Immunity: EN55024, EN61000-3-levels 2 (Harmonics), and 3 (Flicker) – AC models only

## Safety

- Standards: UL60950-1, CAN/CSA-C22.2 No. 60950-1-03, EN60950-1, EN60825-1, AS/NZS 60950.1
- Certification: UL, cUL

## Restrictions on Hazardous Substances (RoHS) Compliance

- EU RoHS compliant
- China RoHS compliant

Product Specifications

|            | 10/100/1000T (RJ-45)<br>PoE Enabled Ports | 10/100/1000T (RJ-45)<br>PoE-in-Port | 1000X SFP Ports | Switching Fabric | Forwarding Rate |
|------------|-------------------------------------------|-------------------------------------|-----------------|------------------|-----------------|
| x320-10GH  | 8                                         | -                                   | 2               | 24Gbps           | 14.96Mpps       |
| x320-11GPT | 8                                         | 1                                   | 2               | 24Gbps           | 16.4Mpps        |

Physical Specifications

|            | Width            | Depth            | Height            | Mounting   | Unpacked Weight   | Packaged Weight  | Packaged Dimensions                             |
|------------|------------------|------------------|-------------------|------------|-------------------|------------------|-------------------------------------------------|
| x320-10GH  | 210 mm (8.26 in) | 180 mm (7.08 in) | 42.5 mm (1.67 in) | Rack-mount | 1.60 kg (3.53 lb) | 2.7 kg (5.95 lb) | 417 x 336 x 151 mm<br>(16.42 x 13.23 x 1.67 in) |
| x320-11GPT | 210 mm (8.26 in) | 180 mm (7.08 in) | 42.5 mm (1.67 in) | Rack-mount | 1.60 kg (3.53 lb) | 3.5 kg (7.71 lb) | 417 x 336 x 151 mm<br>(16.42 x 13.23 x 1.67 in) |

Power and Noise Characteristics

|            | Maximum PoE Power                              | Maximum PoE Ports Supported |                |               |                |                | No PoE Load              |                         | Full PoE Load                   |                                     |
|------------|------------------------------------------------|-----------------------------|----------------|---------------|----------------|----------------|--------------------------|-------------------------|---------------------------------|-------------------------------------|
|            |                                                | PoE<br>(7.5W)               | PoE<br>(15.4W) | PoE+<br>(30W) | PoE++<br>(60W) | PoE++<br>(90W) | Max Power<br>Consumption | Max Heat<br>Dissipation | Max Power<br>Consumption        | Max Heat<br>Dissipation             |
| x320-10GH  | 240W (1 x PWR300 PSU)                          | 8                           | 8              | 8             | 4              | 2              | 21W                      | 71W                     | 320W                            | 218 BTU/h                           |
|            | 480W (2 x PWR300 PSUs)                         | 8                           | 8              | 8             | 8              | 5              |                          |                         | 600W                            | 409 BTU/h                           |
|            | 720W (3 x PWR300 PSUs)                         | 8                           | 8              | 8             | 8              | 8              |                          |                         | 880W                            | 600 BTU/h                           |
| x320-11GPT | 0W (switch powered by 30W PoE) <sup>1</sup>    | 0                           | 0              | 0             | 0              | 0              | 22W                      | 75W                     | 98W (using AC<br>power adapter) | 350W (using<br>AC power<br>adapter) |
|            | 31.6W (switch powered by 60W PoE) <sup>1</sup> | 4                           | 2              | 1             | 0              | 0              |                          |                         |                                 |                                     |
|            | 46.2W (switch powered by 90W PoE) <sup>1</sup> | 6                           | 3              | 1             | 0              | 0              |                          |                         |                                 |                                     |
|            | 62W (switch powered by AC Adaptor)             | 8                           | 4              | 2             | 0              | 0              |                          |                         |                                 |                                     |

Latency (microseconds)

|            | Port Speed |       |
|------------|------------|-------|
|            | 100Mbps    | 1Gbps |
| x320-10GH  | 5.4µs      | 3.0µs |
| x320-11GPT | 5.5µs      | 3.0µs |

