IE510-28GSX
Industrial Ethernet, Stackable Layer 3 Switch

Our ruggedized IE510-28GSX Industrial Ethernet switch is built for enduring performance in harsh environments, such as those found in manufacturing, transportation and physical security. Offering high throughput, rich functionality and advanced security features, the IE510-28GSX switch delivers the performance and reliability demanded by industrial deployments in the Internet of Things (IoT) age.

Overview
The Allied Telesis IE510-28GSX Layer 3 wirespeed switch is ideal for industrial Ethernet applications. With a wide operating temperature range of between -40°C and 75°C, it tolerates harsh and demanding environments, such as those found in industrial and outdoor deployment.

Device management is provided via Industry-standard CLI, SNMP, Telnet, SSH, or Allied Telesis Autonomous Management Framework™ (AMF). AMF is unique to Allied Telesis managed devices, offering simplified device provisioning, recovery and firmware upgrade management.

Performance
The IE510-28GSX managed switch is high-performance and cost-effective, and meets the high reliability requirements of industrial network operations. This robust switch provides network managers with several key features using simple web-based management functions, including port-based VLANs, IEEE 802.1p, QoS, port trunking/link aggregation, port mirroring, priority queues, and IEEE 802.1x security support. With support for up to 16K MAC addresses, the IE510-28GSX switch is the ideal option for integrating management into any network solution.

Secure
Advanced security features protect the network. Unprecedented control over user access is provided with Network Access Control (NAC), mitigating threats to network infrastructure. This ensures the network is accessed only by known users and devices—all users’ adherence to network security policies is checked, and then either access is granted or remediation is offered. Secure access can also be provided for guests. A secure network environment is guaranteed. The IE510-28GSX offers powerful control over network traffic types, secure management options, loop guard to protect against cabling mistakes, and tri-authentication for comprehensive access control.

High network resiliency
The convergence of network services in the enterprise has led to increasing demand for highly available networks with minimal downtime. VCStack™, in conjunction with link aggregation, provides a network with no single point of failure, and is a simple solution for resiliency in access applications.

The IE510-28GSX supports highly stable and reliable ICT network switching, with recovery times down to 50ms. Choices include Allied Telesis Ethernet Protection Switched Ring (EPSRing™), and the standards-based ITU-T G.8032—Ethernet Ring Protection Switching (ERPS).

For high-availability automation networks based on Ethernet technology, the IE510-28GSX may run the Media Redundancy Protocol (MRP) for a deterministic failover on ring topology.

The IE510-28GSX can form a VCStack of up to four units for enhanced resiliency and simplified device management. Full EPSRing support and VCStack-LD (Long Distance), which enables stacks to be created over long distance fiber links, make the IE510-28GSX the perfect choice for distributed environments.

Future-proof
The IE510-28GSX ensures a future-proof network, with superior flexibility coupled with the ability to stack multiple units. The IE510-28GSX model features 1/10 Gigabit uplink ports and a comprehensive IPv6 feature set, to ensure it is ready for future network traffic demands. These models are Software Defined Networking (SDN) ready, supporting OpenFlow v1.3.

Key Features
- AlliedWare Plus™
- Autonomous Management Framework™ (AMF)
- OpenFlow for SDN
- Routing capability (ECMP, OSPF, RIP, Static)
- Industry-leading QoS
- Active Fiber Monitoring (AFM)
- sFlow
- Ethernet Protection Switched Ring (EPSRing™)
- EPSR Master
- Ethernet Ring Protection Switching (ITU-T G.8032)
- High-availability automation network support (MRP)
- Upstream Forwarding Only (UFO)
- Redundant power inputs
- Alarm input/output
- USB port for image/configuration backup, restore and upgrade
- VCStack and VCStack-LD
- Modbus support
- Web-based GUI for easy management
Key Features

**Allied Telesis Autonomous Management Framework™ (AMF)**
- AMF 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-update, auto-provisioning and auto-recovery enable plug-and-play networking and zero-touch management.

