Introduction to Industrial Ethernet Switches

The Broadest Portfolio of Industrial Ethernet Switch Solutions

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Solutions Tailored for Industrial Infrastructures

Industrial automation applications require industrial-grade solutions that ensure availability, real-time operation, security, and reliability. Building a fully rugged infrastructure that is stable enough to ensure smooth system operations is even more challenging. In this case, solutions that support resilient and flexible network redundancy, real-time monitoring and control, seamless integrated security, and rugged parameters are needed. Moxa offers a full spectrum of industrial Ethernet switches that fit all industrial requirements.

Network Requirements for Industrial Applications

Absolute Network Availability and Resilience
- Rapid recovery capability eliminating single points of failure to ensure continuous operations
- Easy and flexible redundant network planning

Real-time Network Monitoring and Control
- Powerful network management platform to supervise networks, ensuring optimal operations and minimal system downtime
- Dynamic device status reports by email warning or signal outputs (e.g., digital output, relay contact) prevent system damage and losses

Advanced Network Management and Security
- Seamlessly integrate with industrial automation networks
- Intelligent implementations to optimize network performance
- Easily migrate to next generation networking standards
- Secure data transmission across networks

Rugged Design with Reliability and Durability
- Redundant power inputs to reduce vulnerability to power failures
- Ring topology to provide a backup path
- Fanless and high MTBF
- Withstands extreme temperature, shock, drops, and vibrations
- A rugged high strength housing to keep out harmful substances
- Strict industrial regulatory approval to ensure safe operation

Moxa’s Solutions

- Moxa Turbo Ring™ self-healing technology for network redundancy (recovery time < 20 ms)
- Line-swap fast recovery for quick response when devices change ports
- Innovative Turbo Chain™ technology for flexible redundant network planning (recovery time < 20 ms)

- MXview industrial network management software for visualizing and troubleshooting your networks
- Automatic email warnings and relay output alarms for port breaks and power failures

- EtherNet/IP, Modbus/TCP, IEEE 1588 PTP, LLDP, DHCP Option 82, SNMP Inform, GoS, IGMP snooping, and VLAN supported
- IPv6 compliant for next generation Internet technologies
- Integrated security features: TACACS+, IPv6 802.1X, HTTPS, SSH, SNMPv3, and port security supported

Product Portfolio

Moxa is your one-stop shop for industrial DIN-Rail mounted and rack mounted Ethernet switches, allowing you to choose the right products for your applications. All of Moxa’s network switches have an optimal price-to-performance ratio for building robust Ethernet platforms in industrial environments.

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Embedded Ethernet switches
Rackmount managed and unmanaged Ethernet switches
PoE/PoE+ managed and unmanaged Ethernet switches
Rackmount managed and unmanaged Ethernet switches
Network management software
Firewall/VPN secure router
Moxa’s MXview industrial network management software is designed to analyze, monitor, configure, and troubleshoot the remote network connections formed by Moxa’s managed Ethernet switches, wireless AP/bridge/client solutions, and other SNMP networked devices for industrial automation. It visualizes the physical wiring map of your network via a simple, user-friendly Web Browser UI for remote management. You can easily track real-time network status, identify failure points quickly, and reduce the troubleshooting response time of complex and critical network operations with MXview.

MXview Live Network Topology Visualization for Easy Troubleshooting

MXview Live Network Topology Visualization for Easy Troubleshooting

The SCADA/HMI system is the supervisory core of industrial control systems. It connects to RTUs, PLCs, and the network infrastructure for complicated data acquisition, monitoring, and control to ensure efficient and safe operations. Moxa provides several network management solutions, including SNMP OPC server and EtherNet/IP and Modbus/TCP-enabled network devices, to easily and directly integrate network status into SCADA/HMI systems. In addition, users now have a new option for network supervision with Moxa’s industrial network management software, which supports SNMP devices and Moxa’s Ethernet switches installed on industrial networks.

High-performance Layer 3 Switching Capability

Layer 3 switches use the IP address to make switching decisions, as routers do, but are hardware optimized to transmit data just as fast as Layer 2 switches. The 802.1Q VLAN of a Layer 2 switch allows network operators to configure and maintain their network more effectively, but cross VLAN communication still relies on traditional Layer 3 routers. Both routers and Layer 3 switches use a routing protocol and routing table to determine the best path. However, compared to routers, which are usually software-based, Layer 3 switches are faster and less expensive. This is due to their built-in switching hardware with optimized chips and full-wire speed IP frame forwarding performance suitable for interconnecting VLANs. Moxa now offers high-performance Layer 3 switches that use state-of-the-art routing technology to partition a large-scale LAN into multiple subnets for improved network performance.

