



EN 50155
IRIS Certification

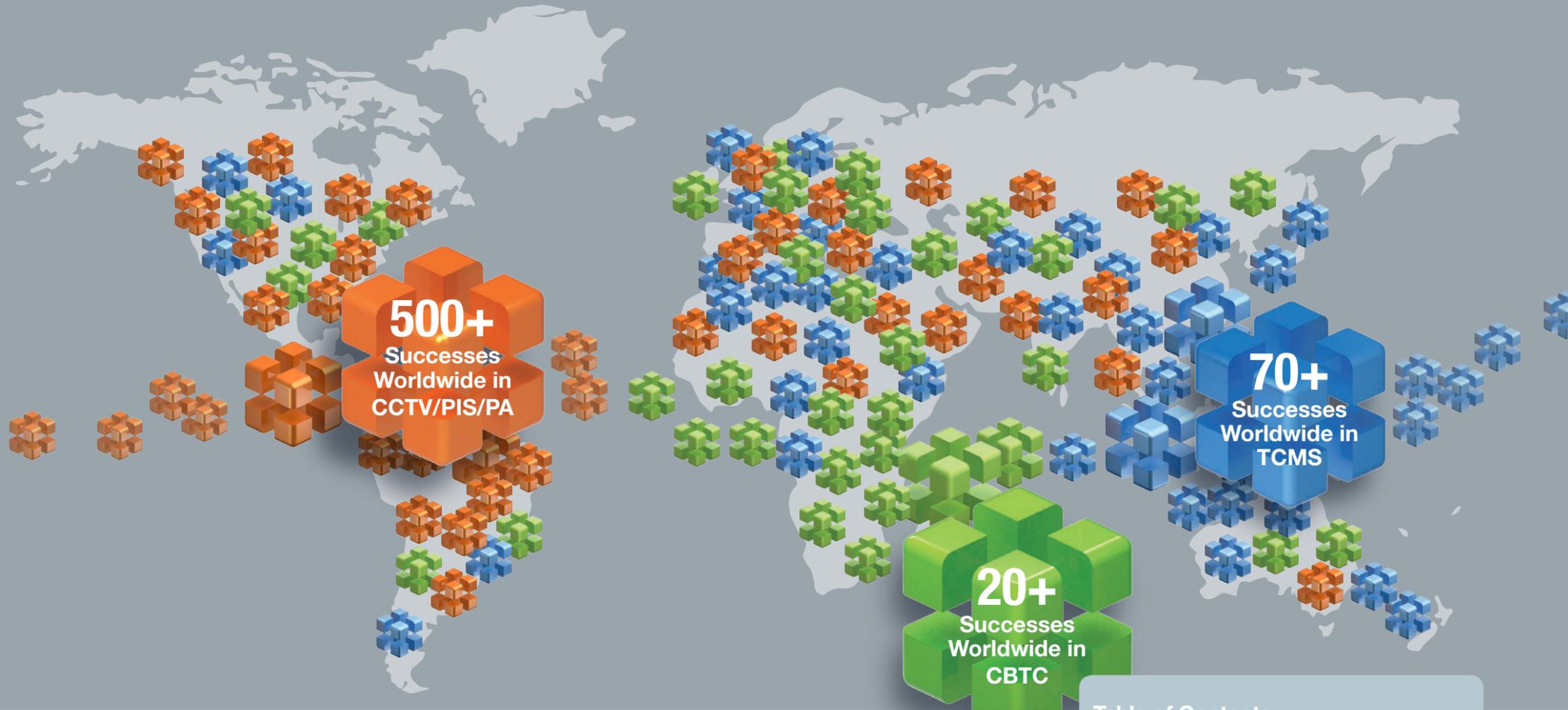
Integrated IP Solutions for Smarter Railways

Industrial Networking and Computing Solutions

Travel Comfortably, Arrive Safely

Your Trusted Partner in Railway Automation

Moxa is an IRIS-certified global leader for a wide range of IP-based communications solutions. Moxa continually contributes its networking expertise and innovative technologies to the railway industry through new market-specific solutions and membership of the IEC railway committee. Railway operators from around the world have discovered new operational efficiencies by deploying Moxa's unique railway technologies, such as intelligent wireless inter-carriage connections, millisecond-level Ethernet redundancy, and WLAN roaming solutions. With over 30 years of experience in industrial networking, Moxa has a proven record of developing products with longevity and has been part of hundreds of worldwide successful deployments on major railway systems for establishing or upgrading passenger comfort and network operations.



IRIS-Certified for Maximum Quality

Moxa has proven its ability to meet the specific requirements and growing expectations of railway customers by receiving the coveted International Railway Industry Standard (IRIS) certification. This certification attests to Moxa's high standards in all phases of product development, including design, development, and manufacturing. The certification covers passenger information systems and communication systems.



Wide-Range of Rail-Certified Products

Moxa's portfolio includes over 400 railway-specific products ranging from onboard to trackside, and end devices to network architecture. Moxa provides integrated IP solutions that enhance the safety and efficiency of railway operations. Our end devices include computers tailor-made for deployment on trains, and controllers and remote I/O products for condition monitoring. For railway IP network design, we utilize our industrial networking expertise to provide a variety of Ethernet switches for onboard, trackside, train stations, control centers, wireless AP/client for train-to-ground communications, and smart network management software to help optimize the efficiency of the network.

Hundreds of Successful Deployments Worldwide

Rail systems operate on a decades-long life cycle. Rail systems are considered mission-critical applications that require highly reliable IP-based solutions. We have been devoted to the railway industry for many years and have established strong credibility by deploying our networking and computing solutions around the world. The hundreds of successful deployments of Moxa's products in major railway systems such as CCTV, PIS (Passenger Infotainment Systems), CBTC (Communication-based Train Control), and TCMS (Train Control Management Systems), have proven that our leading IP solutions are capable of providing high reliability and network availability that meet the demands of the rail industry.

Table of Contents

Overview

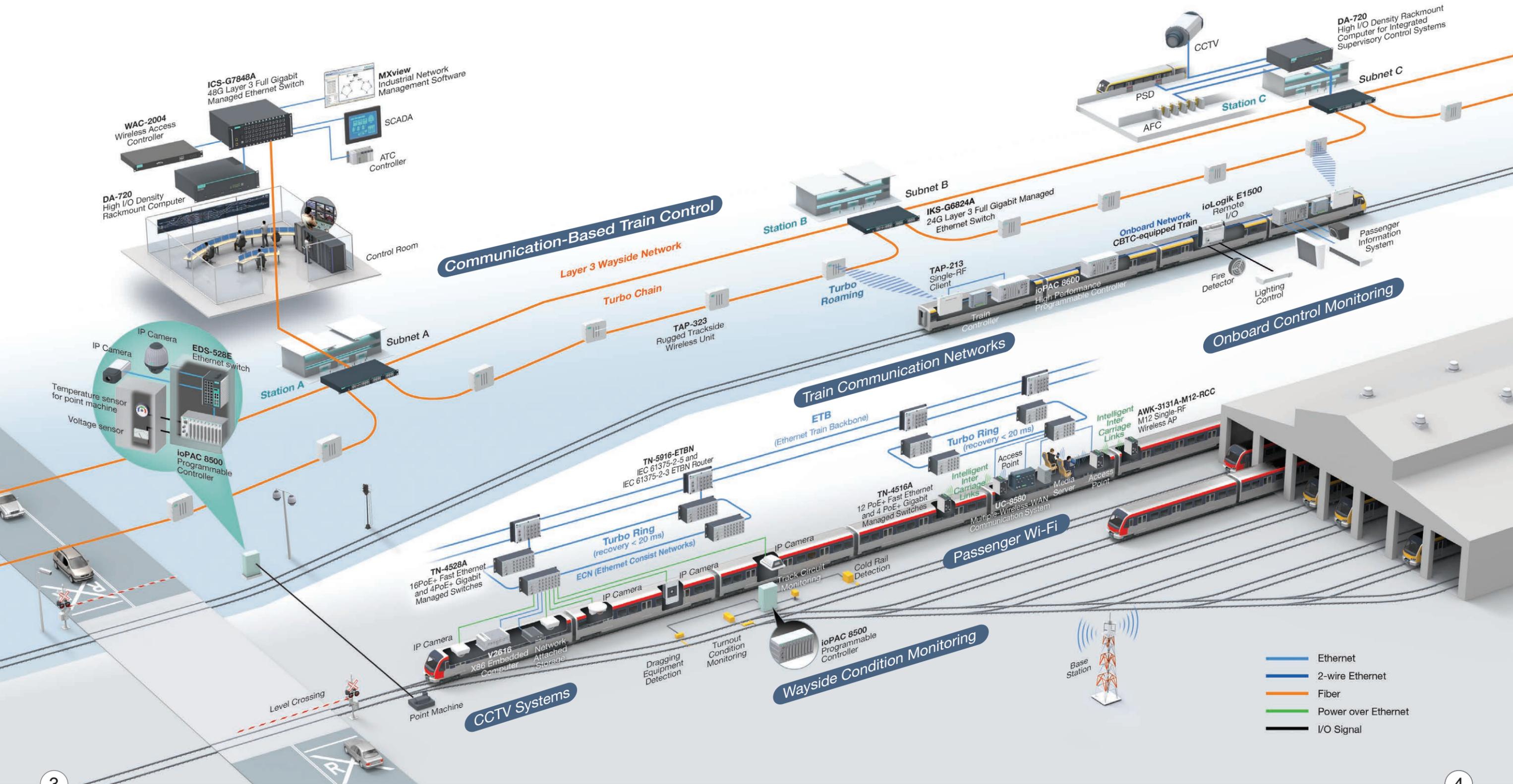
Your Trusted Partner in Railway Automation	P1
Integrated IP Solutions for Rail Systems	P3

