WHITE PAPER

New Locations and New Requirements for Onboard IP CCTV

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Overview

IP-based CCTV systems are becoming an absolute requirement for train operations. Effective video surveillance protects passenger safety and makes train operations more efficient, which has led to increased investment in onboard IP CCTV systems. In recent years these systems have expanded in scope and reach, with cameras now being deployed in more and more locations throughout the train, and these new video surveillance applications have introduced important new IP video requirements. As IP cameras are deployed in more and more locations onboard a train, there is a corresponding increase in the performance, reliability, and design requirements for those IP cameras.

Advanced IP CCTVs Deliver Operational Efficiency

The conventional usage of CCTV systems has been to provide security. However, in intelligent railway systems, operators have found that CCTV systems can also make operations more efficient by providing key visibility and real-time information. With an advanced and integrated IP CCTV system, train operators can get an immediate live view of the status inside or outside the train at specific key locations. The train operator, whether onboard or in a control room, can use this information when loading and unloading passengers, checking the status of the routes, or identifying when a train car is full.

More Deployment Locations Needed

Train operators can only truly realize the operational benefits of IP CCTV systems if the system is sufficiently advanced and camera coverage is sufficiently thorough. Whereas in the past it was sufficient just to install a few consist cameras with broad surveillance coverage of the carriage, modern systems give operators greater situational awareness by making video surveillance more pervasive. This means more cameras, in more locations, doing more work. For example, consider the tram project illustrated on the following page.

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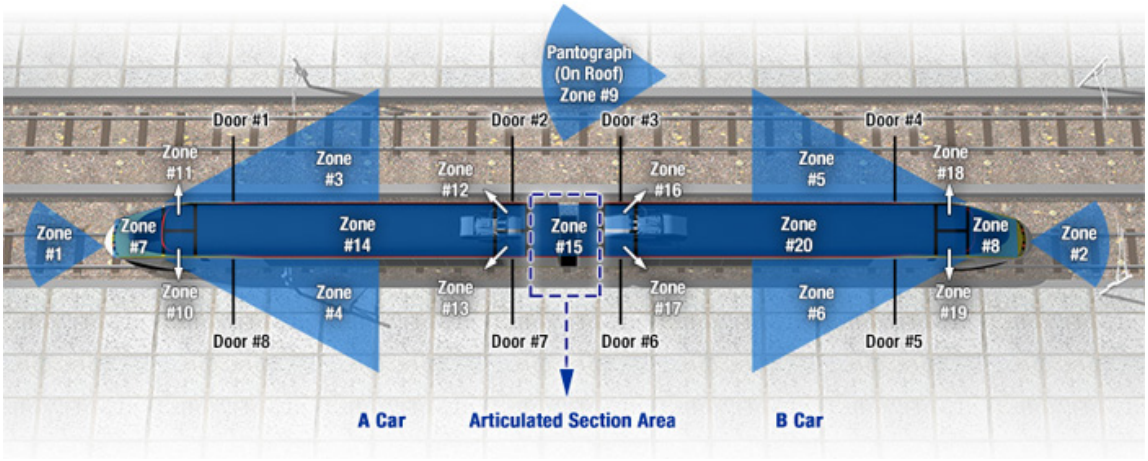

This tram contains multiple cameras installed throughout the train:

1. **Forward and rear facing cameras (Zones 1 and 2):** These two cameras monitor the track status and work with the event data recorder in the train car.
2. **Retro-vision cameras (Zones 3 to 6):** These cameras are mainly for the driver or operator to view the passengers entering and exiting the train when it is stopped at the platform, or to record the trackside situation when the train is moving.
3. **Car control cameras (Zones 7 and 8):** These cameras are located in the driver's cabin, or in the control room in an unmanned train. They monitor the status of the train control panel and LED signals.
4. **Pantograph camera (Zone 9):** For trains that use overhead wiring, this exterior, roof-mounted camera monitors the pantograph that connects the train or tram with the catenary overhead line.
5. **Door cameras (Zones 10 to 13, 16 to 19):** These cameras monitor passengers entering or exiting through specific doors. This interior view supplements the driver's exterior view of the doors via rear-view cameras. In addition, this video recording can be used for reviewing ticketing information, as some systems may use video-based person-counting technology.
6. **Consist cameras (Zone 14, 15, 20):** These cameras monitor the situation inside the car, as illustrated below.

While just these six location types will bring the number of cameras in a consist to about 15, additional camera deployment locations are becoming more common in modern systems.