Message Authentication:  
HMAC (SHA-1, SHA-2(224, 256, 384, 512)  
Random Number Generation:  
DRBG (Hash, HMAC and Counter)

Non FIPS Approved Algorithms  
RNG (AES128/192/256)  
DES  
MD5

Encryption (management traffic only)

FIPS 180-1 Secure Hash standard (SHA-1)  
FIPS 186 Digital signature standard (RSA)  
FIPS 46-3 Data Encryption Standard (DES and 3DES)

Ethernet Standards

IEEE 802.2 Logical Link Control (LLC)  
IEEE 802.3 Ethernet  
IEEE 802.3ab1000BASE-T  
IEEE 802.3af Power over Ethernet (PoE)  
IEEE 802.3at Power over Ethernet up to 30W (PoE+)  
IEEE 802.3bt Power over Ethernet Plus Plus (PoE++)  
IEEE 802.3azEnergy Efficient Ethernet (EEE)  
IEEE 802.3u 100BASE-X  
IEEE 802.3x Flow control - full-duplex operation  
IEEE 802.3z 1000BASE-X

IPv4 Features

RFC 768 User Datagram Protocol (UDP)  
RFC 791 Internet Protocol (IP)  
RFC 792 Internet Control Message Protocol (ICMP)  
RFC 793 Transmission Control Protocol (TCP)  
RFC 826 Address Resolution Protocol (ARP)  
RFC 894 Standard for the transmission of IP datagrams over Ethernet networks  
RFC 919 Broadcasting Internet datagrams

RFC 922 Broadcasting Internet datagrams in the presence of subnets  
RFC 932 Subnetwork addressing scheme  
RFC 950 Internet standard subnetting procedure  
RFC 951 Bootstrap Protocol (BootP)  
RFC 1027 Proxy ARP  
RFC 1035 DNS client  
RFC 1042 Standard for the transmission of IP datagrams over IEEE 802 networks  
RFC 1071 Computing the Internet checksum  
RFC 1122 Internet host requirements  
RFC 1191 Path MTU discovery  
RFC 1256 ICMP router discovery messages  
RFC 1518 An architecture for IP address allocation with CIDR  
RFC 1519 Classless Inter-Domain Routing (CIDR)  
RFC 1542 Clarifications and extensions for BootP  
RFC 1591 Domain Name System (DNS)  
RFC 1812 Requirements for IPv4 routers  
RFC 1918 IP addressing  
RFC 2581 TCP congestion control

IPv6 Features

RFC 1981 Path MTU discovery for IPv6  
RFC 2460 IPv6 specification  
RFC 2464 Transmission of IPv6 packets over Ethernet networks  
RFC 3056 Connection of IPv6 domains via IPv4 clouds  
RFC 3484 Default address selection for IPv6  
RFC 3596 DNS extensions to support IPv6  
RFC 4007 IPv6 scoped address architecture  
RFC 4193 Unique local IPv6 unicast addresses  
RFC 4291 IPv6 addressing architecture  
RFC 4443 Internet Control Message Protocol (ICMPv6)

<sup>1</sup> The x320-11GPT uses PD port 11 to receive PoE power, but cannot be powered by PoE if the AC adapter is connected

STANDARDS & PROTOCOLS

AlliedWare Plus Operating System

Version 5.5.6-1

Authentication

RFC 1321 MD5 Message-Digest algorithm  
RFC 1828 IP authentication using keyed MD5

Cryptographic Algorithms

FIPS Approved Algorithms  
Encryption (Block Ciphers):  
AES (ECB, CBC, CFB and OFB Modes)  
3DES (ECB, CBC, CFB and OFB Modes)  
Block Cipher Modes:

CCM  
CMAC  
GCM  
XTS

Digital Signatures & Asymmetric Key Generation:

DSA  
ECDSA  
RSA  
Secure Hashing:  
SHA-1  
SHA-2 (SHA-224, SHA-256, SHA-384, SHA-512)

|          |                                                   |
|----------|---------------------------------------------------|
| RFC 4861 | Neighbor discovery for IPv6                       |
| RFC 4862 | IPv6 Stateless Address Auto-Configuration (SLAAC) |
| RFC 5014 | IPv6 socket API for source address selection      |
| RFC 5095 | Deprecation of type 0 routing headers in IPv6     |
| RFC 5175 | IPv6 Router Advertisement (RA) flags option       |
| RFC 6105 | IPv6 Router Advertisement (RA) guard              |

### Management

|                                                         |                                                                                                          |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| AT Enterprise MIB including AMF Plus MIB and SNMP traps |                                                                                                          |
| Optical DDM MIB                                         |                                                                                                          |
| SNMPv1, v2c and v3                                      |                                                                                                          |
| IEEE 802.1AB Link Layer Discovery Protocol (LLDP)       |                                                                                                          |
| RFC 1155                                                | Structure and identification of management information for TCP/IP-based Internets                        |
| RFC 1157                                                | Simple Network Management Protocol (SNMP)                                                                |
| RFC 1212                                                | Concise MIB definitions                                                                                  |
| RFC 1213                                                | MIB for network management of TCP/IP-based Internets: MIB-II                                             |
| RFC 1215                                                | Convention for defining traps for use with the SNMP                                                      |
| RFC 1227                                                | SNMP MUX protocol and MIB                                                                                |
| RFC 1239                                                | Standard MIB                                                                                             |
| RFC 1724                                                | RIPv2 MIB extension                                                                                      |
| RFC 2011                                                | SNMPv2 MIB for IP using SMIv2                                                                            |
| RFC 2012                                                | SNMPv2 MIB for TCP using SMIv2                                                                           |
| RFC 2013                                                | SNMPv2 MIB for UDP using SMIv2                                                                           |
| RFC 2096                                                | IP forwarding table MIB                                                                                  |
| RFC 2578                                                | Structure of Management Information v2 (SMIv2)                                                           |
| RFC 2579                                                | Textual conventions for SMIv2                                                                            |
| RFC 2580                                                | Conformance statements for SMIv2                                                                         |
| RFC 2674                                                | Definitions of managed objects for bridges with traffic classes, multicast filtering and VLAN extensions |
| RFC 2741                                                | Agent extensibility (AgentX) protocol                                                                    |
| RFC 2787                                                | Definitions of managed objects for VRRP                                                                  |
| RFC 2819                                                | RMON MIB (groups 1,2,3 and 9)                                                                            |
| RFC 2863                                                | Interfaces group MIB                                                                                     |
| RFC 3164                                                | Syslog protocol                                                                                          |
| RFC 3176                                                | sFlow: a method for monitoring traffic in switched and routed networks                                   |
| RFC 3411                                                | An architecture for describing SNMP management frameworks                                                |
| RFC 3412                                                | Message processing and dispatching for the SNMP                                                          |
| RFC 3413                                                | SNMP applications                                                                                        |
| RFC 3414                                                | User-based Security Model (USM) for SNMPv3                                                               |
| RFC 3415                                                | View-based Access Control Model (VACM) for SNMP                                                          |
| RFC 3416                                                | Version 2 of the protocol operations for the SNMP                                                        |
| RFC 3417                                                | Transport mappings for the SNMP                                                                          |
| RFC 3418                                                | MIB for SNMP                                                                                             |
| RFC 3621                                                | Power over Ethernet (PoE) MIB                                                                            |
| RFC 3635                                                | Definitions of managed objects for the Ethernet-like interface types                                     |
| RFC 3636                                                | IEEE 802.3 MAU MIB                                                                                       |
| RFC 4188                                                | Definitions of managed objects for bridges                                                               |
| RFC 4318                                                | Definitions of managed objects for bridges with RSTP                                                     |
| RFC 4560                                                | Definitions of managed objects for remote ping, traceroute and lookup operations                         |
| RFC 6527                                                | Definitions of managed objects for VRRPv3                                                                |
| RFC 7011                                                | IPFIX: a method of exporting IP flow data in a network for analysis                                      |