Moxa Solutions for Major Railway Systems

Optimized Networks for Multiple Systems	P5
Communication-Based Train Control (CBTC)	P9
Train Communication Network (TCN)	P13
Passenger Wi-Fi	P17
Condition Monitoring	P19

Integrated IP Solutions for Rail Systems

With over 30 years of experience in the railway industry, Moxa has a broad portfolio that provides wired and wireless networking, computing, controller, and I/O solutions for trains, trackside, at stations as well as the control center. Moxa's integrated IP solutions have been deployed all over the world in railway systems including CCTV, CBTC, TCMS, Passenger Wi-Fi, condition monitoring, and other railway systems.



Optimized Networks for Multiple Systems

Trains require multiple systems such as a Passenger Information System (PIS) and Public Address (PA) system that help ensure a safe and smooth travel experience for passengers. In order to enhance passenger safety, IP surveillance systems are essential on modern trains. IP surveillance systems are dependent on reliable Ethernet networks to deliver data from surveillance cameras and passenger information systems to a control center. With optimized multi-purpose systems, train operators can fulfill a variety of system demands. Moxa's large product portfolio ensures onboard, train-to-ground, and wayside communications are reliable and robust enough to tackle the unique challenges of the rail industry.

Requirements for Networks that Support Multiple Systems

- High-bandwidth onboard networks for multiple systems including CCTV
- Reliable train-to-ground connectivity to support seamless network communications between onboard and wayside systems
- An easy-to-use platform that can connect more than 10 independent subsystems for effortless system expansions at the wayside and reliable wayside communications
- Durable computing platform for network video recorders (NVRs)

Multi-Purpose Network Solutions

<p>1 TN-4528A-16PoE-4GPoE Onboard Ethernet Switch</p> <ul style="list-style-type: none"> • 24+4G Port • Up to 20 PoE+ ports • Up to 30 watts per PoE port • Up to 120 watt PoE power budget 	<p>2 TAP-213 Onboard Wireless AP/Client</p> <ul style="list-style-type: none"> • 300 Mbps data rate • Fast roaming function 	<p>3 TAP-323 Trackside Wireless Unit</p> <ul style="list-style-type: none"> • 300 Mbps data rate • 2 fiber SFP ports and 4 PoE ports 	<p>4 IKS-6728A-8PoE Layer 2 Trackside Ethernet Switch</p> <ul style="list-style-type: none"> • 24+4G PoE+ port • Multicast/unicast traffic redundancy 	<p>5 ICS-G7852A Layer 3 Trackside Ethernet Switch</p> <ul style="list-style-type: none"> • 48G+4 10GbE port • Multicast/unicast traffic redundancy 	<p>6 MXstudio Industrial network management suite for installation, operation, maintenance, and diagnostics</p> 
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You may also be interested in

TN-4516A-12PoE-4GPoE
Onboard Ethernet Switch

- 12+4G Port
- Up to 12 PoE+ ports
- Up to 30 watts per PoE port



Rail Integrated Supervisory Control System

7 DA-720
High I/O Density Rackmount Computer

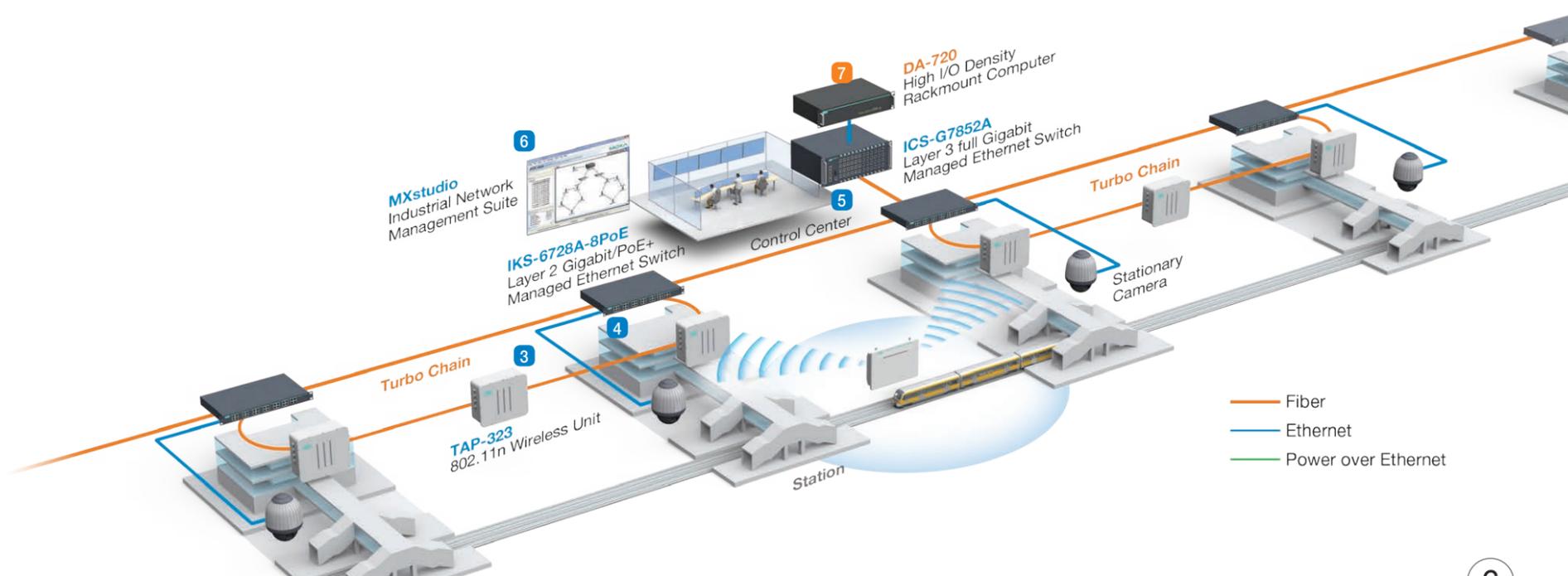
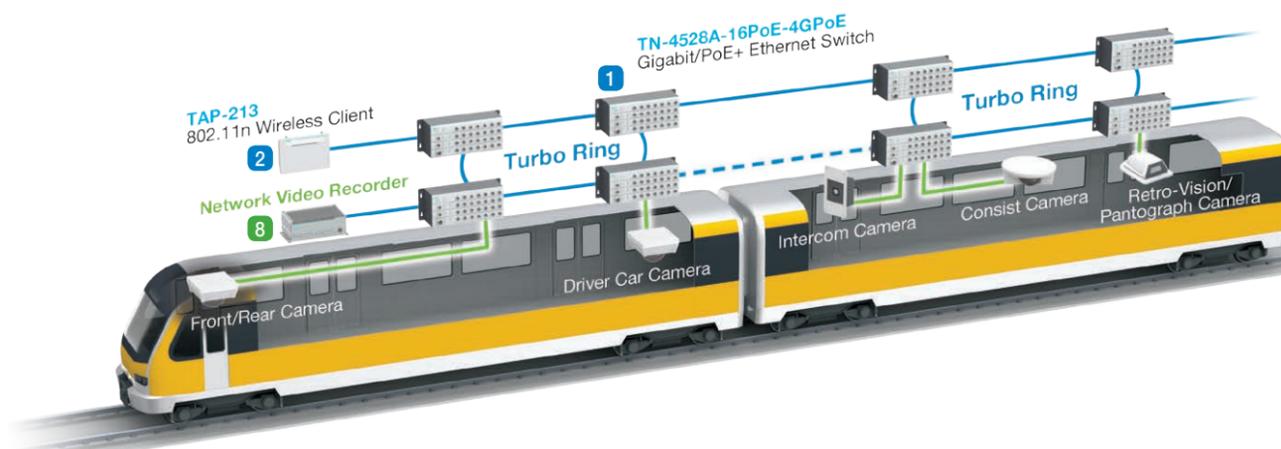
- High I/O density: Up to 22 gigabit LAN ports + 10 serial ports, or 14 gigabit LAN ports + 18 serial ports
- Compliance with EN 50121-4 standard