**VCStack™ (Virtual Chassis Stacking)**
- Create a VCStack of up to four units with 40Gbps of stacking bandwidth to each unit. Stacking links are connected in a ring so each device has dual connections to further improve resiliency. VCStack provides a highly available system where network resources are spread out across stacked units, reducing the impact if one of the units fails.
- Aggregating switch ports on different units across the stack provides excellent network resiliency.
- Long-distance stacking allows a VCStack to be created over longer distances, perfectly for a distributed network environment.

**Software Defined Networking (SDN)**
- OpenFlow is a key technology that enables the use of SDN to build smart applications that unlock value and reduce cost.

**Resiliency**
- EPSRing and ITU-T G.8032 ERPS enable a protected ring capable of recovery within as little as 50ms. These features are perfect for high performance and high availability.
- High-availability automation networks are achieved by means of de facto standards Media Redundancy Protocol (MRP) as defined by the IEC 62439-2; MRP is specified only for ring networks with up to 50 devices, and guarantees fully deterministic switchover behavior.
- Spanning Tree Protocol compatible, RSTP, MSTP, static Link Aggregation Group (LAG), and dynamic Link Aggregation Control Protocol (LACP) support.

**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. Enjoy boosted network performance and guaranteed delivery of business-critical Ethernet services and applications. Time-critical services such as voice and video take precedence over non-essential services such as file downloads, maintaining responsiveness of your applications.

**Loop Protection**
- Throttling limiting, also known as rapid MAC movement, detects and resolves network loops. It is highly user-configurable — from the rate of loop traffic to the type of action the switch should take when it detects a loop.
- With throttling 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 throttling limiting to send special Loop Detection Frame (LDF) packets that the switch listens for. If a port receives an LDF packet, it 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.
- sFlow
  - sFlow is an industry-standard technology for monitoring high-speed switched networks. It provides complete visibility into network use, enabling performance optimization, usage accounting/billing, and defense against security threats. Sampled packets sent to a collector (up to 5 collectors can be configured) ensure it always has 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.
- UniDirectional Link Detection (UDLD)
  - UniDirectional Link Detection (UDLD) is useful for monitoring fiber-optic links between two switches that use two single-direction fibers to transmit and receive packets. UDLD prevents traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails.
- Link Layer Discovery Protocol—Media Endpoint Discovery (LLDP–MED)
  - LLDP–MED extends LLDP basic network endpoint discovery and management functions. LLDP–MED allows for media endpoint specific messages, providing detailed information on power equipment, network policy, location discovery (for Emergency Call Services) and inventory.
- VLAN Translation
  - VLAN Translation allows traffic arriving on a VLAN to be mapped to a different VLAN on the outgoing paired interface.
- In Metro networks, it is common for the Network Service Provider to give each customer their own unique VLAN, yet at the customer location, give all the customers the same VLAN-ID for tagged packets to use on the wire. VLAN-translation can be used by the Service Provider to change the tagged packet’s VLAN-ID at the customer location to the VLAN-ID for tagged packets to use within the NSF’s network.
- This feature is also useful in Enterprise environments where it can be used to merge two networks together without manually reconfiguring the VLAN numbering scheme. This situation can occur if two companies have merged and the same VLAN-ID is used for two different purposes.
- Voice VLAN
  - Voice VLAN automatically separates voice and data traffic into two different VLANs. This automatic separation places delay-sensitive traffic into a voice–dedicated VLAN, which simplifies QoS configurations.
- 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.
- Security (Tri-authentication)
  - Authentication options on the IE510-28GSX 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.
- Access Control Lists (ACLs)
  - AlliedWare Plus delivers industry-standard Access Control functionality through ACLs. ACLs filter network traffic to control whether routed packets are forwarded or blocked at the port interface. This provides a powerful network security mechanism to select the types of traffic to be analyzed, forwarded, or influenced in some way.
- 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.
- Dynamic Host Configuration Protocol (DHCP) Snooping
  - DHCP servers allocate IP addresses to clients, and the switch keeps a record of addresses assigned on each port. IP source guard checks against this DHCP snooping database to ensure only clients with specific IP and/or MAC address can access the network. DHCP snooping can be combined with other features, like dynamic ARP inspection, to increase security in Layer 2 switched environments, and also provides a traceable history, which meets the growing legal requirements placed on service providers.
- Alarm Input/Output
  - Alarm Input/Output are useful for security integration solutions; they respond to events instantly and automatically by a pre-defined event scheme, and notify alert message to the monitoring control center. The 2-pin terminal blocks may be connected to sensors and actuator relays. Alarm input receives signal from external devices like motion sensor and magnets; that will trigger subsequent actions if something changes. Alarm output controls external device upon a event (i.e. sirens, strobes, PTZ camera).
- Premium Software License
  - By default, the IE510-28GSX offers a comprehensive Layer 2 and basic Layer 3 feature set that includes static routing and IPv6 management features. The feature set can easily be upgraded with premium software licenses.
- Modbus
  - Modbus enables communication with Supervisory Control and Data Acquisition (SCADA) systems for industrial automation.
IE510-28GSX | Industrial Ethernet, Stackable Layer 3 Switch