### Multicast Support

|                                                |                                                        |
|------------------------------------------------|--------------------------------------------------------|
| Bootstrap Router (BSR) mechanism for PIM-SM    |                                                        |
| IGMP query solicitation                        |                                                        |
| IGMP snooping (IGMPv1, v2 and v3)              |                                                        |
| IGMP snooping fast-leave                       |                                                        |
| IGMP/MLD multicast forwarding (IGMP/MLD proxy) |                                                        |
| MLD snooping (MLDv1 and v2)                    |                                                        |
| PIM for IPv6                                   |                                                        |
| RFC 1112                                       | Host extensions for IP multicasting (IGMPv1)           |
| RFC 2236                                       | Internet Group Management Protocol v2 (IGMPv2)         |
| RFC 2710                                       | Multicast Listener Discovery (MLD) for IPv6            |
| RFC 2715                                       | Interoperability rules for multicast routing protocols |

|          |                                                                                         |
|----------|-----------------------------------------------------------------------------------------|
| RFC 3306 | Unicast-prefix-based IPv6 multicast addresses                                           |
| RFC 3376 | IGMPv3                                                                                  |
| RFC 3618 | Multicast Source Discovery Protocol (MSDP)                                              |
| RFC 3810 | Multicast Listener Discovery v2 (MLDv2) for IPv6                                        |
| RFC 3956 | Embedding the Rendezvous Point (RP) address in an IPv6 multicast address                |
| RFC 3973 | PIM Dense Mode (DM)                                                                     |
| RFC 4541 | IGMP and MLD snooping switches                                                          |
| RFC 4601 | Protocol Independent Multicast - Sparse Mode (PIM-SM): protocol specification (revised) |
| RFC 4604 | Using IGMPv3 and MLDv2 for source-specific multicast                                    |
| RFC 4607 | Source-specific multicast for IP                                                        |

### Open Shortest Path First (OSPF)

|                           |                                                         |
|---------------------------|---------------------------------------------------------|
| OSPF link-local signaling |                                                         |
| OSPF MD5 authentication   |                                                         |
| OSPF restart signaling    |                                                         |
| Out-of-band LSDB resync   |                                                         |
| RFC 1245                  | OSPF protocol analysis                                  |
| RFC 1246                  | Experience with the OSPF protocol                       |
| RFC 1370                  | Applicability statement for OSPF                        |
| RFC 1765                  | OSPF database overflow                                  |
| RFC 2328                  | OSPFv2                                                  |
| RFC 2370                  | OSPF opaque LSA option                                  |
| RFC 2740                  | OSPFv3 for IPv6                                         |
| RFC 3101                  | OSPF Not-So-Stubby Area (NSSA) option                   |
| RFC 3509                  | Alternative implementations of OSPF area border routers |
| RFC 3623                  | Graceful OSPF restart                                   |
| RFC 3630                  | Traffic engineering extensions to OSPF                  |
| RFC 4552                  | Authentication/confidentiality for OSPFv3               |
| RFC 5329                  | Traffic engineering extensions to OSPFv3                |

### Quality of Service (QoS)

|               |                                                              |
|---------------|--------------------------------------------------------------|
| IEEE 802.1p   | Priority tagging                                             |
| IEEE 802.1Qaz | Enhanced Transmission Selection (ETS)                        |
| RFC 2211      | Specification of the controlled-load network element service |
| RFC 2474      | DiffServ precedence for eight queues/port                    |
| RFC 2475      | DiffServ architecture                                        |
| RFC 2597      | DiffServ Assured Forwarding (AF)                             |
| RFC 2697      | A single-rate three-color marker                             |
| RFC 2698      | A two-rate three-color marker                                |
| RFC 3246      | DiffServ Expedited Forwarding (EF)                           |

### Resiliency Features

|                                                                 |                                                                         |
|-----------------------------------------------------------------|-------------------------------------------------------------------------|
| ITU-T G.8032 / Y.1344 Ethernet Ring Protection Switching (ERPS) |                                                                         |
| IEEE 802.1ag                                                    | CFM Continuity Check Protocol (CCP)                                     |
| IEEE 802.1AX                                                    | Link aggregation (static and LACP)                                      |
| IEEE 802.1D                                                     | MAC bridges                                                             |
| IEEE 802.1s                                                     | Multiple Spanning Tree Protocol (MSTP)                                  |
| IEEE 802.1w                                                     | Rapid Spanning Tree Protocol (RSTP)                                     |
| IEEE 802.3ad                                                    | Static and dynamic link aggregation                                     |
| RFC 5798                                                        | Virtual Router Redundancy Protocol version 3 (VRRPv3) for IPv4 and IPv6 |