Network Video Recorder (NVR) Computing Solutions

8 V2416A/V2616A
NVR Computers

- High-performance CPU
- Reliable storage function

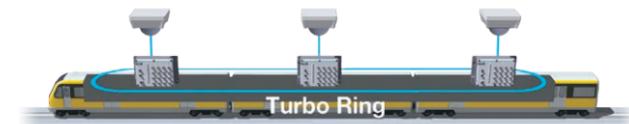
Moxa's Solutions

Network Solutions

Onboard Gigabit and PoE Network Solutions

Onboard CCTV Network Solutions

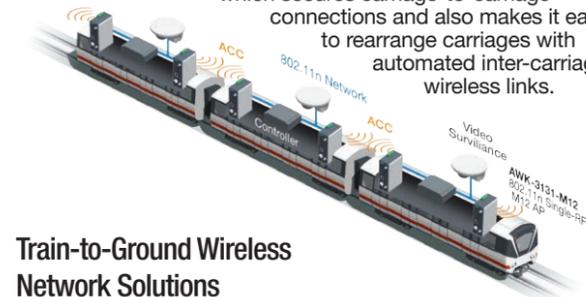
To handle video security or CCTV, Moxa's Ethernet switches can deliver Gigabit speeds to provide enough bandwidth to support applications now and into the future. The TN-4500A Series onboard Ethernet switches have up to 28 ports, including Gigabit ports for smooth full HD video transmissions and Power over Ethernet that provide up to 30 watts per port with a maximum power budget of 120 watts per switch to power networked devices in difficult-to-reach locations and to simplify field wiring and reduce installation costs. In addition, the TN-4500A Series supports Turbo Ring technology for network redundancy to ensure video image failures last less than 50 ms with a 10G/1G Gigabit Ethernet backbone and Dynamic Ring Coupling technology for easy maintenance of the redundant network when train consists are coupled or decoupled.



Turbo Ring (10G/1G Ethernet recovery time < 50 ms)

Onboard Wireless Networks

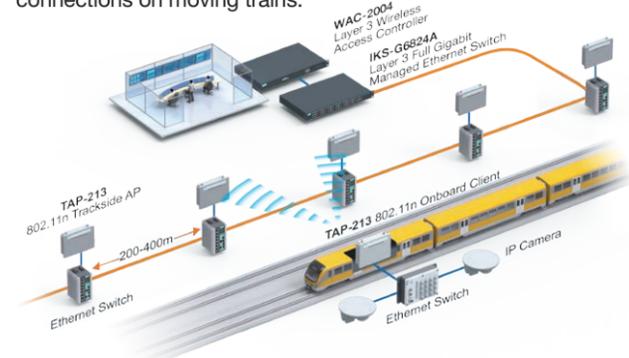
If you need a wireless CCTV network, our AWK-RCC Series supports the 802.11n standard with up to 300 Mbps bandwidth for video transmissions. Our devices support ACC technology, which secures carriage-to-carriage connections and also makes it easy to rearrange carriages with automated inter-carriage wireless links.



Train-to-Ground Wireless Network Solutions

Wireless Communications for Multiple Rail Systems

Moxa's train-to-ground TAP Series wireless devices are the ideal ruggedized wireless solution for railway onboard train-to-ground applications. The TAP Series allows data rates of up to 300 Mbps with the IEEE 802.11n standard so that it can ensure seamless data communications for multiple applications such as CCTV from onboard to wayside. Moxa also offers IP68-rated products for onboard and trackside applications. With their vibration-proof design, the TAP Series can ensure uninterrupted connections on moving trains.



Uninterrupted Train-to-Ground Communications

To keep roaming working on high-speed trains, Moxa's controller-enabled Turbo Roaming performs pre-authentication and accelerates roaming for handoff times under 50 ms, which is vital to achieve uninterrupted train-to-ground connectivity.

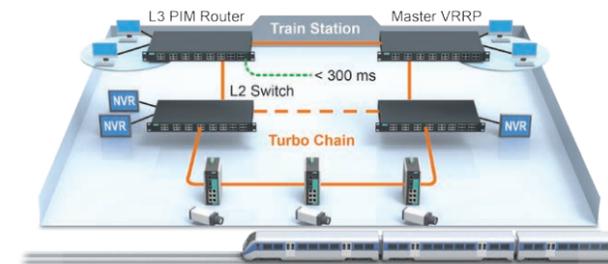


Future-proof Wayside Communications Solutions

Reliable Wayside Connectivity

Wayside Network Redundancy: V-ON

With the demand of connecting more and more systems in railway applications, it becomes more and more important to have resilient connections that can recover within milliseconds. To prevent data loss on layer 2 and layer 3 multicast networks, Moxa introduced V-ON, an innovative technology that integrates Turbo Ring and Turbo Chain protocols and optimizes multicast traffic to enable data, voice, and constant connectivity, especially for multicast-intensive train station applications.



Wayside Communication Networks

In order to provide seamless video surveillance monitoring at the control center, wayside communication networks require:

Moxa's layer 2 and 3 managed Ethernet switches support up to 48G and four 10GbE ports for large scale video over IP networks.

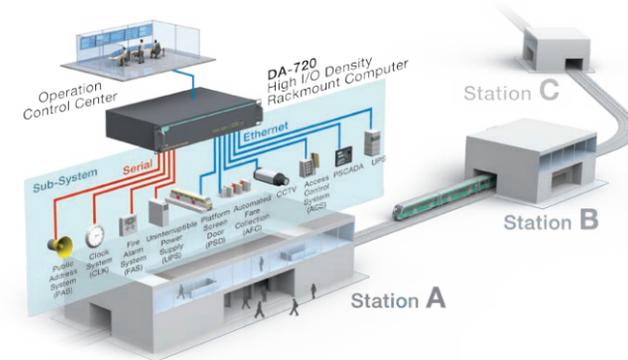


MXstudio is a network management suite designed for installation, operation, maintenance, and diagnostics on rail networks.



Computing Platform for Integrated Supervisory Control Systems

As more and more subsystems are integrated into the core rail system, increasing the complexity of the networks and interfaces, the use of integrated supervisory control systems (ISCSs) with front-end processors in rail automation systems is increasing. Compliant with the EN 50121-4 standard for rail automation, Moxa's DA-720 computers, which provide isolated LAN ports to connect more than 10 independent subsystems, are the best fit for ISCSs.

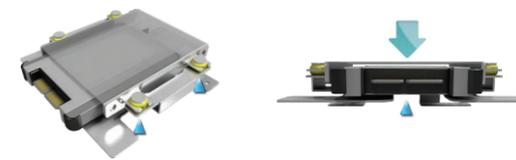


Durable NVR Computers for Different Performance Requirements

NVR Computing Platform Technology Highlights

Secure and Reliable Disk Access During Extreme Vibrations and Shocks

Vibration might be the biggest engineering challenge for computers designed to be used on moving trains. One important part of the solution is to use either solid state drives (which have no moving parts), or industrial-grade hard disks that have been engineered to withstand long periods of heavy vibration. By mounting these already sturdy drives on a highly shock-resistant bracket, the natural tolerances of these devices are significantly enhanced.



Yet these workarounds may still not be enough. The only way to ensure that a device remains unaffected by strong vibrations is to build an independent vibration sensor into the platform, one that may be directly accessed from within the operating system, so that vibration conditions can be monitored and recorded for analysis and system adjustment.

Moxa's V2416A/V2616A NVR computers passed the EN 50155 vibration test with HDDs installed, ensuring they can provide reliable, secure video storage for moving trains.



