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Application Note

AN00015

Onboard Rail Vehicle System uses managed IP67 switch

Belden's ruggedized managed Ethernet switch with PoE provides the connectivity for Alpine rail operator's onboard Passenger Information System (PIS).

Image: © Rhätische Bahn AG

The OCTOPUS 16M 8PoE is a managed fast Ethernet switch designed to meet the environmental challenges of the onboard rail environment. The provision of PoE allows remote devices such as cameras to be easily powered, making their installation easier and cheaper.

Project Overview

Made of multiple elements, Passenger Information Systems (PIS) have grown increasingly sophisticated. Today, the majority of component parts in a PIS use Ethernet for connectivity, and in many cases these parts are powered over Ethernet as well. An Alpine rail operator relies on Belden to connect their main PIS processor, acoustic components, emergency communication stations, interior and exterior displays, video surveillance and TFT screens.

The Challenge

The train operator wanted to provide reliable Ethernet connectivity within its entire rolling stock fleet to ensure uninterrupted operation of the PIS application. Usually, railway equipment suppliers depend on M12 connectors to provide the critical connectivity between cables and equipment.

However, connecting multiple M12 connectors where available space is limited can be challenging as each individual connector has to be screwed into its receptacle. This can sometimes result in the connector back shell being accidentally tightened or made loose (both circumstances potentially affecting the connector performance). Because of this, bayonet M12 couplings developed by Gimota AG were used for this project, based on the M12 plug connection technology proven in industrial use and the standard EN 61076-2-101, and according to the draft standard IEC 61076-2-011. Compatibility is assured as this connector technology also allows connection with screw-type M12 connectors.

System Requirements

- Managed IP67 switch in accordance with IEEE 802.3, store-and-forward-switching, software layer 2 professional, Ethernet (10 Mbit/s) and Fast-Ethernet (100 Mbit/s), power sourcing equipment according to IEEE 802.3af (inline power)
- A customized solution to include bayonet-based M12 not screw-type M12
- Compliance with Rail onboard standards such as EN50155 and EN50121-4
- Bulkhead mounting design

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Why Belden?

Belden delivered a cost effective Layer 2 Ethernet switch solution designed for the challenges of being installed onboard rail vehicles.

- Strong success record with multiple rolling stock manufacturers and operators around the globe
- Superior designed OCTOPUS device fulfills challenging environments of rail vehicle usage
- Readiness to work with partner (Gimota AG) to provide a variant of the standard product fitted with different connectors

The Belden Solution

The OCTOPUS 16M 8PoE Layer 2 managed switch was selected as the most cost-effective solution to the onboard network requirements.

The standard product was modified and fitted with the Gimota AG M12 bayonet connectors. This modification was done in-house by the Hirschmann engineering team and of course included full sets of drawings and documentation. In addition, the IT systems which allow customers and partners to configure OCTOPUS part numbers was updated to include this variant, so that future ordering of the unit is straightforward and support through the life of the product is assured.

The functionality provided includes:

- 8 x 10/100 BASE-TX PoE (phantom power)
- 8 x 10/100 BASE-TX
- 100Mbps Layer 2 functionality
- Unknown multicast filtering
- Multicast support (IGMP Snooping/Query, GMRP)
- Broadcast limiter per port, ingress and egress packet limiter
- Flow Control IEEE 802.3x
- LLDP (topology discovery IEEE 802.1AB)
- Wall/bulkhead mounting
- IP67
- Rail transportation standards
  - EN 50155
  - EN 50121-4

Also important are redundancy and security features such as:

- Port security (MAC and IP address), SNMPv3, SSHv3, SNMP access settings (VLAN/IP), IEEE 802.1X authentication
- HIPER-Ring (ring structure), RSTP (Rapid Spanning Tree Protocol, IEEE 802.1w), redundant network/ring coupling
- Redundant power supply

Cost-effective Layer 2 Ethernet switch solution designed for the challenges of being installed onboard rail vehicles

IP67/54 switches from the OCTOPUS family allow fail-safe networks to be installed in a variety of different application scenarios even under the most difficult conditions and covering the full range of automation solutions, such as rail vehicles.