Specifications

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>10/100/1000T (RJ-45) COPPER PORTS</th>
<th>100/1000X SFP PORTS</th>
<th>1/10 GIGABIT STACKING PORTS</th>
<th>SWITCHING FABRIC</th>
<th>FORWARDING RATE (64-BYTE PACKETS)</th>
<th>STACKING BANDWIDTH</th>
<th>POE SOURCING PORTS</th>
<th>POE BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE510-28GSX</td>
<td>-</td>
<td>24</td>
<td>4 (2 if stacked)</td>
<td>2*</td>
<td>128Gbps</td>
<td>95.2Mpps</td>
<td>40Gbps</td>
<td>-</td>
</tr>
</tbody>
</table>

* Stacking ports can be configured as additional 1G/10G Ethernet ports when unit is not stacked

### Performance
- MAC address: 16K entries
- Packet Buffer: 2 MBbytes (16 Mbits)
- Priority Queues: 8
- Simultaneous VLANs: 4K
- VLAN ID range: 1–4094
- Jumbo frames: 13KB L2 jumbo frames
- Multicast groups: 1K (Layer 2), 256 (Layer 3)
- Routes: 2K (IPv4), 256 (IPv6)

### Other Interfaces
- **Type**: USB2.0 (Host Controller Class)
- **Port no.**: 1
- **Connector**: Type A receptacle
- **Connector**: RJ-45 female
- **Connector**: 2-pin Terminal Block

### Quality of Service
- Eight 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
- Policy-based QoS based on VLAN, port, MAC, and general packet classifiers
- Policy-based storm protection
- Extensive marking capabilities
- Tadtool for queue congestion control
- Strict priority, weighted round robin, or mixed scheduling
- IP precedence and DiffServ marking based on Layer 2, 3, and 4 headers

### Resiliency Features
- Control Plane Prioritization (CPP) ensures the CPU always has sufficient bandwidth to process network control traffic
- Dynamic link failover (host attach)
- Ethernet Ring Protection Switched Ring (EPSR™) with SuperLoop Protection (SLP)
- Ethernet Ring Protection Switching (ITU-T G.8032)
- Link Aggregation Control Protocol (LACP)
- Long-Distance stacking (VCStack-LD)
- Loop protection: loop detection and thrash limiting
- Media Redundancy Protocol (MRP)
- Multiple Spanning Tree Protocol (MSTP)
- PVST+ compatibility mode
- Rapid Spanning Tree Protocol (RSTP)
- Spanning Tree Protocol (STP) with root guard
- Stacking ports can be configured as 10G Ethernet ports
- Virtual Router Redundancy Protocol (VRRPv3)

### Multicasting
- Internet Group Membership Protocol (IGMPv1/v2/v3)
- IGMP proxy
- IGMP snooping with fast leave and no timeout feature
- IGMP static groups
- Multicast Listener Discovery (MLDv1/v2)
- MLD snooping
- Protocol Independent Multicast (PIM)
- PIM Dense Mode (DM) for IPv4 and IPv6
- PIM Sparse Mode (SM) for IPv4 and IPv6
- PIM Dense Mode to Sparse Mode translation

### Security Features
- Access Control Lists (ACLs) based on Layer 3 and 4 headers
- Dynamic ACLs assigned via port authentication
- ACL Groups enable multiple hosts/ports to be included in a single ACL, reducing configuration
- Auth-fail and guest VLANs