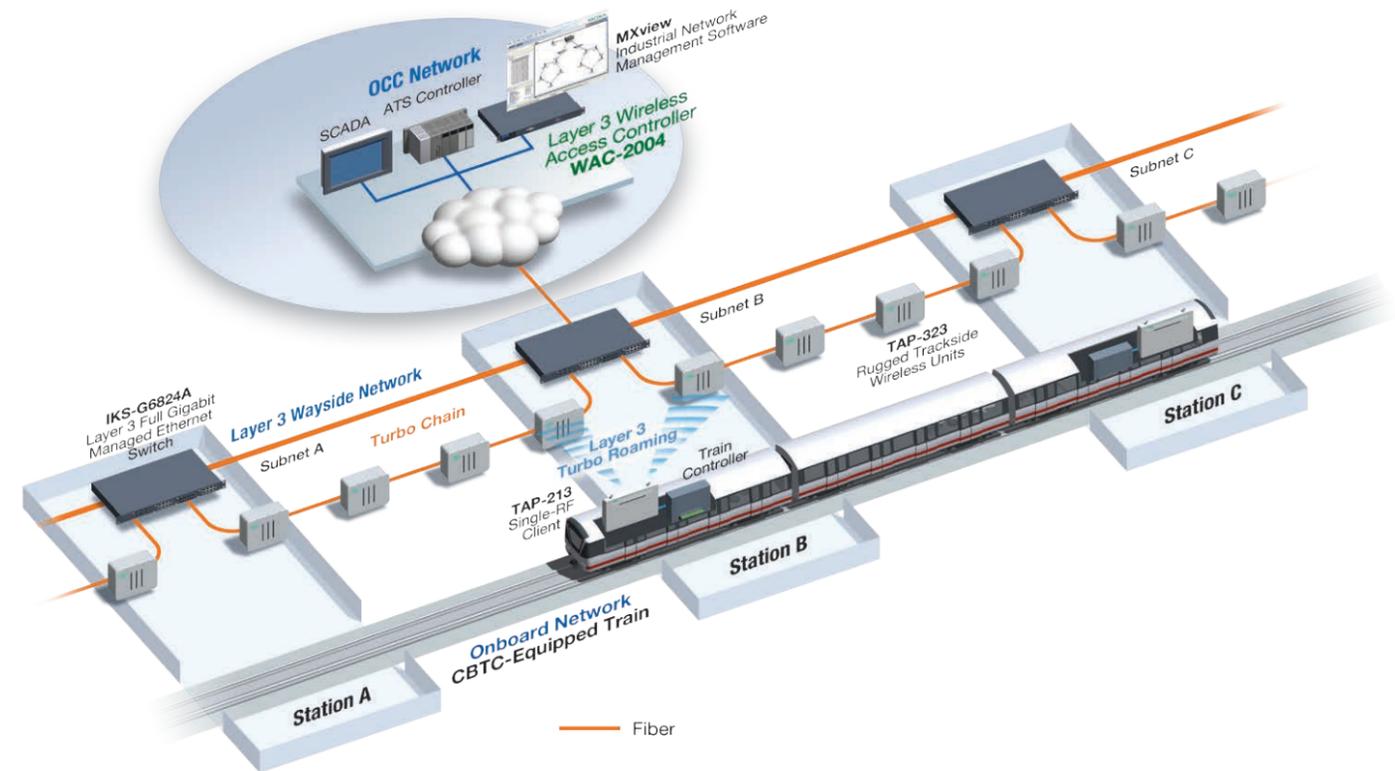
- ✔ **Location:** Los Angeles, U.S.A.
Products Used:
 - TN-5516-8PoE-24-T PoE managed Ethernet switch
 - VPort P06-1MP IP camera
 - ioLogik E1510-M12-CT-T remote I/O
- ✔ **Location:** Montreal, Canada
Products Used:
 - VPort 16-M12 IP camera
- ✔ **Location:** Estonia
Products Used:
 - TN-5524-8PoE PoE managed Ethernet switch
 - VPort P06-1MP IP camera
- ✔ **Location:** Sydney, Australia
Products Used:
 - TN-5524-8PoE PoE managed Ethernet switch
 - VPort P06-1MP IP camera
- ✔ **Location:** Taipei, Taiwan
Products Used:
 - VPort P16-2MP, VPort P26A-2MP, VPort P06HC-2MP onboard IP cameras
 - V2416, V2616 onboard NVRs
 - TN-5516-8PoE-48 PoE managed Ethernet switch
- ✔ **Location:** Prasa, South Africa
Products Used:
 - VPort 06-1MP, VPort P16-1MP onboard IP cameras
- ✔ **Location:** Makkah-Madina, Saudi Arabia
Products Used:
 - VPort P06-1MP onboard IP camera
- ✔ **Location:** Ouargla, Algeria
Products Used:
 - VPort 36-1MP stationary IP camera
 - ICS-G7852A/G7752A Layer 3 managed Ethernet switch
 - IKS-6728A-8PoE, EDS-P510A-8PoE Layer 2 managed Ethernet switch
 - MXstudio network management tool

Enable Continuous Train Operation on Layer 3 CBTC Networks

To ensure fast and safe train operations, the rail signaling system must be able to maintain smooth and continuous communications between the trains and the trackside. It takes three critical elements to make this happen: fast and secure train-to-ground communications, a redundant trackside network, and easy-to-use network management tools. Moxa provides a train-to-ground wireless AP/client to achieve seamless roaming performance, wayside Ethernet switches that offer network redundancy technology, and smart network management software for easy network monitoring and maintenance.

CBTC Network Requirements

- Seamless train-to-ground rail signaling transmissions
- Fast failover redundancy ensure reliable trackside networks
- Easy-to-use network management tools for the control center

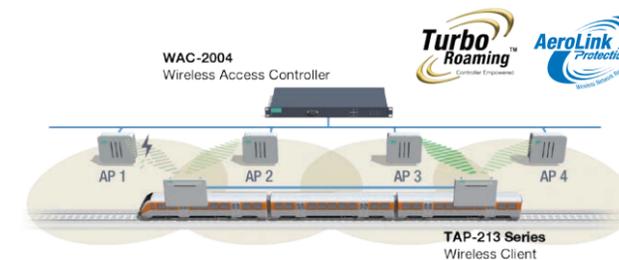


Moxa Solutions

Wireless Train-to-Ground Communications

Wireless Controllers Enable Faster Roaming Times

To provide seamless roaming for high-speed trains, Moxa's rail-specific Turbo Roaming technology is enabled by a Wireless Access Controller (WAC) that offers centralized roaming and security management. When roaming to the next AP, the client can be pre-authenticated by the WAC to bypass the re-authentication process, reducing the switch-over time to less than 50 ms. High-standard security protocols such as WPA, WPA2, and 802.11i are also integrated into the control function to ensure secure network access.



Multiple-Channel Roaming

On a WLAN, adjacent APs should work through different channels to avoid radio interference. Moxa provides three non-overlapping channels for roaming to avoid adjacent channel and co-channel interference.

AeroLink Protection for Wireless Redundancy

Moxa provides the most reliable train-to-ground wireless link with AeroLink Protection technology. Multiple wireless redundancy links can be formed from train-to-ground so if a single wireless link is broken, communication will not be affected due to the quick failover to another redundant train-to-ground path. AeroLink Protection provides wireless redundancy at the network level, preventing any single point of failure for the radios onboard. A link failover time of less than 50 ms ensures fast wireless link recovery while supporting both L2 and L3 wayside networks.

Rugged Trackside Wireless Unit

The TAP-323 trackside wireless unit is designed for train-to-ground wireless communication. It is a highly compact and rugged wireless unit that integrates two access points, a managed fiber switch, and a wide-range AC/DC power supply, all in one outdoor box. It's a cost-effective, time-saving solution that simplifies your complex wayside WLAN network deployment.



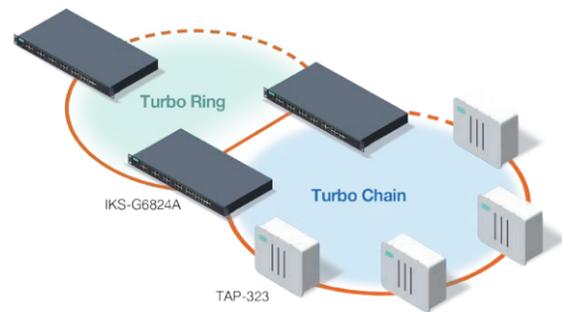
Reliable Trackside Networks with High Availability and Flexibility

A Reliable Fiber Backbone with Fast Self-Healing Functionality for Large-Scale Networks

Wayside data packets need to travel long distances because the depots and stations of a mainline transportation grid typically cover a wide area. The distance between two depots could be anything from a hundred meters to many kilometers. Moxa's large portfolio of Ethernet switches supports multi-mode, single-mode, and long-haul fiber ports. Moxa's switches utilize our own Turbo Ring™ network redundancy technology specifically designed for use in trackside network communications. In addition, the switches deliver excellent convergence times for large-scale networks. Even for a large network with up to 250 nodes, network recovery can be achieved within 20 ms.

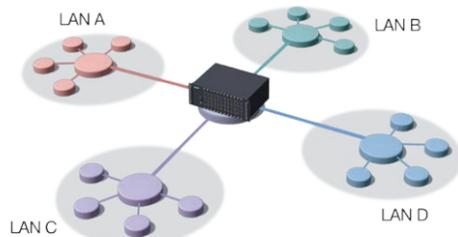
A network that is already up-and-running can be difficult to expand without causing severe disruption to the network. Moxa's Turbo Chain technology overcomes this problem by expanding the network and allowing it to seamlessly integrate and function with the existing network without causing disruption. Turbo Chain works with any network architecture, such as a SONET/SDH telecom network or the RSTP/STP networks that are common in an OCC (operation control center) and larger rail yards. The beauty of Turbo Chain is that it can attach (hook) the expansion onto any existing network, while still maintaining a strong convergence time when a network node or link goes down.