### Routing Information Protocol (RIP)

|          |                                        |
|----------|----------------------------------------|
| RFC 1058 | Routing Information Protocol (RIP)     |
| RFC 2080 | RIPng for IPv6                         |
| RFC 2081 | RIPng protocol applicability statement |
| RFC 2082 | RIP-2 MD5 authentication               |
| RFC 2453 | RIPv2                                  |

### Security Features

|                                                            |                                                    |
|------------------------------------------------------------|----------------------------------------------------|
| SSH remote login                                           |                                                    |
| SSLv2 and SSLv3                                            |                                                    |
| TACACS+ Accounting, Authentication and Authorization (AAA) |                                                    |
| IEEE 802.1X                                                | Authentication protocols (TLS, TTLS, PEAP and MD5) |
| IEEE 802.1X                                                | Multi-supplicant authentication                    |
| IEEE 802.1X                                                | Port-based network access control                  |
| RFC 2246                                                   | TLS protocol v1.0                                  |
| RFC 2818                                                   | HTTP over TLS ("HTTPS")                            |
| RFC 2865                                                   | RADIUS authentication                              |

|          |                                                                                        |
|----------|----------------------------------------------------------------------------------------|
| RFC 2866 | RADIUS accounting                                                                      |
| RFC 2868 | RADIUS attributes for tunnel protocol support                                          |
| RFC 3546 | Transport Layer Security (TLS) extensions                                              |
| RFC 3579 | RADIUS support for Extensible Authentication Protocol (EAP)                            |
| RFC 3580 | IEEE 802.1x RADIUS usage guidelines                                                    |
| RFC 3748 | PPP Extensible Authentication Protocol (EAP)                                           |
| RFC 4251 | Secure Shell (SSHv2) protocol architecture                                             |
| RFC 4252 | Secure Shell (SSHv2) authentication protocol                                           |
| RFC 4253 | Secure Shell (SSHv2) transport layer protocol                                          |
| RFC 4254 | Secure Shell (SSHv2) connection protocol                                               |
| RFC 5176 | RADIUS CoA (Change of Authorization)                                                   |
| RFC 5280 | X.509 certificate and Certificate Revocation List (CRL) profile                        |
| RFC 5425 | Transport Layer Security (TLS) transport mapping for Syslog                            |
| RFC 5656 | Elliptic curve algorithm integration for SSH                                           |
| RFC 6125 | Domain-based application service identity within PKI using X.509 certificates with TLS |
| RFC 6614 | Transport Layer Security (TLS) encryption for RADIUS                                   |
| RFC 6668 | SHA-2 data integrity verification for SSH                                              |
| RFC 8446 | Transport Layer Security (TLS) v1.3                                                    |
| RFC 8894 | Simple Certificate Enrollment Protocol (SCEP)                                          |

### Services

|          |                                                      |
|----------|------------------------------------------------------|
| RFC 854  | Telnet protocol specification                        |
| RFC 855  | Telnet option specifications                         |
| RFC 857  | Telnet echo option                                   |
| RFC 858  | Telnet suppress go ahead option                      |
| RFC 1091 | Telnet terminal-type option                          |
| RFC 1350 | Trivial File Transfer Protocol (TFTP)                |
| RFC 1985 | SMTP service extension                               |
| RFC 2049 | MIME                                                 |
| RFC 2131 | DHCPv4 (server, relay and client)                    |
| RFC 2132 | DHCP options and BootP vendor extensions             |
| RFC 2616 | Hypertext Transfer Protocol - HTTP/1.1               |
| RFC 2821 | Simple Mail Transfer Protocol (SMTP)                 |
| RFC 2822 | Internet message format                              |
| RFC 3046 | DHCP relay agent information option (DHCP option 82) |
| RFC 3315 | DHCPv6 (server, relay and client)                    |
| RFC 3633 | IPv6 prefix options for DHCPv6                       |
| RFC 3646 | DNS configuration options for DHCPv6                 |
| RFC 3993 | Subscriber-ID suboption for DHCP relay agent option  |
| RFC 4330 | Simple Network Time Protocol (SNTP) version 4        |
| RFC 5905 | Network Time Protocol (NTP) version 4                |