### Expandability
- Stack up to four units in a VCSStack
- Premium license option for additional features

### Flexibility and Compatibility
- Gigabit SFP ports will support any combination of Allied Telesis 1000Mpbs and 1000Mbits SFP modules listed in this document under Ordering Information
- 10G SFP+ ports will support any combination of Allied Telesis 10000Mbs SFP and 10GBE SFP+ modules and direct attach cables listed in this document under Ordering Information
- Stacking ports can be configured as 10G Ethernet ports
- Port speed and duplex configuration can be set manually or by auto negotiation

### Diagnostic Tools
- **Active Fiber Monitoring detects tampering on optical links**
- **Automatic link fail detection and port shutdown**
- **Built-In Self Test (BIST)**
- **Cable fault locator (TDR)**
- **Event logging via Syslog over IPv4**
- **Find-me device locator**

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IE510-28GSX | Industrial Ethernet, Stackable Layer 3 Switch

- 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)
- DoS attack blocking and virus throttling
- Dynamic VLAN assignment
- MAC address filtering and MAC address lockdown
- Network Access Control (NAC) features manage endpoint security
- Port-based learn limits (intrusion detection)
- Private VLANs provide security and port isolation for multiple customers using the same VLAN
- RADIUS local server (100 users) and accounting
- Secure Copy (SCP)
- Strong password security and encryption
- TACACS+ Authentication and Accounting
- Tri-authentication: MAC-based, web-based and IEEE 802.1X

Environmental Specifications
- Operating temperature range: -40°C to 75°C (-40°F to 167°F)
- Storage temperature range: -40°C to 85°C (-40°F to 185°F)
- Operating humidity range: 5% to 95% non-condensing
- Storage humidity range: 5% to 95% non-condensing
- Operating altitude: up to 3,000 meters (9,842 ft)

Environmental Compliance
RoHS
China RoHS
WEEE

Physical Specifications

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>DEPTH</th>
<th>WEIGHT</th>
<th>ENCLOSURE</th>
<th>MOUNTING</th>
<th>PROTECTION RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE510-28GSX-80</td>
<td>440 mm (17.32 in)</td>
<td>44 mm (1.73 in)</td>
<td>300 mm (11.80 in)</td>
<td>4.8 Kg (10.58 lb)</td>
<td>metal shell</td>
<td>rack mount</td>
<td>IP30</td>
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</table>

Power and Noise Characteristics

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>INPUT VOLTAGE</th>
<th>COOLING</th>
<th>NO POE LOAD</th>
<th>FULL POE LOAD</th>
<th>MAX POE SOURCING PORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MAX POE POWER</td>
</tr>
<tr>
<td>IE510-28GSX-80</td>
<td>±48V DC, ±60V DC **</td>
<td>fan</td>
<td>74W **</td>
<td>252 BTU/h **</td>
<td>45 dBA</td>
</tr>
</tbody>
</table>

* auto-ranging
** including SFP transceivers’ consumption and margin
Noise: tested to ISO7779; front bystander position

Latency (Microseconds)

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>PORT SPEED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100MBPS</td>
</tr>
<tr>
<td>IE510-28GSX-80</td>
<td>14.5µs</td>
</tr>
</tbody>
</table>

Standards and Protocols

AlliedWare Plus Operating System
Version 5.5.1-1

Cryptographic Algorithms
FIPS Approved Algorithms
Encryption (Block Ciphers):
- AES (GCM, CBC, CFB and OFB Modes)
- 3DES (GCM, 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)
Message Authentication:
- HMAC (SHA-1, SHA-2(224, 256, 384, 512)
Random Number Generation:
- DRBG (Hash, HMAC and Counter)
- RNG (AES128/192/256), DES, MD5
- RNG (AES128/192/256), DES, MD5
- DRBG (Hash, HMAC and Counter)
- RNG (AES128/192/256), DES, MD5

Non FIPS Approved Algorithms
- RFC 1218/192/256, DES, MD5

Ethernet
- IEEE 802.1AX Link aggregation (static and LACP)
- IEEE 802.2: Logical Link Control (LLC)
- IEEE 802.3: Ethernet
- IEEE 802.3ad 10 Gigabit Ethernet
- IEEE 802.3af Power over Ethernet (PoE)
- IEEE 802.3at Energy Efficient Ethernet (EEE)
- IEEE 802.3u: 100X
- IEEE 802.3x: Flow control – full-duplex operation
- IEEE 802.3z: 1000X