The best way to leverage Turbo Ring on a CBTC application is to form an Ethernet backbone along the track. Then, Moxa's trackside APs are able to create several individual 'chains' on the Turbo Ring network in order to gain high-level redundancy on the trackside network.



Layer 3 Wayside Ethernet Switches for Vital and Non-Vital Network Segmentation

CBTC trackside networks need a solution that will avoid any potential interference in the transmission of critical data. For example, railway operations would grind to a halt if a virus or broadcast storm were to shut down the communications network. Moxa's ICS and IKS series Ethernet Layer 3 switches are specifically designed for wayside applications. They are EN-50121-4 compliant and can operate in temperatures ranging from -40 to 75°C. The IKS-G6824A Layer 3 Ethernet switch is especially useful for segregating larger networks.



Large-Scale Network Management Tools

An Industrial-Grade NMS for Easier Wayside Network Management

MXview is a Moxa-exclusive industrial NMS that was specifically designed from the ground up to meet the needs of industrial and railway communications networks, as opposed to enterprise office networks. The NMS includes all of the features below.



- Automatic topology discovery via LLDP
- Real-time link status and traffic statistics
- Real-time alarm via SNMP Trap or SNMP
- Informative network reporting functions
- Support for large networks (2000 nodes)
- Displays a diverse range of devices used in railway networks (through MIB compiler)
- Visualized virtual LAN
- Supports MXview ToGo mobile app for remote monitoring and notifications—anytime, anywhere

Fast and Easy-to-Use Industrial Network Configuration Tool

Moxa's MXconfig is a comprehensive Windows-based utility that is used to install, configure, and maintain multiple Moxa devices in large-sale CBTC networks. MXconfig decreases configuration time and effort, making it easier to deploy hundreds of TAP-323 wireless units and configure their settings, or when performing trackside maintenance of the devices.



- Mass configuration function to reduce setup time
- Topology analysis to eliminate manual configuration errors
- Configuration overview for efficient management

Highlighted Products

Onboard Devices

TAP-213

Railway onboard 802.11n IP68 wireless AP/client



Trackside Devices

TAP-323

Trackside wireless unit consisting of dual radios and a managed fiber Ethernet switch with AC power supply



WAC-2004

Layer 3 wireless access controller



IKS-G6824A

24G-port Layer 3 full Gigabit managed Ethernet switches



IKS-G7826A/G7828A

24G+2 10GbE/24G+4 10GbE-port Layer 3 full Gigabit managed Ethernet switches



Network Management

MXview / MXviewToGo

Industrial network management software designed for converged automation networks



MXconfig

Industrial network configuration tool



Expert Technology

Truly Uninterrupted Train-to-Ground Communications with Sub-50 ms Turbo Roaming

Download the white paper: www.moxa.com/rail/wp/TR



Turbo Chain: A New Recovery System Beyond Ethernet Redundant Ring Technology

Download the white paper: www.moxa.com/rail/wp/TC



Location: China

- Products Used:
- AWK-3121-RTG wireless AP/client
 - WAC-1001 Layer 2 wireless access controller

Location: Mumbai, India

- Products Used:
- TAP-6226 wireless unit
 - WAC-2004 Layer 3 wireless access controller
 - AWK-3121-RTG wireless client

Location: Riyadh, Saudi Arabia

- Products Used:
- TAP-6226 wireless unit
 - AWK-3121-RTG wireless client

Location: Copenhagen, Denmark

- Products Used:
- TAP-6226 wireless unit

Maximizing the Value of Ethernet Technology for Train Communication Networks

Conventional WTB and MVB networks have limited ability to support multiple services. As many of these systems now need to be updated, train communications network operators are turning to IP-based Ethernet Consist Networks (ECN) and Ethernet Train Backbones (ETB). System operators are beginning to recognize the benefits of IP technology as it offers a complete package that can meet rising network demands, reduce operating costs, and deliver improved functionality. Moxa offers a wide selection of EN 50155 compliant industrial Ethernet switches to help operators build IP train networks that integrate multiple isolated and disconnected systems to create a solution that operates more efficiently and remains expandable in the future.

Train Communication Network Requirements

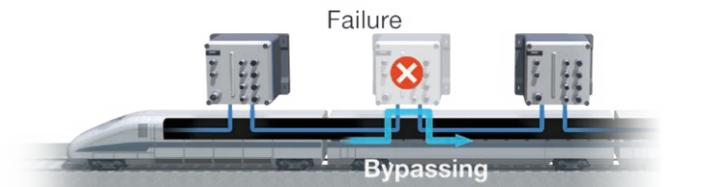
- Flexible network connection to realize high network availability
- Easy installation and maintenance for diverse Ethernet devices
- Future-proof design based on the IEC 61375 standard for Ethernet train communication networks

Moxa Solutions

Advanced Ethernet Redundancy

Bypass Relay Function in Linear Topology

In a linear topology, a failure in any of the upstream links will result in the failure of the downstream links as well. To prevent such a failure, Moxa's TN-5510A/5518A series provides 2 optional Gigabit Ethernet ports with bypass relay functionality. If one of the Ethernet switches fails due to power loss, its ports are bypassed with the relay circuit, and the transmission lines will interconnect automatically to assure continuous system operation.



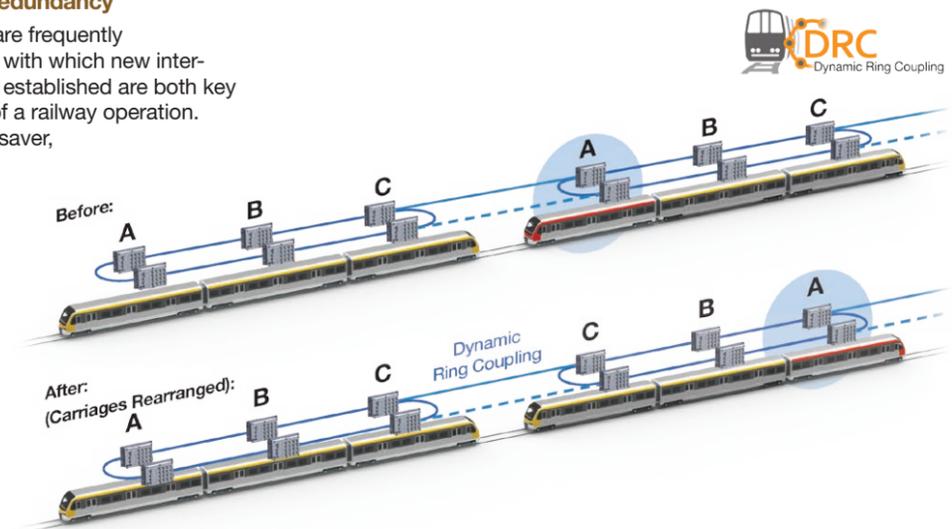
Turbo Ring™ for Fast Ring Redundancy

All of Moxa's managed Ethernet switches support Turbo Ring™, which has a super fast fault recovery time of less than 20 ms at a full load of 250 Ethernet switches, minimizing downtime caused by network failure. If a path in the network fails, the system will return to normal communication in under 20 ms.



Intelligent Inter-Consist Ethernet Redundancy

Because train carriages and consists are frequently reconfigured, the speed and accuracy with which new inter-carriage and inter-consist links can be established are both key determinants in the overall efficiency of a railway operation. Auto-negotiation is a substantial time-saver, but this is hard to implement on networks that use more sophisticated networking technologies such as a ring redundancy topology. Moxa's ToughNet Ethernet switches feature DRC (Dynamic Ring Coupling), an intelligent Ethernet ring redundancy technology that excels at inter-consist networks. By detecting and automatically reconfiguring the network, DRC reduces configuration time and potential human error, ensuring that the system provides highly reliable and efficient operation, day in and day out.



Automatic Error-free Inter-Carriage Wireless Links

ACC allows operators to enjoy the operational and cost benefits of using wireless inter-carriage links, without introducing new maintenance tasks and security vulnerabilities. When utilizing ACC, each device only needs to be configured once for deployment on any carriage and form links in any train configuration. Operators no longer need to manually change their AP configuration each time they recompose the train carriages. ACC technology will intelligently and dynamically form bridge links with 100% accuracy to provide broadband communication throughout the entire train, and still maintain high network security thanks to WPA/WPA2 encryption. ACC also supports high throughput applications through models with 802.11n support in the AWK-RCC series.