Layer 3 Switching Supported by Moxa

- Static Routing
- RIP v1/v2 (Routing Information Protocol)
- OSPF (Open Shortest Path First)
- DVMRP (Distance Vector Multicast Routing Protocol)
- PIM-DM (Protocol Independent Multicast-Dense Mode)
Reliable Network Redundancy

Ethernet network redundancy is essential to today’s industrial Ethernet infrastructures. When a highly integrated system experiences a connection failure, the consequences are costly or even disastrous. In order to maximize system reliability and uptime during network failures, Moxa industrial managed Ethernet switches support enhanced Turbo Ring™ and Turbo Chain™ redundant technology in addition to standard RSTP/STP and port trunking.

Turbo Ring™ for Ring and Media Redundancy

Moxa Turbo Ring™ is a proprietary self-healing technology that enables fast fault recovery of under 20 ms (at a full load of 250 switches). Turbo Ring™ supports three topology options—ring coupling, dual-ring, and dual homing—to reduce redundant network cabling and network planning costs and to ensure the high reliability of your industrial network applications.

**Ring Coupling**—helps you separate distributed devices into different smaller redundant rings, without a control line, but in such a way that the smaller rings at different remote sites will still be able to communicate with each other.

**Dual-Homing**—involves coupling two separate rings with a single EDS switch connecting to two independent connection points. The back-up path will be activated if the operating connection (or main path) fails.

Use Turbo Chain™ to Create Redundant Connections for Large-scale Networks

Moxa’s Turbo Chain™ is an innovative breakthrough that unlocks the ability to create multiple redundant networks beyond the current limitations of redundant ring technology. Turbo Chain™ is easily configured by linking two user-configured end ports with the same segment. Turbo Chain™ easily connects and extends existing redundant networks by enabling high network availability with its self-healing capability (recovery time < 20 ms). In addition, Turbo Chain™ supports standard IEEE 802.1w/802.1D-2004 RSTP and STP protocols. Compared with ring coupling solutions or a network re-design, Moxa Turbo Chain™ is more flexible and cost-efficient and has the potential to save a significant amount on development costs, time, effort, cabling, and Ethernet ports.

**Turbo Chain™: Beyond Redundant Ring**

- Flexible network topology
- Unlimited and easy network expansions
- Fast fault recovery (recovery time < 20 ms)
- Cost-effective configurations
- Moxa’s industrial managed Ethernet switches supported
IPv6 was introduced to increase the number of available IP addresses. Available IPv4 addresses will soon be completely exhausted, so support for IPv6 (128-bit IP addresses) is important to secure the future of your network. Moxa’s managed Ethernet switches have been certified as IPv6 ready by the global IPv6 Forum. They can support IPv6 and IPv4 dual stack service to offer better addressing and security for large networks to protect your future investments.

Efficient Network Performance

Port Trunking for Flexible Network Connections

IEEE 802.3ad (LACP, Link Aggregation Control Protocol) provides flexible network connections and a redundant path for critical devices. For example, the EDS-518A allows users to set up a wider communication path by aggregating a trunk group. A maximum of eight ports can be assigned to one trunk group to optimize your network connection and redundant paths. When selected ports are grouped for trunking, LACP will exchange information to determine whether or not the ports selected in a group can be trunked together.

Transition to Next Generation IPv6 Networks

Quality of Service (QoS) provides a traffic prioritization capability to ensure that important data is delivered consistently and predictably. Moxa’s managed Ethernet switches can inspect IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information, to provide a consistent classification of the entire network. The QoS capability of the managed Ethernet switches improve your industrial network’s performance and determinism for mission-critical applications.

VLAN Eases Network Planning

A VLAN is a group of devices that can be located anywhere on a network, but which communicate as if they are on the same physical segment. VLANs can be used to segment your network without being restricted by physical connections—a limitation imposed by traditional network design. Since all automation systems incorporate sensitive devices that must be protected from unauthorized access, it is essential to have an authentication system set up that only allows authorized users to access the system. If devices belong to different VLANs, they cannot communicate with each other, providing extra security and protection from unwanted invasion or traffic. The IEEE 802.1Q standard and GVRP protocol can exchange the same interoperable parameters to keep consistent VLAN settings over the entire network.

IGMP Snooping and GMRP for Filtering Multicast Traffic

Moxa’s managed Ethernet switches support IEEE 802.1D-1998 GMRP (GARP Multicast Registration Protocol) and IGMP snooping, which provide the ability to prune multicast traffic so that it travels only to those end destinations that require it. The overall effect is to reduce the amount of traffic on the Ethernet LAN.
**IEEE 1588 PTP Enhances Clock Synchronization of Automation Devices**

IEEE 1588 PTP, also known as Precision Time Protocol (PTP), is designed to synchronize the real-time clocks located at the nodes of a distributed system that communicates over a network. Moxa’s managed Ethernet switches with IEEE 1588 PTP are well suited for applications such as motion control that require distributed clocks to be synchronized with great accuracy.