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 925: Address Resolution Protocol (ARP)

Non FIPS Approved Algorithms
- 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 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 1293: Path MNT discovery
- RFC 1350: ICMP router discovery messages
- RFC 1618: An architecture for IP address allocation with CIDR
- RFC 1519: Classless Inter-Domain Routing (CIDR)
- RFC 1542: Clarifications and extensions for BGP
- RFC 1581: Domain Name System (DNS)
- RFC 1712: Requirements for IPv4 routers
- RFC 1918: IP addressing
- RFC 2581: TCP congestion control
IPv6 Features
RFC 1931 Path MTU discovery for IPv6
RFC 2460 IPv6 specification
RFC 2464 Transmission of IPv6 packets over Ethernet networks
RFC 2711 IPv6 router alert option
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)
RFC 4461 Neighbor discovery for IPv6
RFC 4862 IPv6 Stateless Address Auto-Configuration
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

AMF MB and SNMP traps
AT Enterprise MB
Optical DDM MB
SNMPv1, v2c, 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 MB definitions
RFC 1213 MB for network management of TCP/IP-based Internets: MB-1
RFC 1215 Convention for defining traps for usage with the SNMP
RFC 1227 SNMP MIB unk protocol and MB
RFC 1239 Standard MB
RFC 1274 RIPv2 MB extension
RFC 2011 SSMv3 MB for IPv4 using SMv2
RFC 2012 SSMv2 MB for TCP using SMv2
RFC 2013 SSMv2 MB for UDP using SMv2
RFC 2096 IP forwarding table MB
RFC 2578 Structure of Management Information v2 (SMv2)
RFC 2579 Textual conventions for SMv2
RFC 2580 Conformance statements for SMv2
RFC 2674 Definitions of managed objects for bridges with traffic classes, multicast filtering and VLAN extensions
RFC 2741 Agent extensibility (Agent’s) protocol
RFC 2787 Definitions of managed objects for VRRP
RFC 2819 RMON MB (groups 1,2,3 and 9)
RFC 2863 Interfaces group MB
RFC 3176 sfBx: 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 MB for SNMP
RFC 3621 Power over Ethernet (PoE) MB
RFC 3635 Definitions of managed objects for the Ethernet-like interface types
RFC 3636 IEEE 802.3 MAC MB
RFC 4188 Definitions of managed objects for bridges
RFC 4318 Definitions of managed objects for bridges with RSTP
RFC 4593 Definitions of managed objects for remote ping, traceroute, and lookup operations
RFC 5424 Syslog protocol
RFC 6527 Definitions of managed objects for VRRPv3

Multicast Support
Bootstrap Router (BSR) mechanism for PIM-SM
IGMP query solicitation
IGMP snooping (IGMPv1, v2, and v3)
IGMP snooping fast-leave
IGMPv3 MP/MLD state forwarding (IGMPv3/MLD proxy)
MLD snooping (MLDv1 and v2)
PIM-SM and SSM for IPv6
RFC 1112 Host extensions for PIM 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 IPv6v3 for IPv6
RFC 3810 Multicast Listener Discovery v2 (MLDv2) for IPv6
RFC 3956 Embedding the Rendezvous Point (RP) address in an IPv6 multicast address
RFC 3973 Traffic Engineering (TE) MP
RFC 4541 IGMP and MLD snooping switches
RFC 4604 Using IXML and MLv2 for source-specific multicast
RFC 4607 Source-specific multicast for IPv6

Open Shortest Path First (OSPF)
CGSF link-local signaling
CGSF MD5 authentication
CGSF restart signaling
Out-of-band LSLDB resync
RFC 1245 CGSF protocol analysis
RFC 1246 Experience with the CGSF protocol
RFC 1370 Applicability statement for CGSF
RFC 1765 CGSF database overflow
RFC 2328 CGSFv2
RFC 2370 CGSF opaque LSA option
RFC 2719 CGSFv3 for IPv6
RFC 3101 CGSF Not So-Stubby Area (NSSA) option
RFC 3509 Alternative implementations of CGSF area border routers
RFC 3623 Graceful CGSFV3 restart
RFC 3630 Traffic Engineering extensions to CGSF
RFC 4552 Authentication/confidentiality for CGSFv3
RFC 5329 Traffic engineering extensions to CGSFv3