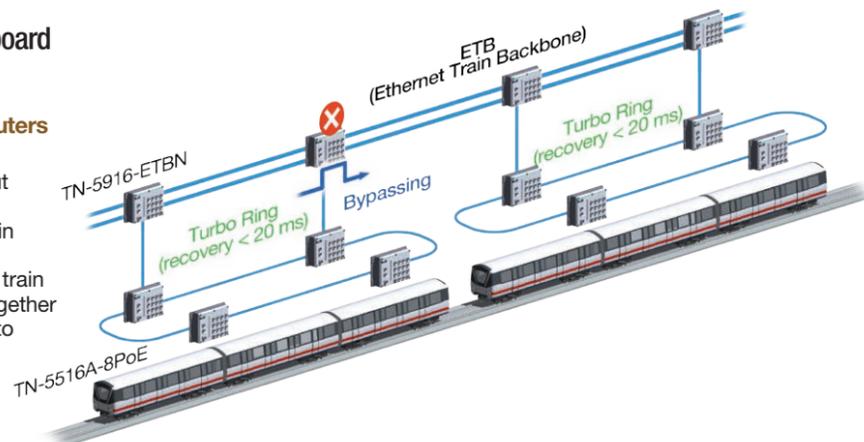


IEC 61375 Compliant IP Solutions for Onboard TCMS Networks

IEC 61375-2-5 Compliant Train Ethernet Routers

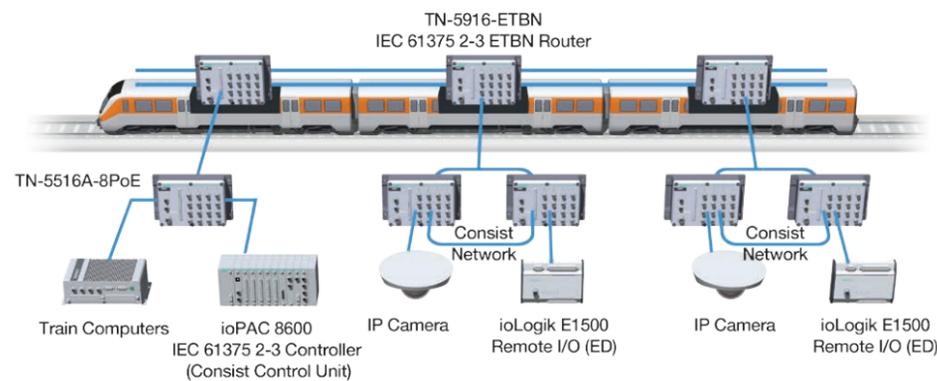
Moxa's TN-5916-ETBN Ethernet routers are designed according to the specifications laid out in the IEC 61375-2-5 standard. The TN-5916-ETBN series routes traffic between Ethernet Train Backbones and Ethernet Consist Networks. In addition, the TN-5916-ETBN router handles the train inauguration as cars of a train are connected together or disconnected, and provides this information to relevant applications.

During operation, the TN-5916-ETBN enables power failure failover without affecting data transmissions in other consists and offering seamless network recovery when the power is recovered.



Integrated IP Solutions for TRDP Networks

Moxa's TCMS network solution comprises a controller and an Ethernet router. Compliance with the IEC 61375-2-3 standard allows the TN-5916-ETBN to act as an ETBN router and the ioPAC 8600 I/O controller to act as a CCU, which together control end devices such as IP cameras and remote I/O devices on the TRDP network.



Integrated IP Solutions for Train-to-Ground Communications

Moxa's UC-8580 train-to-ground computing platform was designed based on the IEC 61375-2-6 standard and has multiple WWAN ports to ensure that train operators can meet their connectivity requirements. To provide more comprehensive solutions, the UC-8580 computing platform uses up to 3 cellular module slots and 1 Wi-Fi module slot to increase flexibility for different communication scenarios. Moreover, the UC-8580 features dynamic routing that can optimize connections based on geographic location or device connectivity status.

Scenario: Trains at the station

Solution:

- LAN can be used via an existing AP at the station to send large amounts of data between the vehicle and the station

Benefit:

- Reduce carrier fees

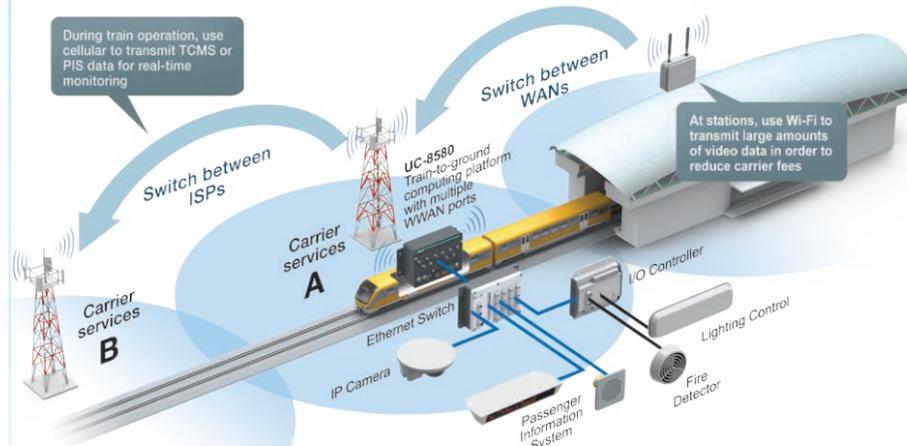
Scenario: Trains along the trackside

Solution:

- WWAN can be used to transmit TCMS or PIS data for real-time monitoring
- Supports up to 4 WWAN connections and 2 SIM card slots per cellular module (3 standard plus 1 customized). Dual-SIM capability ensures that the network will not experience downtime if one SIM in a module fails

Benefit:

- Seamless switchover between ISPs to ensure constant connectivity



Highlighted Products

ToughNet TN Series Railway Routers and Ethernet Switches

Router Series

TN-5916 Series

EN 50155 NAT 16-port router



Layer 3 Series

TN-5816A/5818A Series

EN 50155 16/16+2G-port layer 3 Gigabit managed Ethernet switches



Layer 2 Gigabit/PoE Series

TN-4500A Series

EN 50155 12+4G/24+4G-port Gigabit Ethernet switches with up to 20 PoE ports



TN-5510A/5518A Series

EN 50155 8+2G/16+2G-port Gigabit managed Ethernet switches with 8 PoE ports



Layer 2 Fast Ethernet Series

TN-5508A/5516A Series

EN 50155 8/16-port managed Ethernet switches with 8 PoE ports



TN-5300 Series

EN 50155 8-port unmanaged Ethernet switches



AWK-RCC Series Railway Wireless APs

AWK-3131A-RCC Series

Industrial IEEE 802.11a/b/g/n wireless AP/bridge/client



IEC 61375 Compliant Products

TN-5916-ETBN

IEC 61375-2-3 and 2-5 ETBN router



ioPAC 8600 Series

IEC 61375-2-3 Programmable Controller



UC-8580 Series

Vehicle-to-ground computing platform with multiple WWAN ports



Location: Helsinki, Finland

Products Used:
• TN-5516 Series

Location: Norway

Products Used:
• TN-5516 Series
• TN-5516-8PoE Series

Location: Ukraine

Products Used:
• TN-5518 Series

Location: Paris, France

Products Used:
• TN-5508 Series

Location: Taipei, Taiwan

Products Used:
• TN-5516 Series

Location: China

Products Used:
• TN-5516 Series

Enhancing Passenger Comfort with Intelligent Wireless Technology

A train-wide passenger Wi-Fi system must be able to flexibly adapt to train consist changes during daily operations. Moxa's ACC (Auto Carriage Connection) technology easily and automatically creates wireless connections between train cars without modifying existing cables and couplings. In addition, when a train enters a new region, it must contend with different wireless interfaces such as Wi-Fi, UMTS, HSPA, WiMax, and LTE. Moxa's UC-8580 series multiple-wireless-WAN communication system simplifies the coding of multiple-WAN routing applications, speeding up application development processes and significantly shortening custom development times for system integrators.