**Easy Network Management**

**SNMP Inform Enables Reliable Event Management**

SNMP Inform is used to acknowledge receipt of event notifications. If you use SNMP to monitor your network systems, you can use this event action to send an SNMP Inform notification in response to the specified critical event. Moxa’s managed Ethernet switches can ask an SNMP manager to send an SNMP response to confirm that notification has been received. This means that the SNMP Inform message can be resent several times if a response is not initially received.

**EtherNet/IP and Modbus/TCP Easily Integrate with SCADA/HMI Systems**

EtherNet/IP and Modbus/TCP are international industrial communication protocols that provide a direct connection to automation and control systems. Moxa’s managed Ethernet switches support communication with SCADA/HMI systems using the EtherNet/IP or Modbus/TCP protocol. SCADA/HMI systems can monitor the status of managed Ethernet switches to provide industrial applications with a seamless process and real-time data acquisition.

**Automated Topology Discovery with LLDP**

The Link Layer Discovery Protocol or LLDP (IEEE 802.1AB) is a data-link layer protocol that advertises device information, such as IP address, description, and system capabilities, to neighboring devices over the network. Moxa’s managed Ethernet switches fully implement LLDP. Network management software, such as Moxa’s MXview, can easily discover and manage LLDP-enabled devices to create accurate network topologies and maintain the information used by access devices.

**Intelligent DHCP Option 82 IP Address Allocation**

DHCP Option 82 refers to the “DHCP Relay Agent Information Option,” which allows a DHCP Relay Agent to insert detailed information, such as port information and MAC addresses of relay agents, to a request being transmitted to a DHCP server. DHCP servers can use this information to allocate IP addresses and other assignment settings that are mapped to its MAC address table. Moxa’s managed Ethernet switches support DHCP Option 82, and play the role of DHCP relay agent to communicate a DHCP request. When a new device replaces a device connected to a Moxa switch, the DHCP server can offer the same assigned IP address to reduce system downtime and maintenance requirements.

**Efficient Network Monitoring and Proactive Management with RMON**

RMON (Remote Network Monitoring) is an Internet Engineering Task Force (IETF) standard monitoring specification that allows various network agents and console systems to exchange network monitoring data. RMON provides you with comprehensive network fault diagnosis, planning, and performance-tuning information, and helps you manage your network in a more proactive manner. If configured correctly, RMON probes deliver information before problems occur. This means that you can take action before the problems affect users.
Immediate Event Notifications with Real-time Alarms

Warning by E-mail
Moxa’s managed Ethernet switches send out a warning e-mail when an exception is triggered, providing system managers with real-time alarm messages.

<table>
<thead>
<tr>
<th>Switch Events</th>
<th>Port Events</th>
</tr>
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<tbody>
<tr>
<td>Cold Start</td>
<td>Link On</td>
</tr>
<tr>
<td>Warm Start</td>
<td>Authentication Failure</td>
</tr>
<tr>
<td>Power On/Off</td>
<td>Link Off</td>
</tr>
<tr>
<td>Topology Change</td>
<td>Configuration Change</td>
</tr>
<tr>
<td>Traffic Overload</td>
<td></td>
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</tbody>
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Warning by Relay Output
The managed Ethernet switches provide relay outputs that can be configured to indicate the importance of events when notifying or warning engineers in the field. In response, engineers can respond to higher priority messages quickly and with the appropriate emergency maintenance procedures.

DI for Integrating Other Important Sensors
Moxa’s managed Ethernet switches (not including the EDS-400A or IKS series switches) have two digital inputs for integrating sensors into the Ethernet switches’ automatic alarm mechanism. This is done by redirecting warning messages to an IP network by e-mail notification.

Advanced Network Security

Seamlessly Integrated Network Security
Security is one of the most important requirements for protecting the infrastructure of mission-critical networks. Moxa’s managed Ethernet switches support IEEE 802.1X (port-based network access control) to restrict port access to authorized users only. Authentication is done using the local user database or an external RADIUS server. To further protect data interception, HTTPS and SSH protocols are supported for transferring encrypted data over the Internet. With Radius, TACACS+, IEEE 802.1X, HTTPS, SSH, SNMPv3, and port lock limited access by MAC address, Moxa’s managed switches offer a seamless integrated network security solution to secure your industrial network data.