Quality of Service (QoS)
IEEE 802.1p Priority tagging
IEEE 802.1X Multiple Spanning Tree Protocol (MSTP)
IEEE 802.1AX Link aggregation (static and LACP)
IEEE 802.1p Priority tagging
IEEE 802.1Q VLAN tagging
IEEE 802.1S Multiple Spanning Tree Protocol (MSTP)
IEEE 802.1W Rapid Spanning Tree Protocol (RSTP)
IEEE 802.1X Port-based network access control
IEEE 802.1Q VLAN tagging
IEEE 802.1Q VLAN tagging
IEEE 802.1Q VLAN tagging

Routing Information Protocol (RIP)
RFC 1058 Routing Information Protocol (RIP)
RFC 2080 RIP for IPv4
RFC 2081 RIP routing protocol applicability statement
RFC 2082 RIP 2 MD5 authentication
RFC 2453 RIPv2

Security Features
SSH remote login
SSLSv2 and SSLv3
TACACS+ Accounting and Authentication
IEEE 802.1X Authentication protocols (TLS, TTLS, PEAP, MS-CHAP)
IEEE 802.1X Multi supplicant authentication
IEEE 802.1X Port-based network access control
RFC 2560 X.509 Online Certificate Status Protocol (OCSP)
RFC 2818 HTTP over TLS ("HTTPS")
RFC 2895 RADIUS authentication
RFC 2896 RADIUS accounting
RFC 2897 RADIUS attributes for tunnel protocol support
RFC 2986 PKCS #10: certificate request syntax specification v1.7
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 4291 Secure Shell (SSHv2) protocol architecture
RFC 4292 Secure Shell (SSHv2) authentication protocol
RFC 4293 Secure Shell (SSHv2) transport layer protocol
RFC 4294 Secure Shell (SSHv2) connection protocol
RFC 5176 RADIUS CoA (Change of Authorization)
RFC 5246 Transport Layer Security (TLS) v1.2
RFC 5280 X.509 certificate and Certificate Revocation List (CRL) profile
RFC 5423 Transport Layer Security (TLS) transport mapping for Sising
RFC 5668 Elliptic curve digital signature algorithm for SSH
RFC 6125 Domain-based application service identity within PKI using X.509 certificates with TLS
RFC 6164 Transport Layer Security (TLS) encryption for RADIUS
RFC 6688 SHA-2 data integrity verification for SSH

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 1390 Trivial File Transfer Protocol (TFTP)
RFC 1695 SMTP service extension
RFC 2049 MIME
RFC 2131 DHCPv4 (server, relay and client)
RFC 2132 DHCP options and BootP vendor extensions
RFC 2554 SMTP service extension for authentication
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 67)
RFC 3315 DHCP (server, relay and client)
RFC 3632 IPv6 prefix options for DHCPv6
RFC 3646 DNS configuration options for DHCPv6
RFC 3939 Subscriber-ID suboption for DHCPv6 relay agent options
RFC 4303 Simple Network Time Protocol (SNTP) version 4
RFC 5005 Network Time Protocol (NTP) version 4

VLAN Support
Generic VLAN Registration Protocol (GVRP)
IEEE 802.1ad Provider Backbone Bridging (PBB)
IEEE 802.1Q Virtual LAN (VLAN) bridging
IEEE 802.1Q VLAN classification by port and port
IEEE 802.3ac VLAN tagging