Network Requirements

- Flexible carriage-to-carriage links that adapt when train consists change
- Intelligent multiple wireless routing platform for traveling across wide geographies
- High network capacity to support media-on-demand services
- Connections capable of withstanding constant vibrations
- Operational even under harsh environmental conditions

Moxa Solutions

- Dynamic Routing technology:
 - Optimizes network bandwidth and automates system configuration for diverse wireless networks to adapt to different network conditions along a long train route
- 802.11n solution with 300 Mbps data rate to fulfill demanding media-on-demand services on trains
- Gigabit Ethernet switches provide sufficient network backbone for multimedia services
- Rugged anti-vibration M12 connections
- EN 50155 compliant to resist vibrations, surges, and EMS

Highlighted Products

AWK-RCC Series

IEEE 802.11a/b/g/n wireless radio AP/bridge/client



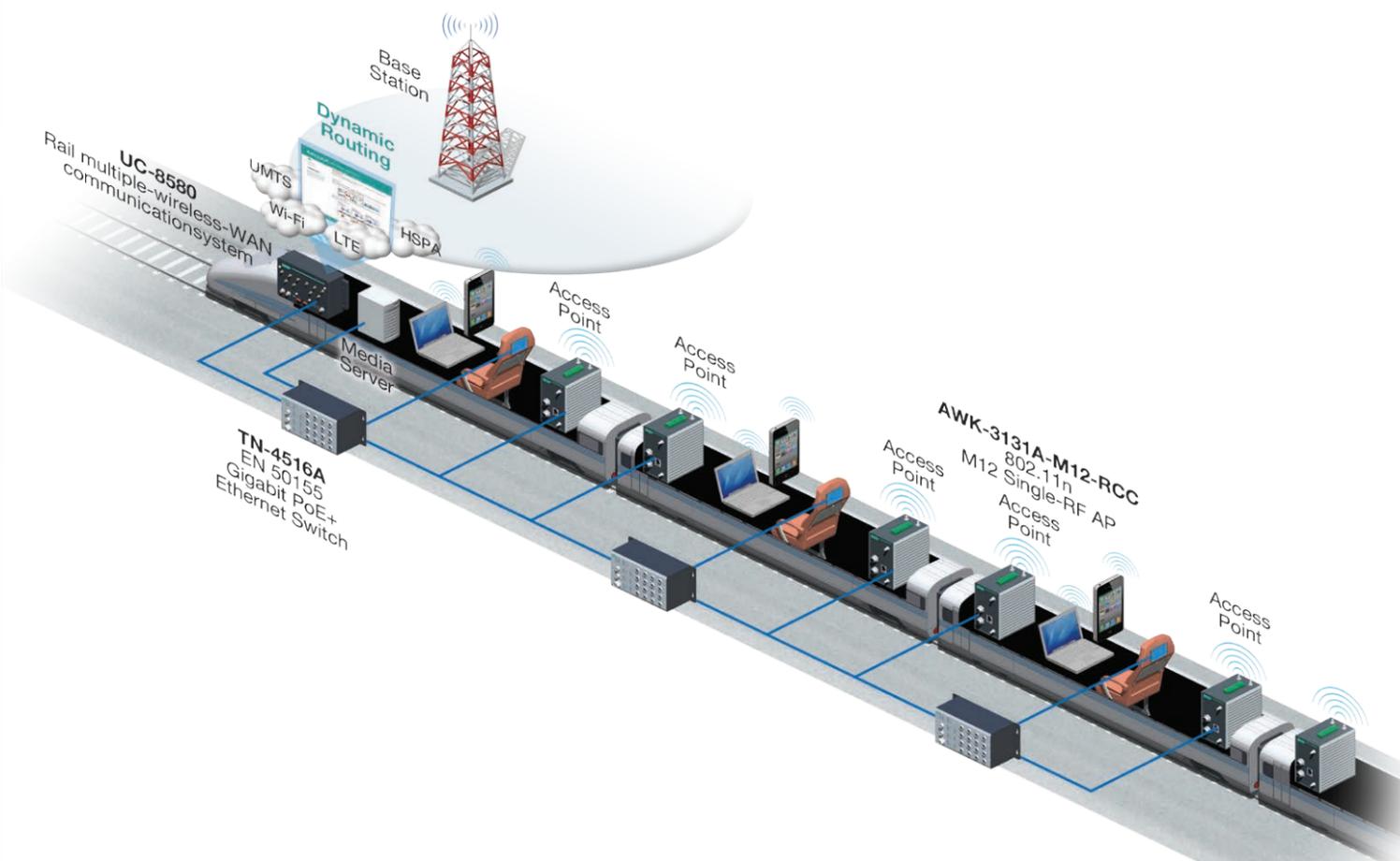
UC-8580 Series

Rail multiple-wireless-WAN communication system



TN-4516A Series

EN 50155 Gigabit/PoE+ Ethernet switches



- ✓ Location: Germany
Products Used:
 - Customized AWK-5232-M12-RCC wireless AP
- ✓ Location: Across Europe
Products Used:
 - AWK-3131-RCC wireless AP

Welcome aboard th

Integrated Solutions for Onboard Condition Monitoring

In order to reduce the maintenance effort and improve the availability of services on trains, train operators need to ensure safe and reliable operation of onboard systems. Therefore, train operators need to be able to remotely monitor onboard systems including air conditioners, emergency alarms, lighting systems, and door indicators. Moxa has developed two products in accordance with the EN 50155 standard, ioPAC 8600 controller and ioLogik E1500 remote I/O, which allow train operators to monitor the status of different onboard systems and integrate information into the TCMS.

Network Requirements

- Quickly replace devices without any complex IP configuration or device setup
- Use existing 2-wire cable for the IP network
- Compact size fits the space-limited environments on trains
- Modular and expandable I/O modules designed for flexibility
- Programmable open platform for easy integration
- Compliance with all railway requirements for greater reliability

Moxa Solutions

ioPAC 8600 EN 50155 Railway Programmable Controllers

- High performance ARM-based CPU (up to 1 GHz) suitable for different railway applications
- Comprehensive SDK for I/O and active reports reduce the amount of programming required
- Compact design combines serial, I/O, Ethernet, and computing capabilities all in one box
- 2-wire Ethernet switch for daisy-chain topologies with a bypass function to leverage existing cables and reduce costs for revamping mid-life trains

ioLogik E1500 EN 50155 Railway Ethernet I/O

- Wide operating temperature: -40 to 85°C (-40 to 185°F)
- Channel-to-Channel isolation (DI only)
- Robust and compact design for harsh environments
- Two LAN ports built-in for daisy-chain network connections (by request)

V2426A Series EN 50155 Railway Computers

- Industrial-grade design suitable for use on trains
- Reliable thermal design that can endure extreme heat even at a full system load
- High-resolution VGA and DVI interfaces for display connections