7. **Intercom cameras:** Most trains include an intercom system for emergency communications between passengers and the driver or operations control center. Intercom activity is recorded and logged for later review. One modern innovation is to add a camera to the intercom system so the driver or operator can see who is speaking into the intercom. As with audio, video is also recorded for later review.
8. **Zone-specific cameras:** Additional video coverage can be useful at certain critical locations in the train, such as priority seats, vending machines, luggage areas, the bike parking area, machine cabinets, etc. Dedicated cameras devoted to these locations can provide added security.

New Requirements for Onboard IP CCTV Cameras

These new camera deployment locations have directly contributed to another trend: growing camera performance requirements. Onboard cameras must meet many demanding requirements.

More Form Factors: Now that IP cameras are deployed in more locations, more form factors are needed. When the CCTV system is simply covering a broad, general area, common dome or box-type cameras are enough. Now that IP cameras are being deployed in more locations, the requirements are more specific. For example, rear-view and pantograph cameras are mounted on the train exterior and need a rugged form factor that is both aesthetically pleasing and able to operate consistently in harsh conditions. Inside the train, the intercom camera must be discreet enough to tuck into the intercom system, hidden inside the wall.

Day and Night View: Onboard IP cameras are usually designed only for daytime viewing, as they are designed with the expectation that there will be interior lighting in train cars. However, cameras providing trackside viewing need both day and night viewing capability in order to handle low illumination conditions at night. In addition, some trains use low lighting in the driver or control rooms. Cameras in these conditions will also need nighttime viewing capability.

High Video Performance: Trackside cameras must record in high resolution and at high frame rates in order to capture meaningful video while the train is moving quickly. Otherwise, the video will just be a blur. Typical requirements for onboard IP cameras are 10 to 15 frames per second, and 640 x 480, 720 x 480, or even megapixel resolution. In contrast, trackside cameras need a much higher performance of around 30 frames per second and 1280 x 720 or 1920 x 1080 resolution.

Extreme Operating Temperature: Trains both inside and outside the carriage now need to operate consistently in extreme temperatures. This is because more and more train operators expect to be able to monitor onboard conditions at any time, even when the air conditioning is inactive while the train is on standby in the garage. Therefore, cameras need to be able to meet the EN 50155 T3 (-25 to 70°C) or TX (-40 to 70°C) temperature criteria.

Demist and Defog for Exterior Cameras: When a camera is installed outside the train, the transparent dome cover or front window may fog up or ice over when it rains or snows, causing the image to be unclear or completely blocked. In this case, you can use a camera housing with a built-in heater to demist and defog the dome cover.

High EMI / Surge Protection Level: EMI and surge protection are new requirements that have been introduced by new IP camera deployments. Usually, onboard CCTV cameras are installed in a safe environment where EMI and surge protection is not very important. Cameras mounted on the train exterior are another story. For these cameras, it is important to support EMI and surge protection to ensure consistent system performance. The minimum requirement in this category is defined by the level 3 criteria in the EN 50121-3-2 (IEC 62232-3-2) "Railway Applications – Electromagnetic Compatibility" standard for rolling stock.

Moxa's Comprehensive EN 50155 Rolling Stock IP CCTV Solutions

Moxa's comprehensive IP CCTV solutions include IP video products, network switches, wireless communications, video management software, and NVR platforms for rolling stock applications.

Moxa's portfolio includes a solution for every application and every installation environment. Moxa provides three different types of EN 50155 IP cameras, which can be deployed as consist IP cameras, rear-view IP cameras, and also flush-mounted as hidden IP cameras. All three are rugged and come with M12 Ethernet connectors, PoE power input, and compliance with key EN 50155 and EN 50121-3-2 criteria. In addition, video resolution up to 1280 x 800 in H.264 and MJPEG are both available for live viewing and video recording.

For applications that need to operate in extreme temperatures, cameras are available with an optional -40 to 70°C operating temperature. These cameras are the first in the world to be compliant with the higher EN 50155 TX criteria. Moxa's cameras do not use built-in heaters or fans, which eliminates a potential point of failure and delivers excellent product longevity of 10 to 20 years in railway applications.

A diverse selection of form factors makes it possible to deploy IP cameras in more locations

In addition to IP cameras, Moxa provides EN 50155 M12 Ethernet switches, EN 50155 NVR platforms, EN 50155 wireless APs, and NVR software. These products can be combined to create a complete EN 50155 IP CCTV system. To simplify configuration, all EN 50155 products are equipped with Moxa FLI™ configuration technology, which automates network settings and device configuration.

Moxa's broad selection of EN 50155 products

Visit the Moxa website (www.moxa.com/rail) for product details, or subscribe to our railway newsletter (www.moxa.com/railnews) to stay up-to-date on the latest railway trends and learn about Moxa's newest IP-based solutions for railway applications.