### VLAN Support

|                                           |                                          |
|-------------------------------------------|------------------------------------------|
| Generic VLAN Registration Protocol (GVRP) |                                          |
| IEEE 802.1ad                              | Provider bridges (VLAN stacking, Q-in-Q) |
| IEEE 802.1Q                               | Virtual LAN (VLAN) bridges               |
| IEEE 802.1v                               | VLAN classification by protocol and port |
| IEEE 802.3ac                              | VLAN tagging                             |

### Voice over IP (VoIP)

|            |               |
|------------|---------------|
| LLDP-MED   | ANSI/TIA-1057 |
| Voice VLAN |               |

FEATURE LICENSES

|                 | Description            | Includes                                                                                                                                                                                                                                             |
|-----------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT-FL-x320-01   | x320 Premium license   | <ul style="list-style-type: none"><li>■ OSPF (256 routes)</li><li>■ PIMv4-SM, DM, and SSM</li><li>■ RIPng (256 routes)</li><li>■ OSPFv3 (256 routes)</li><li>■ PIMv6-SM and SSM</li><li>■ MLD v1/v2</li><li>■ VLAN double tagging (Q-in-Q)</li></ul> |
| AT-FL-x320-8032 | ITU-T G.8032 license   | <ul style="list-style-type: none"><li>■ G.8032 ring protection</li><li>■ Ethernet CFM</li></ul>                                                                                                                                                      |
| AT-FL-x320-CPOE | Continuous PoE license | <ul style="list-style-type: none"><li>■ Continuous PoE power</li></ul>                                                                                                                                                                               |

ORDERING INFORMATION

|                            |                                                                                                                                                            |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT-x320-10GH <sup>2</sup>  | 8-port 10/100/1000T PoE++ switch with 2 SFP ports, and 3 external PSU ports <sup>3</sup>                                                                   |
| AT-x320-11GPT <sup>2</sup> | 8-port 10/100/1000T PoE+ switch with 2 SFP ports, one AC adapter port <sup>4</sup> , and one PoE-in port <sup>5</sup> (supporting PD and PoE pass-through) |
| AT-PWR300-xx               | 300W PoE power supply (for x320-10GH and GS980EM/10H switches)                                                                                             |

Where xx =    10 forUS power cord  
                  20 for no power cord  
                  30 for UK power cord  
                  40 for AU power cord  
                  50 for EU power cord

<sup>2</sup> Trade Act Agreement compliant  
<sup>3</sup> PWR300 power supplies for the x320-10GH must be ordered separately  
<sup>4</sup> The x320-11GPT ships with an AC power adapter  
<sup>5</sup> The x320-11GPT can be powered by PoE from 30W (class 4) to 90W (class 8)

Accessories

| 1000Mbps SFP Modules |                                                                                                 |
|----------------------|-------------------------------------------------------------------------------------------------|
| AT-SPTX/I            | 100 m, 10/100/1000T SFP, RJ-45                                                                  |
| AT-SPSX/I            | 1000SX GbE multi-mode 850 nm fiber up to 550 m                                                  |
| AT-SPLX10a/I         | 1000LX GbE single-mode 1310 nm fiber up to 10 km industrial temperature                         |
| AT-SPBD20-13/I       | 1000BX GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 20 km industrial temperature              |
| AT-SPBD20-14/I       | 1000BX GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 20 km industrial temperature              |
| AT-SPBD40-13/I       | 1000LX GbE single-mode Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 40 km, industrial temperature |
| AT-SPBD40-14/I       | 1000LX GbE single-mode Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 40 km, industrial temperature |