Highlighted Products

ioPAC 8600 Series
Modular Programmable Controllers



ioLogik E1500 Series
Railway Ethernet I/O



V2426A Series
x86-based Embedded Computers



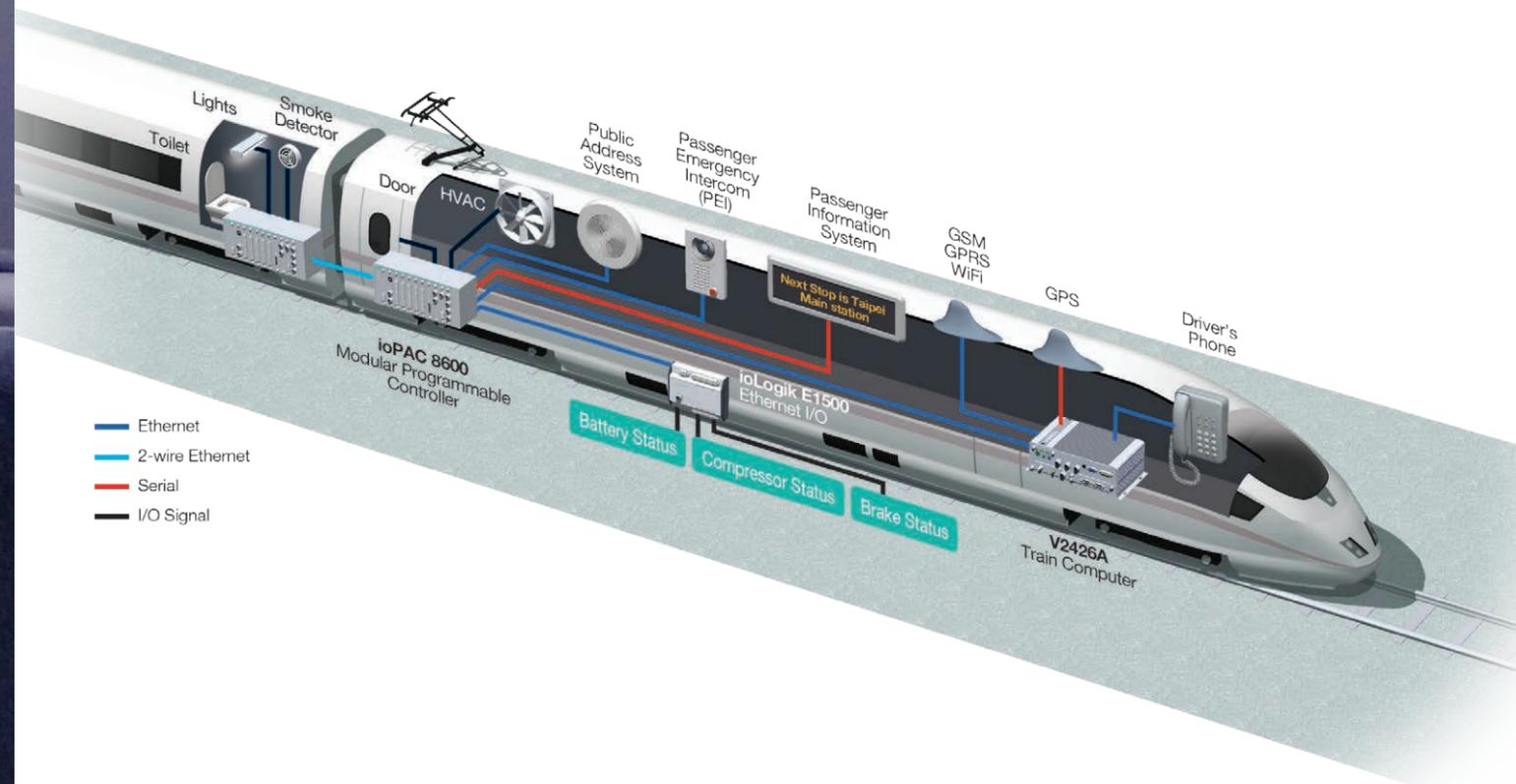
Expert Technology

2-Wire Ethernet Technology

Moxa's innovative 2-wire Ethernet technology can run up to 100 Mbps Ethernet with bypass functionality over two legacy cables. This technology allows aging trains to utilize an Ethernet network when using legacy cables. With two 2-wire Ethernet switch modules and 4 legacy cables, the Ethernet network can reach up to 200 Mbps with redundancy.



- ✓ **Location: Germany**
Products Used:
 - ioPAC 8020 series modular programmable controller
 - ioLogik E1500 EN 50155 compliant Ethernet I/O
- ✓ **Location: United Kingdom**
Products Used:
 - ioLogik E1500 EN 50155 compliant Ethernet I/O
- ✓ **Location: America**
Products Used:
 - ioLogik E1500 EN 50155 compliant Ethernet I/O
- ✓ **Location: Taiwan**
Products Used:
 - ioPAC 8020 series modular programmable controller
- ✓ **Location: China**
Products Used:
 - ioLogik 8500 modular programmable controller



Ensure Wayside Operation Efficiency with Industry Tailored Solutions for Turnouts and Level Crossings

Concern for passenger safety, and the high financial cost and potential loss of reputation due to railway accidents and long delays have led railway infrastructure managers to adopt increasingly sophisticated preventative maintenance systems. However, the ability of railway operators and maintenance engineers to prevent costly system failures and optimize resource allocation depends on the large amounts of real-time wayside asset condition information provided by separate monitoring systems. These data acquisition systems are often comprised of many sensors, transducers, and remote terminal units running on different platforms and closed communication protocols, which can make maintenance more challenging and costly.

Moxa's EN 50121-4 compliant modular programmable controllers are tailored for railway asset monitoring applications, and offer system integrators a more accurate, open platform field solution to collect large amounts of real-time condition monitoring data. Besides being easily and non-intrusively integrated and maintained, Moxa programmable controllers can monitor all critical assets from any remote location.

Network Requirements

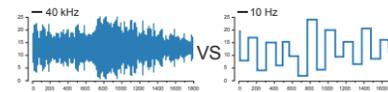
- Modular and compact design fits in space-limited cabinets
- More accurate data facilitates faster and more accurate responses
- Compliant with railway standards for harsh environments
- Easy to perform maintenance without stopping the system

Moxa Solutions

Programmable Controllers Tailored for Railway Asset Monitoring and Predictive Maintenance

■ Precise data acquisition makes troubleshooting easier

Moxa programmable controllers offer up to 40 kHz analog input sampling rates, giving engineers the analog data accuracy they need to correctly analyze events with precise millisecond-level timestamps for event sequencing.



■ Certified equipment for railway applications

Moxa's programmable controllers are compliant with the EN 50155, EN 50121-3-2, and EN 50121-4 railway standards, which require products to withstand high levels of vibration.

■ Extremely rugged with industry-leading MTBF

The high availability, -40 to 75°C wide operating temperature range, and high EMI immunity, which provides surge and ESD protection for the power and communication ports, of Moxa's programmable controllers ensure the utmost reliability.

Easy Deployment, Integration, and Maintenance

■ Supports IEC 61131-3 and C/C++ programming languages

Moxa's programmable controllers support the IEC 61131-3 railway standard and C/C++ programming, enabling easy integration with any system platform.

■ Hot-swappable modules save time on service visits

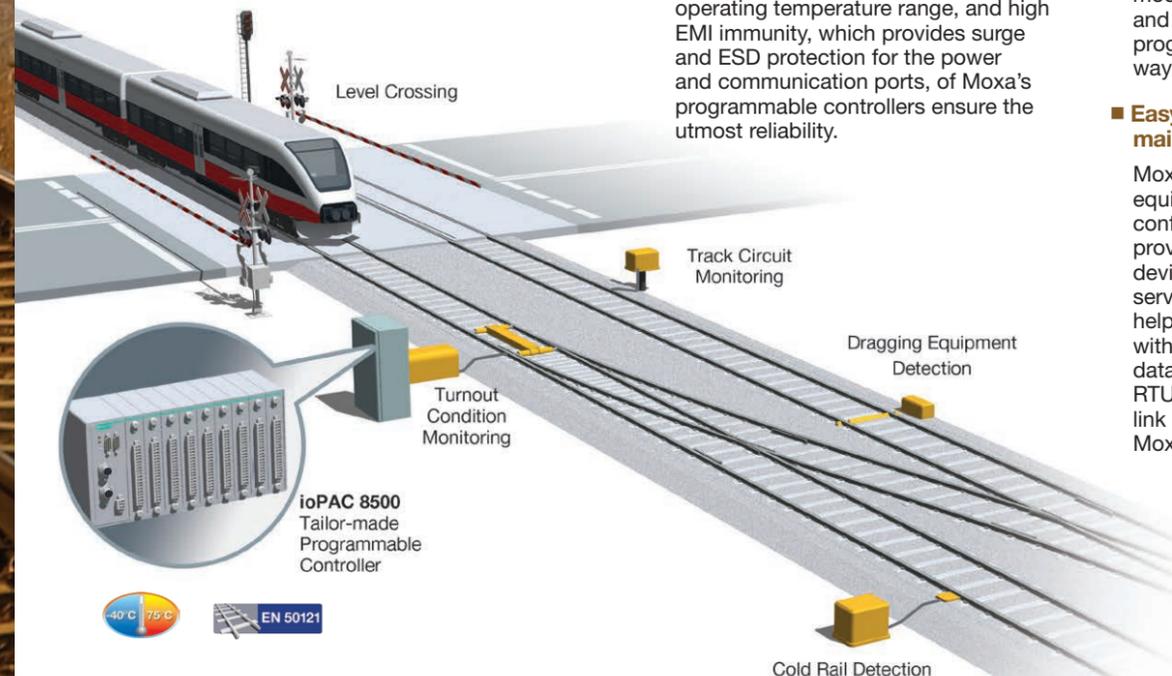
All the I/O modules on Moxa's programmable controllers are hot-swappable so users can replace the modules without shutting down the system. The CPU will then automatically configure the new module. This intelligent architecture means that hardware can be easily upgraded and maintained without highly specialized knowledge or training.

■ Compact modular design for easier deployment

Moxa programmable controllers support a versatile collection of I/O modules. The non-intrusive, compact, and modular design makes Moxa programmable controllers ideal for wayside cabinets with limited space.

■ Easy system configuration and maintenance with RTUxpress

Moxa programmable controllers come equipped with an intuitive offline configuration tool—RTUxpress—that provides a user-friendly interface for device setup, tag management, and service configuration. This utility can help you reduce programming effort with ready-to-run services for alarms, data logging, and communication. RTUxpress also enables you to easily link I/O events and services with Moxa's TagEasy feature.



Highlighted Products

ioPAC 8500 Series

Rugged modular programmable controllers



ioPAC 5542 Series

Rugged compact programmable controllers



Expert Technology

40 kHz AI Sampling Rate Enables Accurate Monitoring

Moxa's RTU controllers use C/C++ standard programming for front-end data processing. These controllers can help to monitor the power, temperature, current, force, and status of the turnout. With 40 kHz sampling rate and pre-recording functions, this product can provide high resolution and precise time-based data.



- ✓ **Location: Poland**
Products Used:
• ioPAC 8500 modular programmable controller
- ✓ **Location: Australia**
Products Used:
• ioPAC 8020 modular programmable controller
- ✓ **Location: Taiwan**
Products Used:
• ioPAC 8500 modular programmable controller
- ✓ **Location: China**
Products Used:
• ioPAC 8500 modular programmable controller
- ✓ **Location: The Netherlands**
Products Used:
• ioPAC 8500 modular programmable controller

Your Trusted Partner in Automation

Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things. With over 30 years of industry experience, Moxa has connected more than 50 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for industrial communications infrastructures.

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