Rugged Industrial Design for Outstanding Reliability

Industrial environments have many hazards, and have exacting requirements for ruggedized equipment:
- Reliable power inputs for maximum network uptime
- Ability to withstand exposure to extreme temperatures
- Immunity from electromagnetic interference
- Ability to withstand vibration, impacts, dust, humidity, and corrosive environments
- Compliant with certification standards
- Long-term durability

Stable and Versatile Power Inputs for Industrial Applications

The redundant power inputs on Moxa’s industrial Ethernet switches can be a life saver; if one power source fails, the redundant power input will kick in and keep the entire system operating safely. Some models feature a wide range of 12/24/48 VDC power inputs, and can handle large power fluctuations (e.g., 48 VDC can handle voltage increases of up to +20%, and 12 VDC can handle voltage decreases down to -20%). If your application is restricted to VAC input power, choose a Moxa Ethernet switch (such as the EDS-200A/200 series) that is specially designed to handle AC power. With these switches you can use either a 24 VDC or 24 VAC power input.

Designed to Withstand Extreme Temperatures

Industrial environments can be extremely hot or unbearably cold, and require network devices that operate reliably when subjected to wide temperature fluctuations. Moxa’s Ethernet switches are rigorously tested beyond industry standards to ensure they will operate in a -40 to 75°C operating temperature range. For example, whereas regulatory standards require only a temperature change of 1°C/minute throughout the cycling examination, Moxa conducts stricter testing with 3°C/minute.

Moxa’s Ethernet switches are all held to strict minimal packet loss requirements, and use passive cooling to ensure reliability even in extreme temperatures.
Outstanding Electromagnetic Immunity

The rugged design of Moxa’s industrial Ethernet switches includes excellent electromagnetic immunity that often surpass the requirements stipulated by EN 50121-4, DNW, and IEC 61000. For example, to provide immunity against magnetic fields induced by power frequencies, Moxa designs for 300 A/m applied continuously and 1000 A/m applied for 1 to 3 second intervals, which is three times stricter than EN 50121-4.

Network Connections Well-protected against Harsh Environmental Conditions

Moxa’s Ethernet switches are built to endure harsh environmental conditions. For example, vibration is a significant challenge for maritime and transportation applications. Moxa’s switches conform to the IEC60068-2-6 standard and are tested at over 1 g of acceleration for an extended time period. When it comes to shock impacts, some of Moxa’s Ethernet switches are designed to exceed other standards, such as NEMA TS2, by an additional 5 g’s of acceleration. Moreover, all Moxa products feature a rugged and high strength housing to protect against the dust and spills that are commonplace at manufacturing locations.

Networking Solutions Certified to Meet Industrial Standards

Several certifications confirm the reliability of Moxa’s industrial Ethernet switches:

- UL 508 and UL 60950-1 certifications for safe use in hazardous locations
- Class I Division 2, ATEX Zone 2 for use in mining and oil and gas industries
- DNV/GL/ABS/LR/NK for marine environments
- NEMA TS2 for traffic control applications
- EN 50121-4 for railway wayside applications
- UL 508 and UL 60950-1 certifications for safe use in hazardous locations
- Class I Division 2, ATEX Zone 2 for use in mining and oil and gas industries
- DNV/GL/ABS/LR/NK for marine environments
- NEMA TS2 for traffic control applications
- EN 50121-4 for railway wayside applications

Relay Output Alarm, Broadcast Storm Protection, 5-year Warranty

- Many of Moxa’s Ethernet switches feature relay output alarms, which provide relay contact outputs to warn engineers on the shop floor when the power fails or a port link breaks, so that they can respond quickly with appropriate emergency procedures.
- Moxa’s unmanaged Ethernet switches are protected from receiving too many broadcast packets. These Ethernet switches have an option to discard broadcast or multicast packets if the number of those packets exceeds a threshold in a preset period of time. When the preset time period expires, the switch will resume receiving broadcast or multicast packets until the threshold is reached again.
- All of Moxa’s Ethernet switches are fanless and feature high MTBF (Mean time Between Failures) ratings for long-term operation. In addition, Moxa’s switches carry a solid 5-year warranty.

Power-over-Ethernet Solution for Simple and Flexible Connections

Moxa provides a complete range of solutions for any IEEE 802.3af/at PoE/PoE+ compliant units that are ideal for hard-to-reach outdoor or harsh environments where a power installation is not readily available or is cost-prohibitive. These PoE products provide PoE powered devices (PDs) with a stable and cost-effective electric power source over an Ethernet cable.

PoE Portfolio

- Managed and unmanaged PoE and PoE+ switches support a highly resilient technology, redundant VDC power inputs, smart PoE functionality, and industrial-grade design.
- Easy-to-scale rackmount PoE switches support up to 16 PoE ports.
- PoE+ injectors inject the needed power, and the data to PoE devices.
- PoE splitters separate the power and data from a PoE input, and distribute the power to non-PoE devices.