- Optimum fail-safety thanks to extremely robust hardware, comprehensive redundancy methods and security functions
- Increased productivity owing to efficient network structures for optimum data communication
- Additional space for other equipment or applications due to compact dimensions

Alpine Rail journey

Product Details

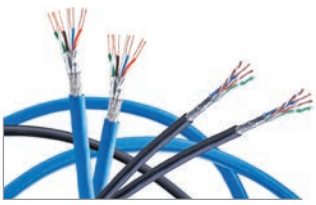
To achieve secure, reliable and uninterrupted communication, the following Belden products are ideally suited to this on type of board rail vehicle application.

OCTOPUS 16M 8PoE

OCTOPUS IP67/54 Ethernet Switches

The OCTOPUS family includes Ethernet switches with 5, 8, 9, 10, 16 or 24 Fast Ethernet ports. In addition, models with Gigabit uplinks are available that, like the Fast Ethernet ports, have vibration-proof M12 connections for twisted pair cables or IEC V1 connections for all types of optical fibers.

- More than 30 different designs
- Vibration-proof M12 connection technology
- IP67/IP54 metal housing with high port density
- Gigabit ports for copper and optical fiber cables
- Fast Ethernet ports with PoE or PoE+
- Redundancy based on RSTP, MRP and HIPER Ring
- Port security and access protection
- External or integrated PoE power supply for 24 V to 60 V or 72 V to 110 V
- Redundant power supply
- LEDs for equipment and network as well as PoE status
- Temperature range -40°C to +70°C
- Approval for rail, road and water vehicles



RailTuff Ethernet Cable

RailTuff Ethernet Cable

Belden offers a range of RailTuff Ethernet Data Cables, for reliable communications and enhanced system performance in railway, transportation and city transit systems. The cables are available for 100 Mbps, 1000 Mbps and 10 Gbps, depending on the application.

- Best-in-class flex life with sustained data transmission due to highly stranded copper conductors
- Fully compliant with EN 50155 Class TX giving a superior temperature rating

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Belden Competence Center

As the complexity of communication and connectivity solutions has increased, so have the requirements for design, implementation and maintenance of these solutions. For users, acquiring and verifying the latest expert knowledge plays a decisive role in this. As a reliable partner for end-to-end solutions, Belden offers expert consulting, design, technical support, as well as technology and product training courses, from a single source: Belden Competence Center. In addition, we offer you the right qualification for every area of expertise through the world's first certification program for industrial networks. Up-to-date manufacturer's expertise, an international service network and access to external specialists guarantee you the best possible support for products.

Irrespective of the technology you use, you can rely on our full support – from implementation to optimization of every aspect of daily operations.

Always Stay Ahead with Belden

In a highly competitive environment, it is crucial to have reliable partners who add value to your business. When it comes to signal transmissions, Belden is the No. 1 solutions provider. We know your business and want to understand your specific challenges and goals to show how effective signal transmission solutions can push you ahead of the competition. By combining the strengths of our five leading brands, Belden, GarrettCom, Hirschmann, Lumberg Automation and Tofino Security, we are able to offer the integrated solution you need. Today, it may be a single cable, switch or connector, to solve a specific issue; tomorrow, it can be a complex range of integrated applications, systems and solutions. With the rise in smart, connected devices brought on by the Industrial Internet of Things (IIoT), together, we can make sure your infrastructure is ready to handle and make sense of the influx of data. Transform your business now with instant access to information, and make your vision a reality. Visit info.belden.com/iiot to learn more.

About Belden

Belden Inc., a global leader in high quality, end-to-end signal transmission solutions, delivers a comprehensive product portfolio designed to meet the mission-critical network infrastructure needs of industrial, enterprise and broadcast markets. With innovative solutions targeted at reliable and secure transmission of rapidly growing amounts of data, audio and video needed for today's applications, Belden is at the center of the global transformation to a connected world. Founded in 1902, the company is headquartered in St. Louis, USA, and has manufacturing capabilities in North and South America, Europe and Asia.

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