



STEMS – SIL 2 ELECTRONIC REAR-VIEW SYSTEM



DESCRIPTION

STEMS is a certified SIL 2 electronic rear-view system for railway vehicles. It replaces conventional optical mirrors with high-resolution IP cameras and dedicated driver cab displays.

The video streams are transmitted via a managed low-latency Ethernet PoE switch. The system provides true video streaming as well as comprehensive railway-grade diagnostics.

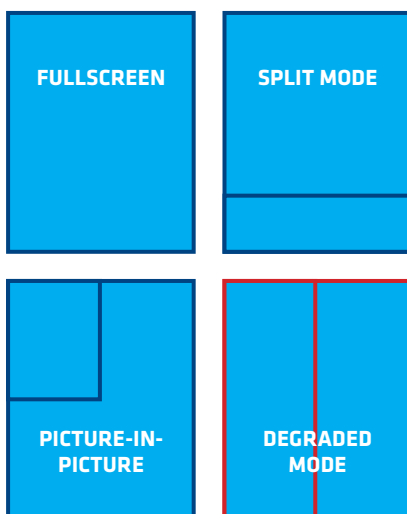
STEMS – SIL 2 ELECTRONIC REAR-VIEW SYSTEM

KEY FEATURES

- | SIL 2 certified for safe image capture, transmission and display
- | Low latency of approx. 100 ms
- | Portrait display optimized for use with polarized sunglasses
- | Multiple display layouts (Full Screen, Split, Picture-in-Picture, Degraded)
- | Two types of external cameras – standard and low-profile
- | PoE cameras + managed switch
- | Integrated diagnostic and safety functions
- | 20-year design lifetime
- | Safety fully ensured by technical means, without the need for additional dynamic elements on the screen

STANDARDS

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|--------------|------------|
| EN 50121-1 | EN 50125-1 |
| EN 50121-3-2 | EN 60529 |
| EN 50124-1 | EN 50126 |
| EN 50155 | EN 50129 |
| EN 61373 | EN 50159 |
| EN 45545-2 | EN 50716 |



TECHNICAL SPECIFICATIONS

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	Humidity	0-100% non-condensing
	Altitude	Up to 1,400 m
SYSTEM ARCHITECTURE	IP cameras (rear-view and blind-spot monitoring) SIL 2 display units Managed PoE Ethernet switch	All components within each driver cab form a closed VLAN segment integrated into the vehicle ECN network via a firewall-controlled router
CAMERA MODULES	EXTCAM-4	AXIS P3925-R in a customized heated IP66 housing for rear-view monitoring
	AXIS P3925-LRE	AXIS P3925-LRE heated IP66/67 camera for blind-spot monitoring
DISPLAY MODULE	DPC-S2-12,1"	12.1-inch portrait display, 1280 × 800, SIL 2 safety module, M12 Ethernet, 24 V DC power supply, external watchdog, multiple display layouts including Degraded Mode
SWITCH MODULE	CMX.ESW10	Managed PoE switch with port-based DHCP, VLAN isolation and Quality of Service, compliant with EN 50155
SAFETY FUNCTIONS	SF01 – Low-Latency Video Streaming	A safe warning is issued if the delay of any video stream exceeds 300 ms due to a system fault.
	SF02 – Unaltered Video Streaming	The video stream is free from hazardous artifacts, corrupted image areas, significantly shifted colors or missing image portions.
	SF03 – Freeze-Free Video Streaming	A safe warning is issued if an image freezes for more than 300 ms due to a system fault.
	SF04 – Image Mirroring	The system mirrors the captured video streams from the rear-view cameras to correctly reproduce the real-world scene, as with a conventional rear-view mirror.
	SF05 – Camera Identification	The system displays video streams exclusively within predefined areas of the screen.
	SF06 – Smooth Video Streaming	The displayed video stream is smooth and free from noticeable delay between consecutive frames.
NETWORK INTEGRATION	Dedicated STEMS VLAN, ECN router firewall (deny-by-default)	TRDP communication for display/camera status and driver cab occupancy