Voice over IP (VoIP)
LLDP-MED ANSI/IEEE 802.1AB
Voice VLAN
### Feature Licenses

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<td>AT-FL-IE5-L2-01</td>
<td>IE510-28GSX Layer-2 Premium license</td>
<td>EPSR Master, VLAN Translation, VLAN double tagging (QinQ), ULDL</td>
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<td>AT-FL-IE5-L3-01</td>
<td>IE510-28GSX Layer-3 Premium license</td>
<td>OSPF, OSPFv3, PIM SM, DM and SSM, PIMv6-SM and SSM, RIP, RIPng, VRRP</td>
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<td>AT-FL-IE5-G8032</td>
<td>IE510-28GSX license for ITU-T G.8032</td>
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<td>AT-FL-IE5-0F13-1YR</td>
<td>OpenFlow license</td>
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<tr>
<td>AT-FL-IE5-0F13-5YR</td>
<td>OpenFlow license</td>
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<tr>
<td>AT-FL-IE5-MODB</td>
<td>Modbus license</td>
<td>Modbus for industrial applications</td>
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### Ordering Information

**AT-IE510-28GSX-80**
- 24x 100/1000X SFP, 4x 1/10G SFP+.
- Industrial Ethernet, Stackable Layer 3 Switch

**Supported SFP Modules**

Refer to the installation guide for the recommended Max. Operating Temperature according to the selected SFP module.

#### 10Gbps SFP+ modules

- **AT-SP10TW1** 1 meter SFP+ direct attach cable
- **AT-SP10TW3** 3 meter SFP+ direct attach cable
- **AT-SP10TW7** 7 meter SFP+ direct attach cable
- **AT-SP10ER40/I** 10Gbps ER SFP+, 40 km
- **AT-SP10LR** 10Gbps LR SFP+, 10 km
- **AT-SP10LR/I** 10 Gigabit Small Form-Factor, 20 km
- **AT-SP10LR20/I** 10 Gigabit Small Form-Factor, 20 km
- **AT-SP10LRM** 10Gbps LRM SFP+, 550 m
- **AT-SP10SR** 10Gbps SR SFP+, 300 m
- **AT-SP10SR/I** 10Gbps SR SFP+, 300 m
- **AT-SP10ZR80/I** 10Gbps ZR SFP+, 80 km

#### 1000Mbps SFP modules

- **AT-SPBD10-13** 10 km, 1G BiDi SFP, LC, SMF (1310 Tx/1490 Rx)
- **AT-SPBD10-14** 10 km, 1G BiDi SFP, LC, SMF (1490 Tx/1310 Rx)
- **AT-SPBD20-13/I** 20 km, 1G BiDi SFP, SC, SMF, I-Temp (1310 Tx/1490 Rx)
- **AT-SPBD20-14/I** 20 km, 1G BiDi SFP, SC, SMF, I-Temp (1490 Tx/1310 Rx)
- **AT-SPBD20LC/I-13** 20 km, 1G BiDi SFP, LC, SMF, I-Temp (1310 Tx/1490 Rx)
- **AT-SPBD20LC/I-14** 20 km, 1G BiDi SFP, LC, SMF, I-Temp (1490 Tx/1310 Rx)
- **AT-SPFX/2** 2 km, 100FX SFP, LC, MMF, 1310 nm
- **AT-SPFX/15** 15 km, 100FX SFP, LC, SMF, 1310 nm
- **AT-SPFXBD-LC-13** 15 km, 100FX BiDi SFP, LC, SMF (1310 Tx/1550 Rx)
- **AT-SPFXBD-LC-15** 15 km, 100FX BiDi SFP, LC, SMF (1550 Rx/1310 Tx)
- **AT-SPFX/S** 550 m, 1000SX SFP, LC, MMF, 850 nm
- **AT-SPS/E** 550 m, 1000SX SFP, LC, MMF, 850 nm, Ext. Temp
- **AT-SPTX** 100 m, 10/100/1000T SFP, RJ-45
- **AT-SPTX/I** 100 m, 10/100/1000T SFP, RJ-45, I-Temp
- **AT-SPZ80** 80 km, 1000ZX SFP, LC, SMF, 1550 nm

#### 100Mbps SFP Modules

- **AT-SPFX/2** 2 km, 100FX SFP, LC, MMF, 1310 nm
- **AT-SPFX/15** 15 km, 100FX SFP, LC, SMF, 1310 nm
- **AT-SPFXBD-LC-13** 15 km, 100FX BiDi SFP, LC, SMF (1310 Tx/1550 Rx)
- **AT-SPFXBD-LC-15** 15 km, 100FX BiDi SFP, LC, SMF (1550 Rx/1310 Tx)